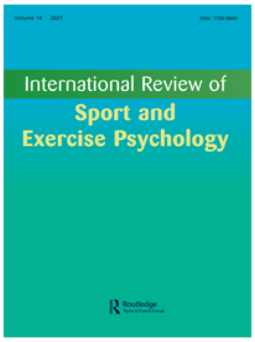
Glandorf, Hanna L ORCID: https://orcid.org/0000-0002-5720-2071, Madigan, Daniel J. ORCID: https://orcid.org/0000-0002-9937-1818, Kavanagh, Owen ORCID: https://orcid.org/0000-0002-2599-8511 and Mallinson-Howard, Sarah H. ORCID: https://orcid.org/0000-0002-8525-1540 (2023) Mental and physical health outcomes of burnout in athletes: A systematic review and meta-analysis. International Review of Sport and Exercise Psychology.



International Review of Sport and Exercise Psychology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rirs20

Mental and physical health outcomes of burnout in athletes: a systematic review and meta-analysis

Hanna L. Glandorf, Daniel J. Madigan, Owen Kavanagh & Sarah H. Mallinson-Howard

To cite this article: Hanna L. Glandorf, Daniel J. Madigan, Owen Kavanagh & Sarah H. Mallinson-Howard (2023): Mental and physical health outcomes of burnout in athletes: a systematic review and meta-analysis, International Review of Sport and Exercise Psychology, DOI: 10.1080/1750984X.2023.2225187

To link to this article: https://doi.org/10.1080/1750984X.2023.2225187

Published online: 25 Jun 2023.

INTERNATIONAL REVIEW OF SPORT AND EXERCISE PSYCHOLOGY
https://doi.org/10.1080/1750984X.2023.2225187

Routledge
Taylor & Francis Group

Mental and physical health outcomes of burnout in athletes: a systematic review and meta-analysis

Hanna L. Glandorf, Daniel J. Madigan, Owen Kavanagh and Sarah H. Mallinson-Howard

Science, Technology & Health, York St John University, York, UK

ABSTRACT

Burnout is a mental health problem that appears to be increasingly common among athletes. Importantly, burnout may also simultaneously increase the risk for other health consequences. In order to examine this idea further, in the present study we provide the first systematic review and meta-analysis of the association between athlete burnout and mental and physical health outcomes. A literature search returned 54 studies ($N =$ 13,976 athletes) examining various negative (e.g. depression, anxiety, insomnia; 27 studies) and positive (e.g. satisfaction, vitality, quality of life; 19 studies) mental health outcomes and physical health outcomes (e.g. biomarkers, somatic symptoms, physiological indices; 18 studies). A systematic review of this literature showed that athlete burnout was associated with both increases in negative mental health outcomes and decreases in positive mental health outcomes. However, evidence for an association between athlete burnout and physical health outcomes was mixed. This broad pattern of findings was supported by a meta-analysis. Our review suggests that burnout may indeed have many negative implications for athletes' health. The findings also identify a need for further research in this area, especially in relation to burnout and its longitudinal association with biomarkers and physiological indices.

ARTICLE HISTORY
Received 11 December 2022
Accepted 5 June 2023

KEYWORDS
Stress; health; sport; wellbeing; exhaustion

Introduction

Sport participation is associated with numerous benefits for athletes. These include financial rewards, friendship networks, and a sense of belonging, but can also include increased wellbeing and improved physical health (Hulteen et al., 2017). However, for some athletes the extreme demands of competitive sport can lead to mental and physical health problems (e.g. Gustafsson et al., 2011; Purcell et al., 2019; Sabato et al., 2016). In the present study, we are interested in understanding how an increasingly prevalent mental health concern in athletes – burnout – may exacerbate other mental and physical health

CONTACT Hanna L. Glandorf h.glandorf@yorksj.ac.uk
Supplemental data for this article can be accessed online at https://doi.org/10.1080/1750984X.2023.2225187.

problems. To do so, we provide the first ever systematic review and meta-analysis of athlete burnout and mental and physical health outcomes. We hope the findings will provide a basis from which to inform policy in regards to the importance of burnout for athletes, highlight directions for future work, and further emphasise the need for prevention and intervention strategies for burnout in sport.

Mental and physical health

Health is essential for optimal human functioning. Rather than viewed as a dichotomy (i.e. healthy vs. unhealthy), current conceptualisations of health are based on a continuum from well to poor (Krahn et al., 2021). Researchers have also argued that health is best conceptualised as multidimensional with the dimensions of mental and physical health being the main focus of theoretical models (e.g. Kivimäki et al., 2020). Both dimensions are influenced by environmental, social, and personal factors and thus can improve or reduce across the lifespan. Such dynamic changes across time may require adaptation to new situations or conditions in order to maintain 'good health'. As such, health should be viewed as continuous and dynamic and determined by adaptation across life as well as constituting multiple dimensions.

Mental health reflects one major dimension of health. It has traditionally been conceptualised as whether an individual meets or does not meet the diagnostic criteria for a mental illness such as those specified in the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychological Association, 2013) as well as the frequency or severity of symptoms that are characteristic for a specific mental illness or group of mental illnesses (Conway et al., 2019). For instance, a psychologist may determine the number of criteria an individual meets for a specific mental illness via a clinical interview. Such interviews can also be accompanied by standardised self-report questionnaires that ask the individual about the frequency and/or severity of specific symptoms (Conway et al., 2021). Such questionnaires establish where an individual may sit on a continuum. In line with the broader conceptualisation of health, this allows a practitioner to establish how mentally well/poor an individual is and thus provides more information to develop individualised intervention approaches.

Beyond the traditional conceptualisation of mental health, there have been calls that mental health should also be conceptualised in terms of its positive aspects (Galderisi et al., 2015). This informed a new way of viewing mental health. Individuals with mental illness who successfully managed their condition were now viewed as healthy. Meanwhile, individuals without mental illness could be viewed as poorly if they were unhappy. In line with this idea, newer and broader conceptualisations of mental health now focus on the individual's ability to value and engage with their life (Wren-Lewis & Alexandrova, 2021). In this broader conceptualisation, to assess an individual's mental health, one could also use self-report measurements concerning their perception of their life's quality or satisfaction (Fusar-Poli et al., 2020). This conceptualisation of mental health therefore includes both the presence of symptoms that may be indicative of a mental illness as well as the presence of positive perceptions of life.

Physical health is the second major dimension of health. It can be conceptualised as the overall condition of the body (McCartney et al., 2019). Thus, physical health is often operationalised as any objective measurement that was taken from the body (Mathers et al., 2003). For instance, physical health may be measured by assessing biomarkers from bodily fluids such as blood and saliva, and by imaging techniques such as electrocardiograms. More recently, however, research has also advocated for adding self-report through standardised questionnaires to measure physical health (Krahn et al., 2021). This approach allows for both objective and subjective assessments that focuses not only on physiology, but also on how individuals subjectively feel with respect to their physical condition.

Health is integral to leading a productive and happy life (Avan & Hachinski, 2021). This remains true for athletes for whom health is key to be able to perform to their highest level in competition (Verhagen et al., 2020). Paradoxically, however, with increased intensity and frequency of training, athletes are also at a higher risk of injury (Sabato et al., 2016) as well as physical health complications such as respiratory inflammation and infection (Gleeson & Pyne, 2015). Furthermore, in recent years, scholars have highlighted that some mental health difficulties appear to be more prevalent in athletes than in the general population (e.g. depressive symptoms; Gouttebarge et al., 2019). It may well be that there are aspects of athletes' experiences such as injuries, performance slumps, and career transitions that make them more susceptible to such difficulties (Rice et al., 2016).

In the present study, we are interested in furthering our understanding of a specific mental health problem – burnout. Public policy is beginning to recognise the importance of burnout in this regard. In particular, several public health organisations have revised relevant policy to highlight burnout as an increasingly relevant occupational health problem. Most notably, has been the recent 11th revision of the World Health Organisation (WHO)'s International Statistical Classification of Diseases (ICD-11; WHO, 2022) which now considers burnout as an occupational phenomenon that has the potential to influence an individual's health status and their contact with health services. Collectively these changes highlight burnout's relevance as a health issue – both in itself but also because of its potential to influence other health factors.

Athlete burnout

Burnout has its theoretical foundations in the human services professions (Maslach & Jackson, 1981). It was formally defined as a multidimensional psychological syndrome with three symptoms: emotional exhaustion, cynicism, and reduced efficacy (Maslach, 1986). Emotional exhaustion represents feelings of being emotionally overextended and exhausted because of one's work. Cynicism describes a cynical and impersonal reaction towards those around oneself. Finally, reduced efficacy depicts a lack of feeling like one is competent and successful at work. In the many occupational contexts that burnout has been examined, these symptoms are associated with many negative outcomes including negative organisational attitudes, worse work performance as well as headaches, muscle tension, and sleep disturbances (Alarcon, 2011; Maslach & Leiter, 2016; Taris, 2006).

Anecdotal accounts that athletes could be susceptible to burnout spurred heightened applied and empirical interest in burnout in the sport context. To advance work in this area, Raedeke and Smith (2001) adapted Maslach's original burnout definition to better reflect the context of sport. In doing so, emotional exhaustion was broadened to include both physical and emotional aspects of exhaustion (physical and emotional exhaustion). Cynicism was revised to describe a reduction in interest and development of a negative attitude towards one's sport (devaluation). Finally, the reduced efficacy was adjusted to reflect a reduced sense of athletic efficacy and accomplishment (reduced sense of athletic accomplishment). Based on this definition, the authors also provided the first robust measure of burnout for athletes – the Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) – which recent reviews show is the most widely used for the quantification of burnout in athletes (e.g. Lin et al., 2021).

There are several reasons to believe that burnout is indeed relevant to athletes. For example, sport is likely conducive to burnout development. In this regard, studies show over 10% of athletes can experience moderate to severe symptoms at some point in the season (Gustafsson et al., 2017a). In addition, and perhaps more importantly, recent evidence suggests that, on average, the prevalence of burnout symptoms is increasing and has been for the past two decades (Madigan et al., 2022). Finally, a growing body of work suggests that burnout is associated with a wide range of important outcomes for athletes. For example, studies have shown burnout to predict reductions in motivation (Martinent et al., 2014) and wellbeing (Nicholls et al., 2022), and an increased risk of dropout from sport (Isoard-Gautheur et al., 2016). These findings appear to generalise across athletes of different competitive levels (e.g. amateur, elite), age groups (e.g. junior, adult), and types of sport (e.g. team, individual; Gustafsson et al., 2017a).

Athlete burnout and mental and physical health

Burnout may also have implications for further health consequences. There are several reasons to believe this to be the case for athletes. Allostatic overload may provide one such explanation (McEwen & Stellar, 1993). This theory was developed in the general psychology literature and seeks to explain how different physiological systems function following the exposure to stress. In this regard, stress is thought to be triggered when environmental challenges exceed an individual's ability to cope with those challenges. Whereas short-term stress exposure and associated physiological changes are assumed to be adaptive, chronic exposure is thought to have a negative impact and increase disease risk via allostatic overload. Allostatic overload is therefore defined as a multisystem dysfunction in the hypothalamus-pituitary-adrenal (HPA) axis and immune, anabolic, and cardiovascular systems. Because the accumulation of chronic stress is also thought to underpin burnout development, it has been suggested that burnout may be tied to subsequent ill health via allostatic overload (Juster et al., 2011).

In regard to athlete burnout specifically, Smith's (1986) cognitive-affective stress model also provides an explanation for why burnout may affect athletes' health. Akin to occupational models, Smith's model suggests that athlete burnout develops in response to chronic stress. In particular, stress is triggered following an athlete's appraisal that the demands of a situation do not correspond with, or outweigh, their available resources to deal with the demands. Again, while acute stress is thought to have adaptive properties, a chronic imbalance between the perceived demands and resources will result in the development of burnout. Smith's model also posits that burnout development includes physiological and behavioural responses. These responses are defined as both physiological symptoms (e.g. fatigue and illness susceptibility) as well as mental health symptoms (e.g. anxiety and depression). This model therefore explicitly highlights how burnout may lead to other health outcomes. This link has also been reiterated in Gustafsson et al. (2011) integrated model of athlete burnout that summarises and integrates dominant models of burnout within sport psychology, including Smith's model. Gustafsson et al.'s (2011) integrated model therefore views burnout as a consequence of stress and links it with further health consequences such as impaired immune function and chronic inflammation. These ideas, then, form the backdrop to the present review.

Many studies outside of sport support the idea that burnout is associated with health outcomes. For example, Williams et al. (2019) reviewed the outcomes of burnout in physicians and found burnout to be linked with mental health problems (e.g. depression), reductions in positive mental health (e.g. reduced quality of life), and increased physical health problems (e.g. musculoskeletal pain). Similar effects have been found by studies on burnout in faculty members (Sabagh et al., 2018), nurses (Jun et al., 2021) and military personnel (Archer & Alagaraja, 2021). Most notably, in this regard, was a recent study by Salvagioni et al. (2017) who reviewed 61 prospective studies that had examined burnout and its health outcomes. This review found burnout to be a significant longitudinal predictor of mental health outcomes (e.g. insomnia), physical health outcomes (e.g. coronary heart disease), in addition to occupational outcomes (e.g. job satisfaction).

Other research has attempted to examine biomarkers of burnout. This work has examined markers that are associated with different systems in the body. For example, studies have assessed hormones associated with the HPA axis, such as cortisol and dehydroepiandrosterone sulphate (DHEA-S), metabolites, such as glycated haemoglobin A1c (HbA1c), triglyceride lipids and biomarkers of immune system function like C-reactive protein (CRP) and secretory immunoglobulin A (sIgA; see Danhof-Pont et al., 2011; Shirom, 2005 for a review). Findings here have been more mixed than for other outcomes, but still suggest that burnout may have a physiological fingerprint that could help to explain why it may lead to chronic mental and physical health outcomes.

The link between athlete burnout and health outcomes has also been supported by empirical research. Cresswell and Eklund (2006), for example, examined the association between burnout and depressive symptoms. They found that emotional and physical exhaustion as well as devaluation were associated with higher levels of depressive symptoms. In more recent work, DeFreese and Smith (2014) showed burnout to be associated with lower levels of life satisfaction. There have also been investigations into the association between athlete burnout and physical health. In this regard, initial work has shown burnout to be associated with physical symptoms which includes headaches, chest pain, and dizziness (Daumiller et al., 2021). Despite these findings, and unlike in occupational contexts, however, the evidence for these relationships has not yet been systematically reviewed or meta-analytically quantified.

The present study

Burnout is a mental health concern in its own right. However, there are also many reasons to expect burnout to be linked to other health outcomes for athletes. Outside of sport, burnout has indeed been consistently associated with an increased incidence of many other health outcomes (Salvagioni et al., 2017). The growing body of literature examining this link in sport has yet to be systematically collated and reviewed. This is additionally important because such a review is key to understand the outcomes of athlete burnout, inform future work in this important and developing area, and to support athletes' health as best as possible. Consequently, the aim of the present study was to provide the first such review. In doing so, we provide quantitative summaries of these relationships where appropriate by way of meta-analysis to determine the strength of current evidence and test the relationships proposed by relevant theories. In line with recent work, we conceptualise health as a multidimensional construct by including studies that assessed negative mental health outcomes, positive mental health outcomes, and physical health outcomes.

Methods

This systematic review and meta-analysis are reported in line with the Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA; Moher et al., 2009). In addition, the protocol for this study was pre-registered and published on PROSPERO prior to conducting the search ([ID removed for anonymisation purposes]).

Literature search

A computerised literature search was conducted, searching the following databases: PsychINFO, PsychARTICLES, MEDLINE, SPORTDiscus, ScienceDirect, and ProQuest Dissertations. In line with the multidimensional conceptualisation of health (Fusar-Poli et al., 2020) and current theories on the association between burnout and health, we used the search terms: 'burnout' and 'athletes' and 'health OR wellbeing OR mental health literacy OR mental health attitudes OR self-perception OR values OR cognitive skills OR performance OR emotions OR behaviour OR self-management OR social skills OR associations OR interpersonal OR meaning of life OR quality of life OR depression OR anxiety OR tension OR anger OR sleep OR fatigue OR illness OR withdrawal'. The search-strings for each of these databases are provided in the supplemental materials (Supplementary Material: Table A). On PsychINFO, PsychARTICLES, MEDLINE, and SPORTDiscus subject headings (e.g. MeSH terms) from these databases were used to include synonyms. We further used wildcards to consider entries with different spellings and grammatical forms. On ScienceDirect, different spellings, grammatical forms, and synonyms were added as free text words since this database does not have a catalogue of subject headings and does not support wildcards. The search date was set between January 2001 (the year the ABQ was published) and March 2022. The first and second author ran the search on the 17th of March 2022, which returned 853 studies. In addition to the standardised search, the authors searched the wider literature through Google Scholar. Once duplicates were removed and abstracts were screened, 116 articles were assessed for eligibility using the inclusion criteria below.

Inclusion criteria

The initial search identified 853 records. Following duplicate removal, 599 records were screened by the first and second author through examining the abstracts to determine whether the record measured burnout and another health outcomes as well as whether the sample were athletes. If this was unclear, the report was sought for retrieval. Disagreement between the two authors were resolved through discussion and mediating with another author. In total, 125 reports were sought for retrieval. We were unable to retrieve the full-text version of nine reports. 116 reports were therefore assessed for eligibility.

We included studies in the present study if they: (a) measured burnout; (b) had a sample of athletes who were competing in their sport; (c) measured another mental or physical health outcome; (d) were published in English; (e) were a published journal article, thesis/dissertation, or conference presentation; and (f) included a sample that was unique (e.g. not included in more than one study). Following the full-text eligibility assessment, studies were excluded because they did not measure a mental and physical health outcome that met the criteria ($n = 42$), did not include sufficient information ($n = 7$), did not measure burnout ($n = 2$), had a non-athlete sample ($n = 1$), or re-analysed already published data ($n = 1$). This assessment resulted in the final inclusion of 54 studies. We have provided an overview of this process in Figure 1.

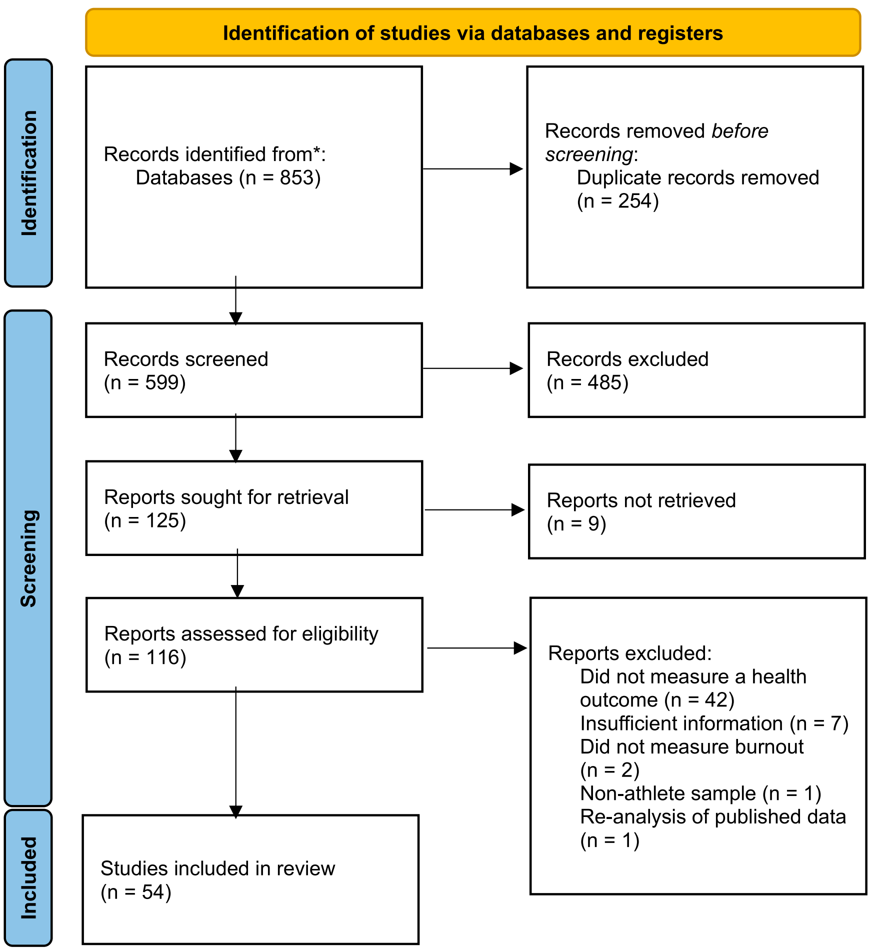


Figure 1. PRISMA flow diagram of reviewed studies on the health outcomes of athlete burnout.

Data extraction

We reviewed the remaining studies in full and summarise the studies in Tables 1–3. We first separated the studies by the health outcomes they examined in relation to burnout (e.g. Table 1: negative mental health, Table 2: positive mental health, Table 3: physiological health). If a report covered more than one of these categories, it was entered in all relevant tables. The following data were extracted for these summary tables: (a) publication information (authors/year), (b) sample size, (c) athlete demographics, (d) study design, (e) measure of burnout, (f) measure(s) of health, (g) statistical analysis, (h) correlations, and (i) additional findings. The extracted data was crosschecked by two authors. We summarised sample size, athlete demographics and the number of times different burnout measure were used for all included studies. For each category (e.g. negative mental health outcomes) and outcome (e.g. depressive symptoms) we then provided an overview of the implemented study designs. For the systematic review, we compared effect sizes from the provided correlations in the reports as well as summarised potential additional findings from further statistical analyses.

Quality assessment

Following data extraction, we provided an assessment of the quality of studies. For this assessment, we followed the National Institute for Health and Care Excellence (NICE) Quality appraisal checklist for quantitative studies reporting correlations and associations (NICE, 2012). This checklist considers the following criteria: study population, methods of selection of exposure/comparison group (if appropriate), outcomes, analyses, and summary. For each of these criteria, studies were rated as: source of bias persists (–), unclear or not all source of bias addressed (+), or risk of bias minimised (++). If a criterium was not applicable to the study design or a study did not report on the specific criterium, the ratings 'not applicable' and 'not reported' were used respectively. This was conducted independently by two authors. Disagreements were resolved via consensus among authors with reference to the original studies. We have included a summary of this information in the supplementary materials (Supplementary Material Table B).

Meta-analytical procedures

Where enough studies existed on outcomes that could be meaningfully pooled, we ran meta-analyses (minimum of two studies; Cochrane Consumers and Communication Review Group, 2016a). All statistical analyses were conducted with R and R Studio (R Core Team, 2022). Effect size interpretations for Pearson's r were based on Cohen's (1988) guidelines deeming 0.1 to 0.3 as small, 0.3 to 0.5 as medium and 0.5 and above as large.

Modelling approach

In line with Gucciardi et al. (2021) recommendations, we used multilevel modelling to meta-analyse the association between burnout and health outcomes (based on reported correlation coefficients [r]). These models partition the variance in the data across three levels. The first level represents sampling-variance, the second level represents

Table 1. Overview of studies examining the association between athlete burnout and negative mental health outcomes.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome Measure/s	Analyses	Total BO CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
Depression											
Amemiya and Sakairi (2021)	143	University athletes, 89 males, 54 females, mean age = 19.83 (1.03)	3-W LONGL, 7-month period, T2 = off-season	Burnout Scale for University Athletes	Kessler Psychological Distress Scale	CLPM	.52	.47	.50	.26	Interpersonal exhaustion correlated with depression (.45; .47; .54) Interpersonal exhaustion predicted future depressive symptoms in the cross-lagged panel model (beta[T1;T2] = .21; beta[T2;T3] = .22).
Cresswell and Eklund (2006)	392	Premier male amateur rugby union players, mean age = 25.3 (4.3)	CS	ABQ MBI	Depression Anxiety Stress Scale	SEM		.56	.59	.07	The purpose of this study was the evaluation of an existing burnout measure, as such, no further models concerning the relationship between burnout and depression were evaluated.
De Francisco et al. (2016)	453	Youth athletes, 68.7% males, mean age = 18.93 (3.85), 23.5% individual athletes	CS	ABQ	Depression subscale from Depression Anxiety Stress Scales	SEM					In the structural model, the latent burnout variable was significantly associated with the latent depression variable (b = .53). No correlations for individual dimensions and the depression scale were provided.
Feeser (2016)	158	Collegiate athletes, 68.4% males, 18 to 25+ year olds, team and individual sports	CS	ABQ	Beck Depression Inventory	REG	.55				Only Spearman correlations between the burnout and depression variables were calculated. Associations between these variables were not tested in the regression models.
Frank et al. (2017)	CS = 194; LONGL = 92	Junior elite athletes; CS: mean age = 15.08 (1.95). LONGL: mean age = 14.82 (2.26); mixed team and individual sports	CS and 3-W LONGL, T1 = preparation, T2 = competition, T3 = recovery	ABQ	Centre for Epidemiologic Studies Depression Scale	REG, CLPM	CS: .59				CS: Burnout was not significantly associated with depression in the multiple linear regression model. LONGL: The CLPM with cross-paths from burnout to depression and depression to burnout showed the best fit. Due to constraints, both directions had the same effect (b = .18).
Gerber et al. (2018b)[a]	257 at baseline, 197 at follow-up	Swiss Olympic partner school students, 163 males, 94 females, mean age = 16.82 (1.44), 45% individual sports Follow-up: 125 boys, 73 girls, mean age = 16.83 (1.4), 45% individual athletes	PROSP, 6-month follow-up	SMBM ABQ	Depression items from Patient Health Questionnaire	Hierarchical REG, CLPM	.40	.19	.17	.28	Physical fatigue (SMBM) significantly correlated with depressive symptoms = .38; cognitive weariness (SMBM) significantly correlated with depressive symptoms = .37; emotional exhaustion (SMBM) significantly correlated with depressive symptoms = .23. In the HL regression model, exhaustion (ABQ) significantly predicted depressive symptoms at follow-up (beta = .18). In the CLPM, devaluation (ABQ) significantly predicted depressive symptoms at follow-up (beta = .13).

(*Continued*)

Table 1. Continued.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome Measure/s	Analyses	Total BO CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
Grobbelaar et al. (2011)	41	Male student rugby union players, mean age = 22.26 (1.39)	7-W LONGL, 5-month period, T1–T3: pre-season, T4–T5: pre-competition, T6–T7: competition	ABQ	Stellenbosch Mood Scale	CORR	.43	.44	.37	.29	No statistical analyses beyond correlations were reported.
King et al. (2021)	84	Professional jockeys, 93% male, 7% female, mean age = 25.5 (6.6)	CS	ABQ	Centre for Epidemiological Studies Depression	Binary univariate LOG-REG					Based on the binary univariate logistic regression, for each unit increased in EPE (OR = 1.17), DEV (OR = 1.3), RSA (OR = 1.03), the odds of meeting the diagnostic cut-off for depression increases. These associations were not significant.
Raedeke et al. (2013)	302	206 males, 96 females, mean age = 19.06 (3.88), team and individual sports	CS	ABQ MBI	Depression Anxiety Stress Scale	CORR		.36	.40	.17	The purpose of this study was the evaluation of an existing burnout measure, as such, no further models concerning the relationship between burnout and depression were evaluated.
Smith et al. (2018)	108	Professional soccer academy athletes, mean age = 16.15 (1.84)	2-W LONGL, 3-month period	ABQ	Centre for Epidemiologic Studies Depression Scale	CLPM		.42	.49	.57	CLPMs for burnout and depression were tested separately, as such, associations between burnout and depression were not evaluated beyond correlations.
Sorkkila et al. (2020)	391	Student athletes, 51% female, mean age = 16 (0)	CS	Sport Burnout Inventory	Internalising symptom subscale of Strengths and Difficulties Questionnaire	SEM	.13	.22	−.03	.13	Correlations represent correlations between latent factors of exhaustion, cynicism, and inadequacy. In the SEM, depressive symptoms and exhaustion were significantly associated (b = .13).
Vaughan et al. (2020)	589	57.21% male, mean age = 23.54 (9.38), team and individual sports	CS	ABQ	Abbreviated Profile of Mood States Questionnaire	REG					In the multiple regression models, overall total burnout (beta = .21), exhaustion (beta = .11), devaluation (beta = .23) and reduced sense of accomplishment (beta = .27) were significantly associated with depression.
Wu et al. (2021)	685	College winter sports athletes, 55% males, 45% females, mean age = 20.5 (1.5), 58.8% individual event, 41.2% team event	CS	ABQ	Depression, Anxiety, Stress scale	Path-A		.45	.53	.32	In the examined path analysis, associations between depression and burnout were not tested.
Anxiety											
Cresswell and Eklund (2006)	392	Premier male amateur rugby union players, mean age = 25.3 (4.3)	CS	ABQ MBI	Depression Anxiety Stress Scale	SEM		.46	.41	.09	The purpose of this study was the evaluation of an existing burnout measure, as such, no further models concerning the relationship between burnout and anxiety were evaluated.

(*Continued*)

Table 1. Continued.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome Measure/s	Analyses	Total BO CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
Gustaffson et al., (2017b)	258	Elite adolescent athletes, 148 males, 105 females, 71% team sports, 29% individual sports, mean age = 16.95 (0.86)	CS	ABQ	Performance Failure Appraisal Inventory	REG		Shame: .27 Self: .22 Loss: .19 Other: .26 Future: .23	Shame: .23 Self: .23 Loss: .23 Other: .22 Future: .19	Shame: .41 Self: .39 Loss: .30 Other: .26 Future: .36	The MV regression analysis showed fear of experiencing shame to be significantly associated with reduced sense of accomplishment (beta = .22).
Isoard-Gautheur et al. (2010)	461	Handball youth athletes, 213 female, 248 males	CS	ABQ	Competitive Anxiety State	CORR		SA: .17		SA: .12 CA: .40	The purpose of this study was the evaluation of an existing burnout measure, as such, no further models concerning the relationship between burnout and anxiety were evaluated.
King et al. (2021)	84	Professional jockeys, 93% male, 7% female, mean age = 25.5 (6.6)	CS	ABQ	Generalised Anxiety Disorder Scale	Binary univariate LOG-REG					Based on the binary univariate logistic regression, for each unit increased in EPE (OR = 4.7), DEV (OR = 3.0), RSA (OR = 2.9), the odds of meeting the diagnostic cut-off for anxiety increases. These associations were significant.
Raedeke et al. (2013)	302	206 males, 96 females, mean age = 19.06 (3.88), team and individual sports	CS	ABQ MBI	Depression Anxiety Stress Scale	CORR		.29	.19	.04	The purpose of this study was the evaluation of an existing burnout measure, as such, no further models concerning the relationship between burnout and anxiety were evaluated.
Sánchez-Romero et al. (2021)	235	Professional yachting, 146 men, 89 women, mean age = 24.66 (8.03)	CS	ABQ	Sport Anxiety Scale-2 Performance Failure Appraisal	SEM		SA: .36 Worry: .18 CD: .39 Shame: .24 Self: .26 Loss: .30 Other: .28 Future: .23	SA: .32 Worry: .06 CD: .46 Shame: .25 Self: .25 Loss: .47 Other: .43 Future: .31	SA: .34 Worry: .30 CD: .32 Shame: .35 Self: .36 Loss: .31 Other: .33 Future: .29	In the CFA, the latent variable of athlete burnout was correlated with the sport anxiety latent ($r = .67$) and the (fear of) performance failure latent ($r = .53$). In the SEM, athlete burnout was significantly associated with sport anxiety (b = .67).

(*Continued*)

Table 1. Continued.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome Measure/s	Analyses	Total BO CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
Vaughan et al. (2020)	589	57.21% male, mean age = 23.54 (9.38), team and individual sports	CS	ABQ	Sport Anxiety Scale-2	REG					In the multiple regression models, overall total burnout (beta = .12), exhaustion (beta = .10), devaluation (beta = .18) and reduced sense of accomplishment (beta = .12) were significantly associated with anxiety.
Werner et al. (2021)	178	Division I collegiate athletes, 131 female, 47 males, mean age = 19.8 (1.4), 45.5% team sports	CS	ABQ	Anxiety subscale from the Depression Anxiety and Stress Scale	Moderate hierarchical REG	.49				In the moderated hierarchical regression model, anxiety was significantly associated with burnout (beta = .45).
Wu et al. (2021)	685	College winter sports athletes, 55% males, 45% females, mean age = 20.5 (1.5), 58.8% individual event, 41.2% team event	CS	ABQ	Depression, Anxiety, Stress scale	Path-A		.39	.41	.17	In the examined path analysis, associations between anxiety and burnout were not tested.
Yildirim and Koruç (2021)	391	Men's soccer youth players, mean age = 17.3 (1.12)	CS	ABQ	Sport Competition Anxiety test	SEM	.47				In the examined SEM, associations between anxiety and burnout were not tested.
Addictive Behaviour											
Becker et al. (2021)	95	Endurance athletes, 54.7% female, mean age = 31.9 (15.02).	CS	ABQ	Exercise Addiction Inventory	ANOVA		.14	−.23	−.10	The study did not assess the relationship between burnout and exercise addiction further.
King et al. (2021)	84	Professional jockeys, 93% male, 7% female, mean age = 25.5 (6.6)	CS	ABQ	Alcohol Use Disorder Identification Test	Binary univariate LOG-REG					Based on the binary univariate logistic regression, for each unit increased in EPE (OR = 1.30), DEV (OR = 1.33), RSA (OR = 1.18), the odds of meeting the diagnostic cut-off for adverse alcohol use increases. These associations were not significant.
Reche et al. (2018)	449	Athletes, 320 males, 129 females, mean age = 19.71 (6.62), 27.6% individual sports	CS	ABQ	Exercise Dependence Scale-Revised	CORR		.29	.13	−.15	No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and exercise dependence.
Insomnia											
Gerber et al. (2018a)	257 at baseline, 196 at follow-up, 50 for sleep-EEG	Swiss Olympic partner school students, 125 boys, 73 girls, mean age = 16.83 (1.4)	2-W LONGL, 6-month period	SMBM	Insomnia Severity Index	CLPM	.43 .46				Provided correlations are based on latent variables of burnout and insomnia. In the CLPM, burnout significantly predicted insomnia over time (b = .27). Insomnia did not significantly predict burnout over time.

(*Continued*)

Table 1. Continued.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome Measure/s	Analyses	Total BO CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
Li et al. (2018)	10	China national blind soccer team, male	5-W LONGL, 5-month period	ABQ	Pittsburgh Sleep Quality Index	dynamic p-technique analysis (Base)	.29 .38				Provided correlations are based on latent variables of burnout and sleep quality. Burnout significantly predicted Sleep Quality over time (beta = .06). Sleep Quality did not significantly predict burnout over time.
Worry											
Moen et al. (2017)[b]	358	Junior athletes, 54% males, 46% females, mean age = 18.2, 28% skiing, 22% soccer, 13% biathlon	CS	ABQ	Penn State Worry Questionnaire	SEM	.49 .36				In the covariance structure model, the burnout latent significantly correlated with worry (*r* = .64). In the first SEM, burnout was significantly associated with worry (b = .44). In the second SEM, burnout was significantly associated with worry (b = .43).
Moen et al. (2016)	356	Junior athletes, 191 males, 165 females, mean age = 18.2, individual and team sports	CS	ABQ	Penn State Worry Questionnaire	Hierarchical REG	.45				In the hierarchical regression model, burnout was significantly associated with worry (b = .18).
Mood											
Grobbelaar et al. (2011)	41	Male student rugby union players, mean age = 22.26 (1.39)	7-W LONGL, 5-month period, T1–T3: pre-season, T4–T5: pre-competition, T6–T7: competition	ABQ	Stellenbosch Mood Scale	CORR	Tension: .42 Anger: .35 Fatigue: .37 Confusion: .39	Tension: .40 Anger: .36 Fatigue: .46 Confusion: .35	Tension: .32 Anger: .29 Fatigue: .22 Confusion: .31	Tension: .34 Anger: .26 Fatigue: .24 Confusion: .33	No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and mood states.
Markati et al. (2019)	142	54 males, 88 females, mean age = 15.75 (1.27), 51% team sports	CS	ABQ	Fatigue scale from Profile Mood States Questionnaire	MANOVA	.45	.64		−.69	Based on MANOVA, individuals with high burnout reported significantly higher fatigue compared to low burnout group (partial eta squared = .80).
Psychological Distress											
King et al. (2021)	84	Professional jockeys, 93% male, 7% female, mean age = 25.5 (6.6)	CS	ABQ	Kessler Psychological Distress Scale	Binary univariate LOG-REG					Based on the binary univariate logistic regression, for each unit increased in EPE (OR = 5.3), DEV (OR = 7.9), RSA (OR = 8.0), the odds of meeting the diagnostic cut-off for psychological distress increases. These associations were significant.

(*Continued*)

Table 1. Continued.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome Measure/s	Analyses	Total BO CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
Martin et al. (2021)	23	Swimming and diving team members, 17 men (age = 20.3), 23 women (age = 19.3)	3-W LONGL, 6-week period pre-competition, T1 = training period start, T2 = middle of training period, T3 = end of training period	ABQ	Training Distress Scale	REG	.47				In the regression model, training distress was not significantly associated with burnout (b = .34; B = .24).
Body Image Dissatisfaction											
Baella-Vigil et al. (2020)	352	University athletes, 245 male, 107 female, mean age = 19.6 (2.42), 48.59% team sports, 51.41% individual sports	CS	ABQ	Body Image Dissatisfaction	Poisson REG					In the original bivariate regression, no significant association between burnout and body dissatisfaction were found. In the follow-up Poisson regression analysis, burnout was significantly associated with body dissatisfaction.
Cumming and Duda (2012)	194	Dance students; 169 females, mean age = 16.73 (1.45)	CS	Exhaustion dimension from the ABQ	Social Physique Anxiety	Two-stage cluster analysis		.20			No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and social physique anxiety.

Notes. EPE = Emotional and Physical Exhaustion; DEV = Devaluation, RSA = Reduced Sense of Accomplishment; CD = Concentration Disruption; SA = Somatic Anxiety; CA = Cognitive Anxiety; CS = Cross-Sectional; LONGL = Longitudinal; PROSP = Prospective; W = Wave; T1 = time point 1; T2 = time point 2; T3 = time point 3; CLPM = Cross-Lagged Panel Model; SEM = Structural Equation Model; REG = Regression; LOG = Logistic; Path-A = Path-analyses; CORR = Correlation; ABQ = Athlete Burnout Questionnaire; MBI = Maslach Burnout Inventory; SMBM = Shirom-Melamed Burnout Measure.

[a]Gerber et al. (2018b) and Gerber et al. (2018c) are treated as the same since these studies were carried out with the same sample.

[b]Moen et al. (2017) and Moen and Myhre (2017) are treated as the same study here since they were carried out with the same sample.

Table 2. Overview of studies examining the association between athlete burnout and positive mental health outcomes.

Publication	Sample size	Demographics	Design	Burnout Measure	Outcome measure/s	Analyses	Total Burnout CORR	EPE CORR	DEV CORR	RSA CORR	Main findings
Satisfaction											
Chen and Chang (2017)	S1: 167 S2: 290	S1: 54 female, mean age = 30.91 (8.78). S2: 123 females, mean age = 16.13 (0.78). Team and individual sports	CS	ABQ	Team satisfaction Satisfaction with life scale	CORR	S1: Team: −.34 Life: −.40 S2: Team: −.47 Life: −.48				No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and team or life satisfaction.
Chen and Kee (2008)	S1: 169; S2: 265	S1: Senior high school athletes, 144 boys, 51 girls, mean age = 16.43 (0.7), 16% team sport. S2: Senior high school athletes, 159 boys, 106 girls, mean age = 16.47 (0.7)	CS	ABQ	S1: Satisfaction with life scale, Team satisfaction S2: Team satisfaction	REG		S1: Team: −.40 Life: −.30 S2: Team: −.30	S1: Team: −.46 Life: −.31 S2: Team: −.42	S1: Team: −.56 Life: −.45 S2: Team: −.29	No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and team or life satisfaction.
DeFreese and Barczak (2017)	86	Collegiate (40%) and club (60%) athletes, 70% females, mean age = 20.2 (1.5), team and individual sports	CS	ABQ	Satisfaction with Life scale	Hierarchical REG	−.16	−.14	−.10	−.16	No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and life satisfaction.
DeFreese and Smith (2014)	465	Collegiate athletes, 24% diving, 76% track and field, 41% males, 59% females, mean age = 19.7 (2.3)	4-W LONGL, 4-month period, T1 = beginning of season, T4 = end of season	ABQ	Satisfaction with life scale	Multilevel linear modelling	−.40	−.31	−.30	−.42	In the growth model, a negative fixed-effect, temporal association between athlete burnout and life satisfaction was found for global (mean slope = −.31) and dimensional burnout models (EPE = −.16; DEV = −.17; RSA = −.25). Evidence for significant between-athlete variation in the athlete burnout-life satisfaction relationship in the global burnout model was also found (random slope = .08). This result was the same for the dimensional models apart from RSA.

(*Continued*)

Table 2. Continued.

Publication	Sample size	Demographics	Design	Burnout Measure	Outcome measure/s	Analyses	Total Burnout CORR	EPE CORR	DEV CORR	RSA CORR	Main findings
Gabana et al. (2017)	293	Varsity athletes; 107 males, 186 females; mean age = 19.63 (1.26); 44% individual sports	CS	ABQ	Satisfaction with Life Scale (adapted to sport)	REG (bias-corrected bootstrapping)	−.52				No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and life satisfaction.
Gerber et al. (2018c)	257 at baseline, 197 at follow-up	Students from Swiss Olympic partner schools, 163 males, 94 females, mean age = 16.82 (1.44); 125 boys, 73 girls, mean age = 16.83 (1.4), 45% individual athletes	2-W LONGL, 6-month period	ABQ SMBM	Satisfaction with Life Scale	CLPM; Hierarchical REG	SMBM: −.43	ABQ: −.22	ABQ: −.30	ABQ: −.47	Physical fatigue (SMBM) significantly correlated with satisfaction with life = −.36; cognitive weariness (SMBM) significantly correlated with life satisfaction = −.34; emotional exhaustion (SMBM) significantly correlated with life satisfaction = −.35. No further analyses were carried out concerning the relationship between burnout and life satisfaction
Lee et al. (2017)	332	Students athletes registered with Korean Olympic Committee, 225 males, 107 females, mean age = 17.57 (0.62)	CS	ABQ	Satisfaction with Life Scale	SEM		−.33	−.42	−.50	In the SEM, burnout was significantly associated with satisfaction (b = −.56).
Markati et al. (2019)	142	54 males, 88 females, mean age = 15.75 (1.27), 51% team sports	CS	ABQ	Performance Satisfaction	MANOVA	−.42	−.01		−.69	Based on MANOVA results, individuals with high burnout reported significantly lower performance satisfaction (partial eta squared = .80).
Moen et al. (2016)	356	Junior athletes, 191 males, 165 females, mean age = 18.2, individual and team sports	CS	ABQ	Athlete Satisfaction Questionnaire	REG	−.39				In the hierarchical regression analysis, performance satisfaction was significantly associated with burnout (B = −.06; beta = .023)
Moen et al. (2017)	358	Junior elite athletes, 54% males, 46% females, mean age = 18.2, 28% cross country skiing, 22% soccer, 13% biathlon	CS	ABQ	Athlete Satisfaction Questionnaire	SEM	−.32				Among the latent variables, burnout significantly correlated with performance satisfaction (r = −.29). In the SEM, performance satisfaction was non-significantly associated with burnout (beta = .05).

Yildirim and Koruç (2021)	391	Men's soccer youth players, mean age = 17.3 (1.12)	CS	ABQ	Satisfaction with life scale	SEM	−.23		No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and life satisfaction.
Subjective Vitality/Wellbeing/Vigour									
Adie et al. (2008)	539	271 males, 268 females, mean age = 22.75 years (4.63), all team sports	CS	ABQ	Subjective Vitality Scale	CORR		−.15	No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and subjective vitality.
Adie et al. (2012)	91; 37 dropped out/did not complete	Male adolescents, mean age = 13.82 (1.99)	7-W LONGL, covered beginning, middle and end of season	ABQ	Subjective Vitality Scale	CORR	−.27		No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and subjective vitality.
Balaguer et al. (2012)	Study 1: 725; Study 2: 597	T1: 725 male soccer players, mean age = 12.57 (0.54), T2: 597 male soccer players, mean age = 12.58 (0.54)	2-W LONGL, T1 = 2 months into season, T2 = end of season	ABQ	Subjective Vitality Scale	CORR	−0.16 [T1–>T1] −.13 [T1–>T2] −.19 [T2–>T2]		No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and subjective vitality.
Chen and Chang (2017)	167	S1: 54 female, mean age = 30.91 (8.78). S2: 123 females, mean age = 16.13 (0.78). Team and individual sports	CS	ABQ	Subjective vitality scale	CORR	S1: −.50 S2: −.62		No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and subjective vitality.
Chuang et al. (2021)	120	Golfers, 64 males, 56 females, average age = 22.28 (6.86)	CS	ABQ	Subjective Vitality Scale	CORR	−.30		No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and subjective vitality.
Healy et al. (2014)	241	Athletes from regional-level sports teams, 158 males, 83 females, mean age = 23.06 (5.45)	CS	ABQ	Subjective Vitality scale	CORR	−.35		No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and subjective vitality.

(*Continued*)

Table 2. Continued.

Publication	Sample size	Demographics	Design	Burnout Measure	Outcome measure/s	Analyses	Total Burnout CORR	EPE CORR	DEV CORR	RSA CORR	Main findings
Grobbelaar et al. (2011)	41	Male student rugby union players, mean age = 22.26 (1.39)	7-W LONGL, 5-month period, T1–T3: pre-season, T4–T5: pre-competition, T6–T7: competition	ABQ	Stellenbosch Mood Scale – Vigour Subscale	CORR	−.32	−.27	−.24	−.27	No further statistical analyses beyond correlations were carried out.
Zhang et al. (2021)	515	Elite athletes, 290 males, 225 females, mean age = 18.24 (3.16), team and individual sports	CS	ABQ	Training and competition well-being scale	CORR	−.45				No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and well-being.
Quality of Life											
Verkooijen et al. (2012)	123	CTO athletes and Non-CTO athletes, CTO: 41% male, mean age = 19.2 (2.85), Non-CTO: 57% males, mean age = 18.6 (3.2)	CS	ABQ	World Health Organisation Quality of Life instrument	MANCOVA, REG	Total: −.54 Physical: −.44 Psycho-Social: −.50 Social: −.31 ENV: −.38	Total: −.50 Physical: −.44 Psycho-Social: −.43 Social: −.29 ENV: −.32	Total: −.31 Physical: −.29 Psycho-Social: −.25 Social: −.15 ENV: −.22	Total: −.45 Physical: −.29 Psycho-Social: −.49 Social: −.27 ENV: −.32	The linear regression analysis showed a strong significant effect of RSA (beta = −.50) on the psychosocial domain from the quality of life instrument. No other subscales were tested.

Notes. EPE = Emotional and Physical Exhaustion; DEV = Devaluation, RSA = Reduced Sense of Accomplishment; CS = Cross-Sectional; LONGL = Longitudinal; CLPM = Cross-Lagged Panel Model; SEM = Structural Equation Model; REG = Regression; CORR = Correlation; ABQ = Athlete Burnout Questionnaire; SMBM = Shirom-Melamed Burnout Measure.

Table 3. Overview of studies examining the relationship between athlete burnout and physical health outcomes.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome measure/s	Analyses	Total burnout CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
Biomarkers											
Bartholomew et al. (2011)	294 (120 saliva sample)	80 males, 214 females, mean age = 14.51 (1.51), 169 individual sport athletes, 125 team sport athletes; 28 males and 92 females for saliva sample	CS	ABQ	Secretory immunoglobulin A	SEM	.03				No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and IgA concentration.
Becker et al. (2021)	95	Endurance athletes, 54.7% female, mean age = 31.9 (15.02)	CS	ABQ	C-Reactive Protein (log-corrected)	ANOVA		.05	.21	.01	After correcting for multiple comparisons, no significant correlations between any of the ABQ subscales and CRP levels were found. No further statistical analyses were carried out to test this relationship.
Davis et al. (2018)	86	Student athletes, 55 males, 27 females, mean age = 19.87 (2.94), all from team sports	CS	Exhaustion from ABQ	Salivary Cortisol (change saliva)	SEM		.10			No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and cortisol concentration.
Healy et al. (2014)	241	158 males, 83 females, mean age = 23.06 (5.45), regional-level team sport	CS	ABQ	Secretory immunoglobulin A	CORR	IgA concentration: .17 IgA output: .19				No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and IgA concentration or output.
Hew-Butler et al. (2021)	73	Student athletes, 24 males, 49 females, team and individual sports	PROSP, 3-month period, pre- and post-season	ABQ	Serum 25-OH Vitamin D Serum Ferritin (iron)	REG	Vitamin D change: .41 Pre-season iron: .41 Post-season iron: .36				Regression analyses with the whole cohort showed no significant relationships between burnout and Vitamin D or ferritin. However, a decrease in Vitamin D significantly predicted and explained 20.6% of variance in DEV in males. Pre-season ferritin levels significantly explained 16% of variance in EPE in males.
Martin et al. (2021)	40	Swimming and diving team members, 17	3-W LONGL, 6-week period pre-	ABQ	Testosterone Cortisol	Path analyses	T/C ratio change: .34				

(*Continued*)

Table 3. Continued.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome measure/s	Analyses	Total burnout CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
		men (age = 20.3), 23 women (age = 19.3)	competition, T1 = training period start, T2 = middle of training period, T3 = end of training period		Myoglobin Creatine Kinase		MYO change: .24 CK change: .13				A path model showed T/C ratio change to significantly predict athlete burnout (b = .01; B = .35).
Monfared et al. (2021)	42	Student athletes, 14 males (mean age = 15.86; 1.53), 28 females (mean age = 15.07; 4.11), 19% individual sports	CS	ABQ	Salivary cortisol	Path analyses					In the path model, a salivary cortisol increase was significantly associated with an increase in burnout (beta = .24).
Souza et al. (2018)	24	Football and futsal athletes	CS	ABQ	DHEA-S Cortisol (Blood) Testosterone	ANOVA					The ANOVA showed no significant differences between the burnout and the control group in DHEA-s, cortisol, or testosterone concentrations.
Physical/Somatic symptoms											
Appleton and Duda (2016)	406	67% male, mean age = 23.1, 61 individual sports, 345 team sports	CS	ABQ	Physical Symptoms Checklist	Moderated REG		.41	.29	.30	In the examined moderated regression, associations between burnout and physical symptoms were not tested.
Cumming and Duda (2012)	194	Dance students; 169 females, mean age = 16.73 (1.45)	CS	Exhaustion dimension from the ABQ	Physical symptoms checklist	Two-stage cluster analysis		.36			No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and physical symptoms.
Daumiller et al. (2021)	124	Elite athletes, 97 male, 28 female, mean age = 23.7 (4.0), team and individual sports	CS	ABQ	Psychosomatic symptoms from Stress and Coping Inventory	Path analysis	.53				In the path model, burnout and psychosomatic symptoms were significantly correlated (r = .44).
Healy et al. (2014)	241	158 males, 83 females, mean age = 23.06 (5.45), regional level team sports	CS	ABQ	Physical symptoms checklist	CORR	.32				In the examined SEM, associations between burnout and physical symptoms were not tested.
Reinboth and Duda (2004)	265	Adolescent male soccer and cricket players, mean age = 16.44 (1.32)	CS	ABQ	Physical symptoms checklist	CORR		.43			In the examined moderated regression, associations between burnout and physical symptoms were not tested.

Physiological indices											
Gerber et al. (2018a)	257 at baseline, 196 at follow-up, 50 athletes for sleep-EEG data	Swiss Olympic partner school students, 125 boys (30 for EEG), 73 girls (20 for EEG), mean age = 16.83 (1.4)/EEG = 17.2 (1.6)	2-W LONGL, 6-month period	SMBM	Sleep-EEG assessment	CLPM, T-test					Athletes above the critical cut-off for clinically relevant burnout did not differ in any of the objectively assessed sleep parameters.
Kristiansen et al. (2012)	24	Elite competitive swimmers, 15 males, 9 females, mean age = 18.25 (1.6)	CS	ABQ	Methacholine challenge [direct bronchial hyperresponsiveness] Eucapnic voluntary hyperventilation (EVH) test [indirect bronchial hyperresponsiveness]	CORR	MCT: −.03 EVH: .20		MCT: −.11 EVH: .19	MCT: .23 EVH: 0	No further statistical analyses beyond correlations were carried out to examine the relationship between burnout and bronchial hyperresponsiveness.
Monfared et al. (2021)	42	Student athletes, 14 males (mean age = 15.86; 1.53), 28 females (mean age = 15.07; 4.11), 19% individual sports	CS	ABQ	Heartrate Blood Volume Pulse (BVP) Respiratory rate (RR) Galvanic skin response (GSR)	Path-A					In the path model, GSR was not significantly associated with burnout. BVP (beta = −.26) and RR (beta = −.25) were significantly associated with burnout.
Ryu et al. (2015)	26	High school student athletes, 21 males, 5 females, mean age = 18.1 (1.2), track and field, soccer and volleyball	CS	MBI	EEG recordings during Stroop Colour and Word Test	ANOVA					No-burnout group showed significantly longer mean reaction time than the Burnout group in the response to word naming (d = 0.58) and the response to colour tasks (d = 0.66). No-burnout group showed higher accuracy of responses than the burnout group on word naming (d = 0.31) and the colour tasks (d = 0.51). No-burnout group showed significantly higher theta power than those in the burnout group (d = 2.20). No-burnout group showed significantly higher alpha power than those in the burnout group (d = 1.79). No-burnout group showed significantly higher beta power than the burnout group (d = 2.90).

(*Continued*)

Table 3. Continued.

Publication	Sample Size	Demographics	Design	Burnout Measure	Outcome measure/s	Analyses	Total burnout CORR	EPE CORR	DEV CORR	RSA CORR	Additional Findings
Injury											
Grylls and Spittle (2008)	264	Competitive athletes, 124 men, 140 women, mean age = 37.5 (15.7), team and individual sports	CS	MBI	Current Injury status Number of sporting injuries during their sporting career	T-test and CORR		.13	.20	.22	Currently injured athletes had significantly lower mean scores of exhaustion ($eta^2 = .11$), depersonalisation ($eta^2 = .04$), sporting accomplishments ($eta^2 = .02$) compared to uninjured.
Moen et al. (2017)	358	Junior elite athletes, 54% males, 46% females, mean age = 18.2, 28% cross country skiing, 22% soccer, 13% biathlon	CS	ABQ	Training days lost to injury	SEM	.06				In the measurement model, the burnout latent significantly correlated with injuries ($r = .15$). In the SEM, injury was non-significantly associated with burnout.

Notes. EPE = Emotional and Physical Exhaustion; DEV = Devaluation, RSA = Reduced Sense of Accomplishment; CD = Concentration Disruption; SA = Somatic Anxiety; CA = Cognitive Anxiety; SC = Self-Confidence; CS = Cross-Sectional; LONGL = Longitudinal; PROSP = Prospective; W = Wave; T1 = time point 1; T2 = time point 2; T3 = time point 3; CLPM = Cross-Lagged Panel Model; SEM = Structural Equation Model; REG = Regression; LOG = Logistic; Path-A = Path-analyses; CORR = Correlation; ABQ = Athlete Burnout Questionnaire; MBI = Maslach Burnout Inventory; SMBM = Shirom-Melamed Burnout Measure.

within-study variance, and the third level represents between-study variance. Through this partitioning, these models account for dependency among effect sizes such as when a single study provides more than one effect size for the same association. This is the case when longitudinal studies provide several correlation coefficients for the same association, burnout was measured through a total score, but also through the three dimensional scores (EPE, DEV, RSA), and/or through several instruments (e.g. ABQ and SMBM) in the same study.

To conduct the analyses, we followed Gucciardi et al. (2021) tutorial for multilevel meta-analyses. At first, to evaluate whether the partitioning of variance across three levels was meaningful, we performed likelihood-ratio tests. In these tests, we compared the full model where the variances are freely estimated to separate models in which the within-study and between-study variance was fixed to zero. If the models showed to be significantly different, the partitioning was deemed meaningful.

Heterogeneity

Heterogeneity was assessed using both the total heterogeneity of the weighted mean effect sizes (Q^T) and the *I*-squared statistic. The *I*-squared statistic was further partitioned into the within-study and between-study heterogeneity. For the *I*-squared value, we followed Higgins and Thompson's (2002) suggestions that values of 25, 50 and 75% indicate low, medium and high levels of heterogeneity. Where substantial heterogeneity existed, we first analysed for outliers, which was followed by assessing meta-bias and substantial moderators.

Outlier assessment

For outlier assessment, we used several approaches. In the first step, we assessed a forest plot that showed the individual effects and confidence intervals in relation to the overall effect and confidence interval. We then tested whether any of the individual effect sizes had residuals that exceeded three standard deviations. We also tested whether any of the individual effects were flagged testing for a Cook's distance of more than three times the mean. In the final step, if outliers were removed through either of the above steps, we compared the model with outliers to a model without the outliers to assess how much of a change the removal of outliers made to the overall effect.

Meta-bias

To test for meta-bias, we first visualised potential publication bias with a traditional funnel plot and a sunset-enhanced funnel plot that integrated knowledge of statistical power of individual effects (see Kossmeier et al., 2020). We followed this visual analysis with a multilevel extension of Egger's test of symmetry in which the overall pooled effect is regressed on to the standard error of individual effect sizes (Fernández-Castilla et al., 2019). Lastly, we considered methodological features as moderators of the overall pooled effect which included publication type (journal vs. dissertation) and sample size.[1]

Moderator analyses

To assess which moderators may contribute meaningfully to the overall model, we first ran moderator analyses for each potential moderator (burnout measure, burnout dimension, outcome measure, design). Moderators that significantly reduced the heterogeneity from the overall model were considered potentially meaningful. In the next step, these moderators were included in a separate model. We then compared the degree of heterogeneity in the model when potentially meaningful moderators are included with the baseline model or the overall pooled effect only. If this comparison was significant and the moderator model showed to reduce the heterogeneity, the moderators were considered to be meaningful.

Results

We have first structured the results of the present review around the characteristics of the studies: the samples, which measures of burnout were used, and their design. Following this, the findings of the studies are reported on the three major aspects of health: negative mental health outcomes, positive mental health outcomes, and physical health outcomes. Each of these sections is then further subdivided into the specific outcomes that were examined (e.g. depression for negative mental health outcomes). Table 1 (negative mental health outcomes), Table 2 (positive mental health outcomes) and Table 3 (physical health outcomes) provide further details on the studies relevant to each category. The results of the meta-analyses are reported thereafter.

Athlete samples

In the present review, a total of 13,976 athletes were included. The average age was 19.8 years old (mean range 12.6 to 37.5 years). About a third were females (35%; range 0% to 87%). Of the 54 studies included, 13 were carried out with youth athletes, while the remaining were carried out with adult samples. In terms of the competition level, 26% of athletes competed in their university/college league and 20% at school level. About 15% of athletes were characterised as elite level athletes, 4% as competitive athletes and 2% as club athletes. The remaining 33% were unspecified with regards to competition level.

Burnout measures

Of the 54 studies included in the present review, 48 (89%) used the Athlete Burnout Questionnaire to operationalise burnout. Other burnout measures included the Maslach Burnout Inventory ($n = 2$), the Shirom-Melamed Burnout Measure ($n = 2$), the Burnout Scale for University Students ($n = 1$) and the Sport Burnout Inventory ($n = 1$). From the studies that used the ABQ, 23 used a total burnout score only, 14 used the dimensional scores, seven used both the total and the dimensional scores, and four studies used the exhaustion dimension only. As such, while researchers appear to have a clear preference for using the ABQ for the assessment of burnout in athletes, there is variability in how the ABQ is used to operationalise burnout.

Study designs

Most studies in the present review adopted a cross-sectional design ($n = 41$). Eleven studies used a longitudinal design (two-wave = 5, three-wave = 2, four-wave = 1, five-wave = 1, seven-wave = 2) with those that provided seasonal information starting either pre-season, at the beginning of the season or in the middle of the season and finishing at the end of the season. One paper provided both a cross-sectional and a longitudinal sample (two waves). One study used a prospective design (pre- and post-season, over a period of three to seven months depending on the sport). Tables 1–3 provide further details on how studies with such designs analysed the data.

Study quality

Of the 54 studies included, all showed criteria where not all sources of bias were addressed. In 41 studies, the source of bias persisted on at least one criterium. Sources of bias were predominantly found due to a lack of theoretical models specifically for the link between psychological and physical health variables and a lack of power analyses. A large number of studies also did not specifically model athlete burnout in relation to a relevant health outcome since their focus was on other associations. While these studies may have employed strong analytical methods to test the associations of interest to them, they only provided correlations for the association between athlete burnout and the relevant health outcome. As such, the analytical methods for such studies were appraised as a potential source of bias. Table A in the supplemental materials provides an overview of the quality assessment.

Health outcomes

We now turn to the results of the included studies, specifically in regard to which health outcomes were linked to burnout.

Negative mental health outcomes

From the 54 included studies, 27 were relevant to the association between burnout and negative mental health outcomes (see Table 1). Three of these studies were published with the same sample but different statistical analyses, as such, 24 unique samples were included for negative mental health outcomes. These negative mental health outcomes covered depression ($n = 13$), anxiety ($n = 10$), addictive behaviour ($n = 3$), insomnia ($n = 2$), worry ($n = 2$), mood ($n = 2$), psychological distress ($n = 2$) and body image dissatisfaction ($n = 2$). Each of these outcomes are now outlined in detail.

Depression. The association between athlete burnout and depression was covered by 13 studies. In these studies, on average, 32% of participants were female and the age ranged from 14.8 to 25.5 years. Competition levels, where specified, included university ($n = 5$), professional ($n = 2$), junior elite ($n = 2$), youth ($n = 1$) and amateur ($n = 1$). Nine of these studies were cross-sectional and five were longitudinal (one paper had both a cross-sectional and longitudinal sample). The longitudinal studies were all conducted with either youth athletes or athletes in educational settings (e.g. university). Apart from Amemiya and Sakairi (2021), those studies that reported seasonal information started the study at the beginning of the season and ended it at the end of the season. The longitudinal studies employed two to seven waves and spanned three to seven months. The findings show that both total and dimensional measures of athlete burnout were positively correlated with depression. Effect sizes ranged from small to medium ($r = -.03$ to .59; see Table 1 for full details). In the longitudinal studies that modelled burnout and depression over time, total and dimensional measures of burnout predicted increased depression. However, Frank et al.'s (2017) study found reciprocal effects with burnout predicting depressive symptoms as well as depressive symptoms predicting burnout over time.

Anxiety. Ten studies examined the association between burnout and anxiety, all of which were cross-sectional. On average, 27% of participants were female and the age ranged from 17.0 to 25.5 years. Competition levels, where specified, included university ($n = 2$), professional ($n = 2$), youth ($n = 2$), junior elite ($n = 1$), and amateur ($n = 1$). The findings show that both total and dimensional measures of athlete burnout were positively correlated with anxiety in most studies. Effect sizes ranged from small to medium size ($r = .06$ to .46; see Table 1 for full details). Studies that examined the relationship between athlete burnout and anxiety using regression all showed burnout to be significantly associated with anxiety (Gustafsson et al., 2017b; King et al., 2021; Sánchez-Romero et al., 2021; Vaughan et al., 2020; Werner et al., 2021).

Addictive behaviour. The association between athlete burnout and addictive behaviour was examined by three studies, all of which were cross-sectional. On average, 30% of participants were female and the age ranged from 19.7 to 31.9 years. Competition levels, where specified, included professionals only ($k = 1$). The findings showed the exhaustion dimension to be positively correlated with exercise dependence, while the RSA dimension was negatively correlated with exercise dependence. Effect sizes were small ($r = -.10$ to .29; see Table 1 for full details). The devaluation dimension was the only burnout dimension that showed mixed results. While Becker et al. (2021) found devaluation to be negatively correlated with exercise addiction, Reche et al. (2018) showed the reverse. As such, the correlation between devaluation and exercise addiction showed mixed results. King et al.'s (2021) study on alcohol dependence found no significant association with burnout.

Insomnia. Two studies examined the association between athlete burnout and insomnia, and both had a longitudinal design. Overall, on average, 27% of the participants were female. Only Gerber et al. (2018a) reported the average age of participants, which was 16.8 years. Competition levels, where specified, included junior elite ($k = 1$) and national level ($k = 1$). The studies employed two to five waves and spanned five to seven months.

The findings showed the total burnout measure to be positively correlated with insomnia. Effect sizes were small-to-medium sized ($r = .29$ to .46; see Table 1 for full details). In both tested models, burnout was found to predict insomnia over time. The opposite direction, insomnia predicting burnout, was tested for but showed to be nonsignificant in both studies.

Worry. Two studies examined the association between athlete burnout and worry of which both were carried out with cross-sectional designs. On average, 46% of participants were female and the age was 18.2 years. Competition levels, where specified, included youth ($n = 2$) only. The findings showed the total burnout measure to be positively correlated with worry. Effect sizes were medium sized ($r = .36$ to .49; see Table 1 for full details). In all models, burnout was significantly and positively associated with worry.

Mood. Two studies examined the association between burnout and mood. One study was cross-sectional, the other was longitudinal. On average, 48% of participants were female and the age ranged from 15.8 to 22.2 years. Competition levels, where specified, included university only ($k = 1$). The longitudinal study employed seven waves and spanned five months. The findings showed the total and dimensional burnout measure to be positively correlated with tension, anger, fatigue, and confusion. Effect sizes ranged from small to medium ($r = .22$ to .46; see Table 1 for full details). While Grobbelaar et al. (2011) showed fatigue to increase with higher reduced sense of accomplishment, Markati et al. (2019) showed the reverse association with fatigue decreasing with higher reduced sense of accomplishment. As such, there were mixed results for the association between reduced sense of accomplishment and fatigue.

Psychological distress. Two studies examined the association between athlete burnout and psychological distress. One study was cross-sectional, the other was longitudinal. On average, 27% of participants were female and the age ranged from 19.3 to 25.5 years. Competition levels, where specified, included professionals only ($k = 1$). The longitudinal study employed three waves that spanned six weeks from pre- to post training. The findings showed mixed results for the association between burnout and psychological distress. Martin et al. (2021) found total burnout to be positively correlated with training distress ($r = .47$), but in their regression model, this association was no longer significant (see Table 1 for details). King et al. (2021) further showed that exhaustion significantly increased the risk for meeting the diagnostic cut-off for psychological distress.

Body image dissatisfaction. Two cross-sectional studies examined the association between burnout and body image dissatisfaction. On average, 51% of participants were female and the age ranged from 16.7 to 19.6 years. Competition levels, where specified, included university only ($k = 1$). The findings showed an association between burnout and body image dissatisfaction. Cumming and Duda (2012) found a significant, positive correlation between body image dissatisfaction and the exhaustion dimension with a small effect size ($r = .20$; see Table 1 for full details). Baella-Vigil et al.'s (2020) originally planned bivariate regression did not show a significant association between burnout and body dissatisfaction, but the follow-up Poisson regression analyses showed this association to be significant.

Positive mental health outcomes

From the 54 included studies, 22 were relevant to the association between burnout and positive mental health outcomes (see Table 2). These outcomes covered satisfaction ($n = 11$; across multiple domains), subjective vitality/wellbeing ($n = 8$), and quality of life ($n = 1$). Each of these outcomes is outlined in detail below.

Satisfaction. The association between burnout and satisfaction was examined in eleven studies. Nine of these studies were cross-sectional, while the other two were longitudinal. On average, 41% of participants were female and the age ranged from 15.8 to 20.2 years.

Competition levels, where specified, included youth ($k = 4$), university ($k = 3$), and junior elite ($k = 2$). Both longitudinal studies were carried out with youth athletes. The longitudinal studies employed two to four waves and spanned four to six months. Where specified, these studies covered the beginning to the end of the season. The findings showed total and dimensional burnout measures to be negatively correlated with satisfaction across multiple domains (life, team, performance). Effect sizes ranged from small to medium ($r = -.01$ to $-.56$; see Table 2 for details). DeFreese and Smith's (2014) longitudinal study further showed a negative fixed-effect, temporal association between athlete burnout and life satisfaction for both the total and dimensional burnout models. Their multilevel model also demonstrated the effect of athlete burnout on life satisfaction to vary significantly across individuals, as such, athlete burnout may have a strong effect on life satisfaction in some individuals, but a lesser effect in others.

Subjective vitality. Eight studies examined the association between burnout and subjective vitality. Three of these studies were carried out with longitudinal designs, while the other five were cross-sectional. On average, 27% participants were female and the age ranged from 12.57 to 23.06 years. Competition levels, where specified, included youth ($k = 2$), university ($k = 1$), regional ($k = 1$) and professional ($k = 1$). Both longitudinal studies were conducted with either youth athletes or athletes in educational settings (e.g. university). The longitudinal studies employed two to seven waves and spanned over five months covering the start of the season to the end of the season. The findings showed total and dimensional burnout measure to be negatively correlated with subjective vitality. Effect sizes ranged from small to medium ($r = -.13$ to $-.62$; see Table 2 for details). While three of these studies implemented longitudinal designs, none of these studies tested the temporal association between burnout and subjective vitality beyond correlations.

Quality of life. Verkooijen et al.'s (2012) study was the only one to assess the association between burnout and quality of life. On average, 59% of participants were female and the age was 18.9 years. In this cross-sectional study, burnout was negatively correlated with all dimensions of the quality-of-life measure. Effect sizes ranged from small to medium ($r = -.15$ to $-.50$; see Table 2 for details). The employed linear regression model showed a strong significant effect of the RSA dimension on the psychosocial domain of the quality-of-life instrument. No other associations between the burnout dimensions and quality-of-life subscales were tested.

Physical health outcomes

From the 54 included studies, 18 were relevant to the association between burnout and physical health outcomes (see Table 3). These outcomes covered biomarkers ($n = 8$), physical and somatic symptoms ($n = 5$), physiological indices ($n = 4$), and injury ($n = 2$). Each of these outcomes are reported in detail below.

Biomarkers. Eight studies covered the association between burnout and biomarkers of which six were cross-sectional, one was prospective, and one was longitudinal. On average, 53% of participants were female and the age ranged from 14.5 to 31.9 years. Competition levels, where specified, included university ($k = 3$) and regional ($k = 1$).

The prospective and longitudinal studies employed two to three waves and spanned six weeks to three months covering pre-season to post-training or post-season. The findings for associations between burnout and multiple biomarkers showed mixed results ($r = .01$ to .41; see Table 3 for full details). Cortisol was examined as a biomarker in four studies. Monfared et al. (2021) was the only study to find a significant positive association between burnout and salivary cortisol. However, while Martin et al. (2021) did not look at cortisol on its own, they examined the ratio between cortisol and testosterone in serum. This ratio is considered a marker of physiological stress and showed to significantly predict athlete burnout in their path model. Martin et al. (2021) further analysed for creatine kinase and myoglobin levels, however, these only showed small correlations and no associations with athlete burnout in the path model. A study by Souza et al. (2018) also compared testosterone and DHEA-s levels in serum between their burnout and control group, where they found no significant difference for either of these biomarkers.

Apart from hormones, other biomarkers associated with the immune system were also examined. Bartholomew et al. (2011) and Healy et al. (2014) assessed the association between secretory immunoglobulin A (sIgA) and burnout. While Bartholomew et al. (2011) found no association with burnout, Healy et al. (2014) found small correlations that were not statistically significant. Another immune system related biomarker examined was C-reactive protein, however, Becker et al. (2021) found no significant associations after correcting for multiple comparisons.

Other tested biomarkers were associated with nutrition. Hew-Butler et al. (2021) examined Vitamin D as well as iron levels in blood. They found small correlations for Vitamin D change, pre-season iron and post-season iron levels to total burnout. While the regression analyses showed no associations for the whole sample, there were significant associations between Vitamin D and the DEV dimension as well as pre-season iron levels and the EPE dimension in males.

Physical and somatic symptoms. Five studies examined the association between burnout and physical symptoms of which all were cross-sectional. On average, 34% of participants were female and the age ranged from 16.4 to 23.7 years. Competition levels, where specified, included youth ($k = 2$), regional ($k = 1$), and professional ($k = 1$). Findings showed physical symptoms to positively correlate with higher burnout. Effect sizes ranged from small to medium ($r = .29$ to .53; see Table 3 for full details). However, only Daumiller et al. (2021) modelled this association in their path analyses through a correlation, which was found to be significant. None of these studies tested the association between burnout and physical symptoms beyond correlations.

Physiological indices. Three studies examined the association between burnout and physiological indices of which three studies were cross-sectional and one was longitudinal. On average, 33% of participants were female and the age ranged from 15.1 to 18.3 years. Competition levels, where specified, included youth ($k = 2$) and junior elite ($k = 2$). The longitudinal study employed three waves and spanned six months. Kristiansen et al. (2012) examined the association between bronchial hyperresponsiveness and burnout, however, none of the examined correlations were significant ($r = .00$ to .23; see Table 3 for details). Monfared et al. (2021) assessed heartrate, blood volume pulse, respiratory rate, and the galvanic skin responses. In their path model, blood volume pulse and respiratory rate were significantly associated with burnout.

Gerber et al. (2018a) compared physiological sleep parameters (electroencephalogram [EEG] measurements) between their burnout and control group. They found no significant differences in sleep parameters between these groups. Ryu et al. (2015) also used EEG measurements to compare their burnout and control group, however, they recorded these measurements during a Stroop colour and word naming test to assess cognitive skills. While the control group showed longer mean reaction times in both tasks, they also showed higher accuracy than the burnout group. The control group further demonstrated higher theta, alpha and beta power than the burnout group.

Injury. Two studies examined the association between burnout and injury that were both cross-sectional. On average, 49% of participants were female and the age ranged from 18.2 to 37.5 years. Competition levels, where specified, included junior elite only ($k = 1$). Both studies showed small, positive correlations between athlete burnout and injury ($r = .06$ to $.22$; see Table 3 for full details). Grylls and Spittle (2008) further showed significantly lower mean scores of exhaustion, depersonalisation and sporting accomplishments in injured athletes compared to uninjured. In Moen et al.'s (2017) measurement model the burnout latent significantly correlated with training days lost to injury, while this association became non-significant in the examined structural equation model.

Meta-analyses

We now turn to the results of the meta-analyses. These were performed for outcomes that had been examined by two or more studies and that could be meaningfully pooled. To determine whether studies could be meaningfully pooled, we followed previous research (Valentine et al., 2010) and guidelines from the Cochrane Consumers and Communication Review Group (2016b). The examined outcomes were therefore: depressive symptoms, anxiety, satisfaction, vitality, and physical symptoms. Forest plots of effect sizes for each outcome can be found in the Supplemental Materials (Figure A, D, G, J, M).

Depression

Pooled effect and heterogeneity. The overall pooled effect for the association between burnout and depression was medium sized ($r^+ = .39$, 95% CI = .32, .51, $p < .001$, $g^+ = .42$, $k = 13$). The likelihood ratio tests revealed significant variance in effects within studies (level 2; LRT = 120.26, $p < .0001$) and between studies (level 3; LRT = 5.26, $p = .02$), which suggests the partitioning of variance across levels is meaningful. The variability in observed effects was found to be larger than expected based on sampling variability ($Q(64) = 442.07$, $p < .0001$). The proportion of variability in effects that could not be attributed to sampling variance ($I^2 = 85.03\%$) was distributed roughly evenly within-studies ($I^2 = 50.40\%$) and between-studies ($I^2 = 34.63\%$).

Outlier analyses. The outlier analyses highlighted one individual effect that had residuals that exceeded three standard deviations. However, the exclusion of this outlier had no effect on the overall pooled effect ($r^+ = .39$, 95% CI = .32,.51, $p < .001$). Similarly, four individual effects were flagged with a Cook's distance of three times the mean. Again, the exclusion of these effects had barely any effect on the overall pooled effect ($r^+ = .38$, 95% CI = .29,.51, $p < .001$). Together, these results suggest that the overall pooled effect is largely robust to outliers and influential cases.

Meta-bias. Based on traditional funnel plots (see Supplemental Figure B), a multilevel extension of Egger's test ($F(1,63) = 0.19$, $p = .66$) and tests of methodological moderators (publication status, sample size) the meta-analytic data was minimally influenced by publication bias. Power estimations further suggested the likelihood of false positives being included in the current meta-analysis to be low (see Supplemental materials for further details).

Moderator analyses. The moderator analyses showed the outcome measure ($F(6,58) = 4.60$, $p > .001$), the burnout measure ($F(3,61) = 2.87$, $p = .04$), and the burnout dimensions ($F(3,61) = 4.39$, $p < .01$) to have a significant effect on the overall pooled effect (see Supplemental materials for further details). We consequently tested whether the full model with relevant moderators significantly reduced the degree of heterogeneity compared to the model without the moderators. The addition of moderators was found to significantly reduce heterogeneity ($Q(64) = 442.07$, $p < .001$). However, the residual heterogeneity remained statistically meaningful ($QE(64) = 178.13$, $p < .001$).

Anxiety

Pooled effect and heterogeneity. The overall pooled effect for the association between burnout and anxiety was medium sized ($r^+ = .30$, 95% CI = .21, .41, $p < .001$, $g^+ = .31$, $k = 10$). The likelihood ratio tests revealed significant variance in effects within studies (level 2; LRT = 120.26, $p < .0001$), but not between studies (level 3; LRT = 0, $p = 1$). This suggests most of the variance lays on the within-studies level, while the different studies vary little from each other. We continued with the multilevel meta-analysis, however, to account for the dependency of individual effects. The variability in observed effects was found to be larger than expected based on sampling variability ($Q(13) = 151.01$, $p < .0001$). The proportion of variability in effects that could not be attributed to sampling variance ($I^2 = 92.00\%$) was attributed to within-studies ($I^2 = 92.00\%$) with no variability between-studies ($I^2 = 0\%$).

Outlier analyses. The outlier analyses did not highlight any individual effects for residuals exceeding three standard deviations. Similarly, no individual effects were flagged considering a Cook's distance of three times the mean. These results reflect the lack of variance on the within-studies level as no effect would be considered an outlier if all effects are highly similar.

Meta-Bias. Based on a traditional funnel plot (see Supplemental Figure E), a multilevel extension of Egger's test ($F(1,12) = 0.29$, $p = .60$) and tests of methodological moderators (publication status, sample size) the meta-analytic data was minimally influenced by publication bias. Power estimations further suggested the likelihood of false positives being included in the current meta-analysis to be low (see Supplemental Materials for further details).

Moderator analyses. The moderator analyses showed none of the potential moderators, namely the burnout dimension ($F(3,10) = 3.37$, $p = .06$) or outcome measure ($F(3,10) = 1.30$, $p = .33$), to have a significant effect on the overall pooled effect. As such, an extended model with moderators was not tested.

Satisfaction

Pooled effect and heterogeneity. The overall pooled effect for the association between burnout and satisfaction was medium sized ($r^+ = -.37$, 95% CI = −.44, −.33, $p < .001$, $g^+ = -.39$, $k = 11$). The likelihood ratio tests revealed significant variance in effects within studies (level 2; LRT = 27.00, $p < .0001$), but not between studies (level 3; LRT = 0.84, $p = .36$). This suggests most of the variance lays on the within-studies level, while the different studies vary little from each other. We continued with the multilevel meta-analysis, however, to account for the dependency of individual effects. The variability in observed effects was found to be larger than expected based on sampling variability ($Q(13) = 140.09$, $p < .0001$). The proportion of variability in effects that could not be attributed to sampling variance ($I^2 = 79.84\%$) was attributed to within-studies ($I^2 = 62.38\%$) with little variability in between-studies ($I^2 = 17.46\%$).

Outlier analyses. The outlier analyses did not highlight any individual effects that had residuals that exceeded three standard deviations. However, two individual effects were flagged with a Cook's distance of three times the mean. The exclusion of these effects had no effect on the overall pooled effect ($r^+ = -.37$, 95% CI = −.45, −.33, $p < .001$, $g = -.39$). Together, these results suggest that the overall pooled effect is largely robust to outliers and influential cases.

Meta-bias. Based on a traditional funnel plot (see Supplemental Figure H), a multilevel extension of Egger's test ($F(1,33) = 3.60$, $p = .07$) and tests of methodological moderators (sample size) the meta-analytic data was minimally influenced by publication bias. Power estimations further suggested the likelihood of false positives being included in the current meta-analysis to be low (see Supplemental Materials for further details).

Moderator analyses. The moderator analyses showed the burnout dimensions ($F(3,31) = 5.66$, $p < .001$) to have a significant effect on the overall pooled effect (see Supplemental Materials for further details). We consequently tested whether the full model with the burnout dimension significantly reduced the degree of heterogeneity compared to the model without the moderators. The addition of the moderator was found to significantly reduce heterogeneity ($Q(33) = 140.09$, $p < .01$). However, the residual heterogeneity remained statistically meaningful ($QE(33) = 104.19$, $p < .01$).

Vitality

Pooled effect and heterogeneity. The overall pooled effect for the association between burnout and vitality was medium sized ($r^+ = -.35$, 95% CI = −.49, −.24, $p < .001$, $g^+ = -.36$, $k = 8$). The likelihood ratio tests revealed significant variance in effects between studies (level 2; LRT = 9.87, $p < .01$), but not between studies (level 3; LRT = 0.00, $p = 1$). This suggests most of the variance lays on the between-studies level, while the effect sizes within studies vary minimally. We continued with the multilevel meta-analysis, however, to account for the dependency of individual effects. The variability in observed effects was found to be larger than expected based on sampling variability ($Q(13) = 133.66$, $p < .0001$). The proportion of variability in effects that could not be attributed to sampling variance ($I^2 = 77.50\%$) was attributed to between-studies ($I^2 = 77.50\%$) with no variability within-studies ($I^2 = 0.00\%$).

Outlier analyses. The outlier analyses did not highlight any individual effects that had residuals that exceeded three standard deviations. However, four individual effects were flagged with a Cook's distance of three times the mean. The exclusion of these effects lowered the overall pooled effect ($r^+ = -.26$, 95% CI = −.34, −.19, $p < .001$, $g = -.27$). These results suggested the overall pooled effect was affected by outliers. Thus, we conducted the following analyses after excluding the flagged outliers.

Meta-bias. Based on a traditional funnel plot (see Supplemental Figure K), a multilevel extension of Egger's test ($F(1,38) = 0.37$, $p = .54$) and tests of methodological moderators (sample size) the meta-analytic data was minimally influenced by publication bias. Power estimations further suggested that some of the included effect sizes may represent false positives, which questions the evidence base for the association between burnout and vitality (see Supplemental Materials for further details).

Moderator analyses. The moderator analyses showed none of the potential moderators, namely the design ($F(1,38) = 1.72$, $p = .20$), burnout dimension ($F(3,36) = 0.17$, $p = .92$), or outcome measure ($F(1,38) = 0.08$, $p = .78$), to have a significant effect on the overall pooled effect. As such, an extended model with moderators was not tested.

Physical symptoms

Pooled effect and heterogeneity. The overall pooled effect for the association between burnout and physical symptoms was medium sized ($r^+ = .38$, 95% CI = .30, .49, $p < .001$, $g^+ = .40$, $k = 5$). The likelihood ratio tests revealed no significant variance in effects within studies (level 2; LRT = 0.98, $p = .32$) or between studies (level 3; LRT = 0.08, $p = .78$), which suggests the partitioning of variance across levels was not meaningful. This may have been due to the limited number of included studies. We continued with the multi-level meta-analysis, however, to account for the dependency of individual effects.

The variability in observed effects was found to be larger than expected based on sampling variability ($Q(6) = 13.49$, $p = .04$).

Outlier analyses. The outlier analyses did not highlight any individual effects that had residuals that exceeded three standard deviations. However, one individual effect was flagged with a Cook's distance of three times the mean. The exclusion of this effect had barely any effect on the overall pooled effect ($r^+ = .35$, 95% CI = .29,.44, $p < .001$, $g = .37$). Together, these results suggest that the overall pooled effect is largely robust to outliers and influential cases.

Meta-bias. Based on a traditional funnel plot (see Supplemental Figure N), a multilevel extension of Egger's test ($F(1,5) = 3.92$, $p = .11$) and tests of methodological moderators (sample size) the meta-analytic data was minimally influenced by publication bias. Power estimations further suggested that some of the included effect sizes may represent false positives, which questions the evidence base for the association between burnout and physical symptoms (see Supplemental Materials for further details).

Moderator analyses. The moderator analyses showed none of the potential moderators, namely the burnout dimension ($F(3,3) = 1.17$, $p = .45$) to have a significant effect on the overall pooled effect. As such, an extended model with moderators was not tested.

Discussion

The aim of the present study was to provide the first systematic review and meta-analysis of research examining the association between athlete burnout and mental and physical health outcomes. We reviewed 54 studies that included a broad range of negative and positive mental health outcomes and physical health outcomes. Based on an integrative review of the studies we included, we now discuss what we consider to be the key findings before providing some critical considerations for future work in this area, and we end with what we think the implications of the findings are for applied practice and policy.

Key findings

Previous research has repeatedly shown that burnout, beyond its own symptoms, is associated with numerous negative health outcomes for those in occupational settings (e.g. Salvagioni et al., 2017). For the first time in collating the existing research in sport, our findings support this idea by suggesting that burnout is also associated with many negative health outcomes for athletes. In regard to specific outcomes, we found athlete burnout to be associated with negative mental health outcomes that included depression, anxiety, insomnia, worry, and body image dissatisfaction, positive mental health outcomes that included satisfaction, and vitality as well as physical health that included physical symptoms (e.g. headaches, dizziness, infection). For those outcomes with sufficient number of effects (depression, anxiety, satisfaction, vitality, physical symptoms), our meta-analyses suggested these effects were medium in size. Collectively, this research suggests that burnout may well indeed have negative implications for athletes' health, and given the importance of health generally, and for sports performance, burnout should be considered a priority for those working in this area.

Next, we note that, as is common in sport psychology, the majority of studies we reviewed were cross-sectional. However, there were 11 longitudinal studies that provide stronger evidence for the potential causal role that burnout has to play in leading to further health outcomes. For example, several longitudinal studies showed burnout to predict depression (Amemiya & Sakairi, 2021; Frank et al., 2017; Gerber et al., 2018b), insomnia (Gerber et al., 2018a; Li et al., 2018), and life satisfaction (DeFreese & Smith, 2014). This research also provided evidence for a potential complex interplay between certain health outcomes and burnout. Most notably the work of Frank and colleagues showed, analogous to research in occupational psychology (Tóth-Király et al., 2021), that the association between burnout and depression was reciprocal. This is in contrast to insomnia, where burnout predicted sleep quality but not *vice versa* (Gerber et al., 2018a; Li et al., 2018), which does however replicate clinical research (e.g. Rothe et al., 2020). Furthermore, DeFreese and Smith's (2014) longitudinal study showed that athlete burnout had both a fixed-effect and random-effect on life satisfaction. Thus, the strength of the effect athlete burnout had on life satisfaction varied across individuals, and therefore may be determined by other moderators. Such moderators could include coping resources (e.g. resilience) as such resources have previously been shown to buffer the link between burnout and life satisfaction in non-athlete samples (Wang et al., 2022).

Our findings were less clear with respect to physical health outcomes. When examining biomarkers, in line with much of the research outside of sport (Danhof-Pont et al., 2011), we found mixed findings. While cortisol was the most frequently examined biomarker, it did not show any consistent associations with athlete burnout (e.g. Davis et al., 2018; Monfared et al., 2021; Souza et al., 2018). This finding was similar to other hormonal markers associated with the HPA-axis (DHEA-S, testosterone), immunological system (e.g. sIgA) and muscle function (e.g. myoglobin). In regards to other aspects of physical health, with the exception of consistent associations with physical health symptoms, mixed findings were evident for injuries (Moen et al., 2017), respiratory function (Monfared et al., 2021), cardiovascular health (Monfared et al., 2021), electrodermal activity (Monfared et al., 2021), and EEG recordings (Ryu et al., 2015). Across this work, what is generally apparent, then, is that physical health outcomes have not been widely explored, and certainly not in a systematic manner. Similar to work in occupational contexts, it is possible the mixed evidence is more a function of a lack of work, rather than a lack of associations.

The key findings should be considered in relation to the participants' demographics. Similar to other research in sport, most studies were male dominated and included young participants (athlete in their early 20s). Participants were from a range of competitive levels from regional to elite but a large proportion of studies included participants competing in junior or university leagues. This was particularly apparent in the longitudinal studies that were all either conducted with youth or student athletes. Thus, the findings may not apply to older populations or athletes outside of youth and student settings. Most longitudinal studies were also conducted from the beginning of the athletes' season to the end, but did not collect data post-season. Accordingly, it is unclear how burnout and other health outcome levels are associated outside of active training for competition. Burnout levels in athletes may not drop off immediately after the season ends. This means effects that take longer to manifest or only develop after the athlete has experienced heightened burnout levels for an extended period of time may have been missed. This temporal interplay requires further exploration.

Critical considerations and recommendations

Based on a critical appraisal of the studies included in this review, we now provide recommendations for future work in this area. First of all, there is a general need for more studies that explicitly examine the association between athlete burnout and health outcomes. This is particularly the case for the dimensions of positive mental health and physical health. In addition, in the studies that have been conducted, a large proportion only provided correlations. This reflects both the emphasis of studies - not necessarily focused on athlete burnout and health – as well as the designs – which are predominantly cross-sectional. Future work should therefore focus on employing longitudinal designs to study the association between athlete burnout and health over time. Such work should employ appropriate analyses (e.g. Hamaker et al., 2015) and also try to ensure adequate statistical power (e.g. with the inclusion of a *priori* power calculations).

We based our review on Allostatic Load Theory (McEwen & Stellar, 1993), Smith's (1986) Cognitive-Affective Stress Model, and Gustafsson et al.'s (2011) Integrated Model. Specifically, we posited that chronic stress and burnout underpin allostatic overload and the development of further mental and physical health problems. Overall, then, our findings do support the broad assertions of these theoretical perspectives in linking burnout to health. This includes associations with specific outcomes highlighted by Smith (e.g. depression and anxiety) and also possible associations with markers of allostatic overload (e.g. cortisol).

In regards to critical aspects of theory, we also have a few important points to note. First, the majority of studies we reviewed showed a general lack of consideration for theoretical mechanisms to explain the aforementioned associations. This may reflect a more exploratory examination of these associations but could also reflect the potential immaturity in regards to athlete burnout theory and its considerations of health outcomes. In this regard, we suggest an increased emphasis on exploring psychophysiological pathways through which burnout may affect health (and allow for an integration of allostatic overload and those outcomes proposed by Smith). A systematic examination of biomarkers from specific bodily systems would be useful in understanding these processes (e.g. HPA-axis, immune system, anabolic activity; McEwen & Stellar, 1993). In addition, it is likely to be important to separate markers of acute (e.g. C-reactive protein) and chronic processes (e.g. HbA1c). This has been done in other fields and would allow for a more complex elucidation of temporal patterning to establish which effects occur in short term and which effects may become chronic (e.g. van der Horn et al., 2020). Finally, research in occupational settings may be useful in guiding the selection of heretofore unexamined biomarkers. For example, research on professional burnout has started to examine further biological mechanisms such as epigenetic modifications (i.e. DNA methylation; Bakusic et al., 2021). Systematically combining this work with health outcomes will allow for a much more complex and nuanced understanding of the underpinning mechanisms responsible for the present findings, and for informing and revising athlete burnout theory.

Implications for policy and practice

Health underpins all aspects of an athlete's performance. As such, the present findings may have important implications for applied practice and policy. In this regard, we first note the need to include burnout as a factor in systematic monitoring of athlete well-being. The increase in wellbeing officers and sport psychologists in amateur and professional sport provides a means to do so (see Madigan et al., 2019). In addition, the seriousness of burnout has yet to be recognised in national and international sports policy (e.g. United Nations Sustainable Development Goals). We are hopeful that the present findings will help to change this.

The findings of this review highlight calls (e.g. Cresswell & Eklund, 2006; Gustafsson et al., 2017a; Madigan et al., 2022) for increased emphasis on the prevention and treatment of burnout. There are likely many ways this could be achieved; however, an evidence base in sport is still required to determine the optimal means to do so. For now, we suggest relying on the large volume of work that has been conducted outside of sport. This work highlights both personal (e.g. cognitive behavioural therapy based, social and emotional learning-based) and organisational (e.g. changing external pressures, psychoeducation) level interventions to be effective (see Madigan et al., 2023 for a review). Recent evidence further suggests combining these two approaches to be effective at supporting those with burnout symptoms (Pijpker et al., 2019). By systematically monitoring and intervening when burnout occurs, we have the potential to protect athletes from burnout and its health consequences.

Limitations

The present study has several limitations. First, as with the wider burnout literature, most studies in this review were conducted with a relatively healthy sample who were actively competing in their sport. Because burnout is linked to attritional behaviours (e.g. absenteeism, drop-out; Isoard-Gautheur et al., 2016), it is possible these samples are biased in this regard (the so-called 'healthy participant problem'). Consequently, these studies may have underestimated the strength of the association between burnout and other health outcomes or have missed out on certain associations (e.g. those that exist only at higher burnout levels; Bianchi et al., 2014). This is not an easy problem to address but the systematic, continued, and prolonged monitoring of athletes over time may be one means to unpick this issue further (see Saw et al., 2015). Second, our review included studies with samples from a variety of different populations. Whereas this is beneficial from a generalisability perspective, due to the small number of studies in certain populations, it was not possible to examine meaningful differences across these groups. Future work would therefore benefit from a more systematic examination of demographic factors (e.g. age, competitive level; Ang et al., 2016). Finally, power estimations for the included meta-analyses suggested some of the included effect sizes, particularly for physical symptoms and vitality, may represent false positives (Gucciardi et al., 2021). Thus, the associations between burnout and these two symptoms may be biased estimates and, as such, warrant further examination.

Conclusion

We have provided the first systematic review of research examining the association between athlete burnout and mental and physical health outcomes. We found relatively robust evidence that burnout has negative effects on athletes' health beyond its own symptoms, and that this includes a range of outcomes (e.g. depression, satisfaction, somatic symptoms). More studies with stronger designs that examine the development of athlete burnout and its health consequences over time need to be conducted for which we have provided recommendations, but clearly preventing and reducing athlete burnout should become a focus for sporting organisations to support athlete health and optimise performance.

Note

1. This approach to test for meta-bias differs from the pre-registration since Gucciardi et al. (2021) tutorial provided an assessment fit for the multiple levels of the meta-analysis run and was thus deemed more appropriate than the original plan.

Data availability

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

References marked with an asterisk indicate studies included in the systematic review.

*Adie, J. W., Duda, J. L., & Ntoumanis, N. (2008). Autonomy support, basic need satisfaction and the optimal functioning of adult male and female sport participants: A test of basic needs theory. *Motivation and Emotion*, *32*(3), 189–199. https://doi.org/10.1007/s11031-008-9095-z

*Adie, J. W., Duda, J. L., & Ntoumanis, N. (2012). Perceived coach-autonomy support, basic need satisfaction and the well- and ill-being of elite youth soccer players: A longitudinal investigation. *Psychology of Sport and Exercise*, *13*(1), 51–59. https://doi.org/10.1016/j.psychsport.2011.07.008

Alarcon, G. (2011). A meta-analysis of burnout with job demands, resources, and attitudes. *Journal of Vocational Behavior*, *79*(2), 549–562. https://doi.org/10.1016/j.jvb.2011.03.007

*Amemiya, R., & Sakairi, Y. (2021). Examining the relationship between depression and the progression of burnout among Japanese athletes. *Japanese Psychological Research*, *64*(4), 373–384. https://doi.org/10.1111/jpr.12332

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi-org.ezproxy.frederick.edu/10.1176appi.books.9780890425596

Ang, S. Y., Dhaliwal, S. S., Ayre, T. C., Uthaman, T., Fong, K. Y., Tien, C. E., Zhou, H., & Della, P. (2016). Demographics and personality factors associated with burnout among nurses in a Singapore tertiary hospital. *BioMed Research International*, *2016*, 1–12. https://doi.org/10.1155/2016/6960184

*Appleton, P. R., & Duda, J. L. (2016). Examining the interactive effects of coach-created empowering and disempowering climate dimensions on athletes' health and functioning. *Psychology of Sport and Exercise*, *26*, 61–70. https://doi.org/10.1016/j.psychsport.2016.06.007

Archer, L. E., & Alagaraja, M. (2021). Examining burnout in the US military with a focus on US air force: A review of literature. *New Horizons in Adult Education and Human Resource Development*, *33*(4), 17–32. https://doi.org/10.1002/nha3.20331

Avan, A., Hachinski, V., & the Brain Health Learn and Act Group. (2021). Brain health: Key to health, productivity, and well-being. *Alzheimer's & Dementia*, *18*(7), 1396–1407. https://doi.org/10.1002/alz.12478

*Baella-Vigil, G. V., Hurtado-Bocanegra, M., Marroquín-Quintana, J., Rojas-Fernández, M. V., Rosales-Medina, J. M., Urbina-Rodríguez, J. C., Tarabay-Barriga, A. P., & Carreazo, N. Y. (2020). Burnout syndrome in athletes and their association with body image dissatisfaction at a private university. *The Journal of Sports Medicine and Physical Fitness*, *60*(4), 1–6. https://doi.org/10.23736/S0022-4707.19.07965-9

Bakusic, J., Ghosh, M., Polli, A., Bekaert, B., Schaufeli, W., Claes, S., & Godderis, L. (2021). Role of NR3C1 and SLC6A4 methylation in the HPA axis regulation in burnout. *Journal Of Affective Disorders*, *295* (2021), 505–512. https://doi.org/10.1016/j.jad.2021.08.081

*Balaguer, I., González, L., Fabra, P., Castillo, I., Mercé, J., & Duda, J. L. (2012). Coaches' interpersonal style, basic psychological needs and the well- and ill-being of young soccer players: A longitudinal analysis. *Journal of Sports Sciences*, *30*(15), 1619–1629. https://doi.org/10.1080/02640414.2012.731517

*Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, *37*(11), 1459–1473. https://doi.org/10.1177/0146167211413125

*Becker, L., Dupke, A., & Rohleder, N. (2021). Associations between C-reactive protein levels, exercise addiction, and athlete burnout in endurance athletes. *Frontiers in Psychology*, *12*, 1–6. https://doi.org/10.3389/fpsyg.2021.615715

Bianchi, R., Schonfeld, I. S., & Laurent, E. (2014). Is burnout a depressive disorder? A reexamination with special focus on atypical depression. *International Journal of Stress Management*, *21*(4), 307–324. https://doi.org/10.1037/a0037906

*Chen, L. H., & Chang, Y.-P. (2017). Sport-domain gratitude uniquely accounts for athletes' well-being across two cultures: Incremental validity above the general gratitude. *The Journal of Positive Psychology*, *12*(6), 651–659. https://doi.org/10.1080/17439760.2016.1257052

*Chen, L. H., & Kee, Y. H. (2008). Gratitude and adolescent athletes' well-being. *Social Indicators Research*, *89*(2), 361–373. https://doi.org/10.1007/s11205-008-9237-4

*Chuang, H.-Y., Wang, F.-J., & Chi, L.-K. (2021). Mechanisms of mindfulness for professional golfers: The mediating role of basic psychological needs. *Current Psychology*, *42*, 5462–5469. https://doi.org/10.1007/s12144-021-01877-3

Cochrane Consumers and Communication Review Group. (2016a). 'Cochrane Consumers and Communication Group: meta-analysis'. http://cccrg.cochrane.org

Cochrane Consumers and Communication Review Group. (2016b). 'Heterogeneity and subgroup analyses in Cochrane Consumers and Communication Group reviews: planning the analysis at protocol stage. http://cccrg.cochrane.org

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.

Conway, C. C., Forbes, M. K., Forbush, K., Fried, E., Hallquist, M., Kotov, R., Mullins-Sweatt, S. N., Shackman, A. J., Skodol, A. E., South, S. C., Sunderland, M., Waszczuk, M. A., Zald, D. H., Afzali, M. H., Bornovalova, M. A., Carragher, N., Docherty, A. R., Jonas, K. G., Krueger, R. F., … Eaton, N. R. (2019). A hierarchical taxonomy of psychopathology can transform mental health research. *Perspectives on Psychological Science*, *14*(3), 419–436. https://doi.org/10.1177/1745691618810696

Conway, C. C., Forbes, M. K., & South, S. C. (2021). A hierarchical taxonomy of psychopathology (HiTOP) primer for mental health researchers. *Clinical Psychological Science*, *10*(2), 236–258. https://doi.org/10.1177/21677026211017834

*Cresswell, S. L., & Eklund, R. C. (2006). The convergent and discriminant validity of burnout measures in sport: A multi-trait/multi-method analysis. *Journal of Sports Sciences*, *24*(2), 209–220. https://doi.org/10.1080/02640410500131431

*Cumming, J., & Duda, J. L. (2012). Profiles of perfectionism, body-related concerns, and indicators of psychological health in vocational dance students: An investigation of the 2 × 2 model of perfectionism. *Psychology of Sport and Exercise*, *13*(6), 729–738. https://doi.org/10.1016/j.psychsport.2012.05.004

Danhof-Pont, M., van Veen, T., & Zitman, F. (2011). Biomarkers in burnout: A systematic review. *Journal of Psychosomatic Research*, *70*(6), 505–524. https://doi.org/10.1016/j.jpsychores.2010.10.012

*Daumiller, M., Rinas, R., & Breithecker, J. (2021). Elite athletes' achievement goals, burnout levels, psychosomatic stress symptoms, and coping strategies. *International Journal of Sport and Exercise Psychology*, *20*(2), 416–435. https://doi.org/10.1080/1612197X.2021.1877326

*Davis, L., Appleby, R., Davis, P., Wetherell, M., & Gustafsson, H. (2018). The role of coach-athlete relationship quality in team sport athletes' psychophysiological exhaustion: Implications for physical and cognitive performance. *Journal of Sports Sciences*, *36*(17), 1985–1992. https://doi.org/10.1080/02640414.2018.1429176

*De Francisco, C., Arce, C., Vílchez, M. d. P., & Vales, Á. (2016). Antecedents and consequences of burnout in athletes: Perceived stress and depression. *International Journal of Clinical and Health Psychology*, *16*(3), 239–246. https://doi.org/10.1016/j.ijchp.2016.04.001

*DeFreese, J. D., & Barczak, N. (2017). A pilot study of trait emotional intelligence as a moderator of the associations among social perceptions, athlete burnout, and well-being in collegiate athletes. *Athletic Training & Sports Health Care*, *9*(6), 246–253. https://doi.org/10.3928/19425864-20171010-01

*DeFreese, J. D., & Smith, A. L. (2014). Athlete social support, negative social interactions, and psychological health across a competitive sport season. *Journal of Sport and Exercise Psychology*, *36*(6), 619–630. https://doi.org/10.1123/jsep.2014-0040

Feeser, K. (2016). *Getting ahead of the game: A preventative assessment plan for intercollegiate athletics* [PhD]. Southern Illinois University. https://opensiuc.lib.siu.edu/dissertations/1859.

Fernández-Castilla, B., Declercq, L., Jamshidi, L., Beretvas, S., Onghena, P., & Van den Noortgate, W. (2019). Detecting selection bias in meta-analyses with multiple outcomes: A simulation study. *The Journal of Experimental Education*, *89*(1), 125–144. https://doi.org/10.1080/00220973.2019.1582470

*Frank, R., Nixdorf, I., & Beckmann, J. (2017). Analyzing the relationship between burnout and depression in junior elite athletes. *Journal of Clinical Sport Psychology*, *11*(4), 287–303. https://doi.org/10.1123/JCSP.2017-0008

Fusar-Poli, P., Salazar de Pablo, G., De Micheli, A., Nieman, D., Correll, C., Kessing, L., Pfennig, A., Bechdolf, A., Borgwardt, S., Arango, C., & van Amelsvoort, T. (2020). What is good mental health? A scoping review. *European Neuropsychopharmacology*, *31*(2020), 33–46. https://doi.org/10.1016/j.euroneuro.2019.12.105

*Gabana, N. T., Steinfeldt, J. A., Wong, Y. J., & Chung, Y. B. (2017). Gratitude, burnout, and sport satisfaction among college student-athletes: The mediating role of perceived social support. *Journal of Clinical Sport Psychology*, *11*(1), 14–33. https://doi.org/10.1123/jcsp.2016-0011

Galderisi, S., Heinz, A., Kastrup, M., Beezhold, J., & Sartorius, N. (2015). Toward a new definition of mental health. *World Psychiatry*, *14*(2), 231–233. https://doi.org/10.1002/wps.20231

*Gerber, M., Best, S., Meerstetter, F., Isoard-Gautheur, S., Gustafsson, H., Bianchi, R., Madigan, D. J., Colledge, F., Ludyga, S., Holsboer-Trachsler, E., & Brand, S. (2018a). Cross-sectional and longitudinal associations between athlete burnout, insomnia, and polysomnographic indices in young elite athletes. *Journal of Sport and Exercise Psychology*, *40*(6), 312–324. https://doi.org/10.1123/jsep.2018-0083

*Gerber, M., Best, S., Meerstetter, F., Walter, M., Ludyga, S., Brand, S., Bianchi, R., Madigan, D. J., Isoard-Gautheur, S., & Gustafsson, H. (2018b). Effects of stress and mental toughness on burnout and depressive symptoms: A prospective study with young elite athletes. *Journal of Science and Medicine in Sport*, *21*(12), 1200–1205. https://doi.org/10.1016/j.jsams.2018.05.018

*Gerber, M., Gustafsson, H., Seelig, H., Kellmann, M., Ludyga, S., Colledge, F., Brand, S., Isoard-Gautheur, S., & Bianchi, R. (2018c). Usefulness of the Athlete Burnout Questionnaire (ABQ) as a screening tool for the detection of clinically relevant burnout symptoms among young elite athletes. *Psychology of Sport and Exercise*, *39*, 104–113. https://doi.org/10.1016/j.psychsport.2018.08.005

Gleeson, M., & Pyne, D. (2015). Respiratory inflammation and infections in high-performance athletes. *Immunology & Cell Biology*, *94*(2), 124–131. https://doi.org/10.1038/icb.2015.100

Gouttebarge, V., Castaldelli-Maia, J., Gorczynski, P., Hainline, B., Hitchcock, M., Kerkhoffs, G., Rice, S. M., & Reardon, C. L. (2019). Occurrence of mental health symptoms and disorders in current and former elite athletes: A systematic review and meta-analysis. *British Journal of Sports Medicine*, *53*(11), 700–706. https://doi.org/10.1136/bjsports-2019-100671

*Grobbelaar, H. W., Malan, D. D. J., Steyn, B. J. M., & Ellis, S. M. (2011). The relationship between burnout and mood state among student rugby union players. *African Journal for Physical Health Education, Recreation and Dance*, *17*(4), 647–664. http://hdl.handle.net/2263/20321.

*Grylls, E., & Spittle, M. (2008). Injury and burnout in Australian athletes. *Perceptual and Motor Skills*, *107*(2008), 873–880. https://doi.org/10.2466/pms.107.3.873-880

Gucciardi, D., Lines, R., & Ntoumanis, N. (2021). Handling effect size dependency in meta-analysis. *International Review of Sport and Exercise Psychology*, *15*(1), 152–178. https://doi.org/10.1080/1750984X.2021.1946835

Gustafsson, H., Kenttä, G., & Hassmén, P. (2011). Athlete burnout: An integrated model and future research directions. *International Review of Sport and Exercise Psychology*, *4*(1), 3–24. https://doi.org/10.1080/1750984X.2010.541927

Gustafsson, H., Madigan, D. J., & Lundkvist, E. (2017a). Burnout in athletes. *Handbuch Stressregulation Und Sport*, 489–504. https://doi.org/10.1007/978-3-662-49322-9_24

*Gustafsson, H., Sagar, S. S., & Stenling, A. (2017b). Fear of failure, psychological stress, and burnout among adolescent athletes competing in high level sport. *Scandinavian Journal of Medicine & Science in Sports*, *27*(12), 2091–2102. https://doi.org/10.1111/sms.12797

Hamaker, E., Kuiper, R., & Grasman, R. (2015). A critique of the cross-lagged panel model. *Psychological Methods*, *20*(1), 102–116. https://doi.org/10.1037/a0038889

*Healy, L. C., Ntoumanis, N., van Zanten, J. J. C. S. V., & Paine, N. (2014). Goal striving and well-being in sport: The role of contextual and personal motivation. *Journal of Sport and Exercise Psychology*, *36*(5), 446–459. https://doi.org/10.1123/jsep.2013-0261

*Hew-Butler, T., Aprik, C., Byrd, B., Landis-Piwowar, K., Smith-Hale, V., VanSumeren, M., Sabourin, J., Byrd, G., & Martin, J. (2021). *Changes in nutrient biomarkers, body composition, and burnout symptoms in collegiate athletes across a season* [Preprint]. https://doi.org/10.20944/preprints202105.0602.v1

Higgins, J., & Thompson, S. (2002). Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine*, *21*(11), 1539–1558. https://doi.org/10.1002/sim.1186

Hulteen, R. M., Smith, J. J., Morgan, P. J., Barnett, L. M., Hallal, P. C., Colyvas, K., & Lubans, D. R. (2017). Global participation in sport and leisure-time physical activities: A systematic review and meta-analysis. *Preventive Medicine*, *95*, 14–25. https://doi.org/10.1016/j.ypmed.2016.11.027

Isoard-Gautheur, S., Guillet-Descas, E., & Gustafsson, H. (2016). Athlete burnout and the risk of dropout among young elite handball players. *The Sport Psychologist*, *30*(2), 123–130. https://doi.org/10.1123/tsp.2014-0140

*Isoard-Gautheur, S., Oger, M., Guillet, E., & Martin-Krumm, C. (2010). Validation of a French version of the Athlete Burnout Questionnaire (ABQ): In competitive sport and physical education context. *European Journal of Psychological Assessment*, *26*(3), 203–211. https://doi.org/10.1027/1015-5759/a000027

Jun, J., Ojemeni, M. M., Kalamani, R., Tong, J., & Crecelius, M. L. (2021). Relationship between nurse burnout, patient and organizational outcomes: Systematic review. *International Journal of Nursing Studies*, *119*(2021), 103933. https://doi.org/10.1016/j.ijnurstu.2021.103933

Juster, R., Sindi, S., Marin, M., Perna, A., Hashemi, A., Pruessner, J., & Lupien, S. (2011). A clinical allostatic load index is associated with burnout symptoms and hypocortisolemic profiles in healthy workers. *Psychoneuroendocrinology*, *36*(6), 797–805. https://doi.org/10.1016/j.psyneuen.2010.11.001

*King, L., Cullen, S., O'Connor, S., McGoldrick, A., Pugh, J., Warrington, G., Woods, G., Nevill, A., & Losty, C. (2021). Common mental disorders among Irish jockeys: Prevalence and risk factors. *The Physician and Sportsmedicine*, *49*(2), 207–213. https://doi.org/10.1080/00913847.2020.1808435

Kivimäki, M., Batty, G., Pentti, J., Shipley, M., Sipilä, P., Nyberg, S., Souminen, S. B., Oksanan, T., Stenholm, S., Virtanen, M., Marmot, M. G., Singh-Manoux, A., Brunner, E. J., Lindbohm, J. V., Ferrie, J. E., & Vahtera, J. (2020). Association between socioeconomic status and the development of mental and physical health conditions in adulthood: A multi-cohort study. *The Lancet Public Health*, *5*(3), e140–e149. https://doi.org/10.1016/S2468-2667(19)30248-8

Kossmeier, M., Tran, U., & Voracek, M. (2020). Charting the landscape of graphical displays for meta-analysis and systematic reviews: A comprehensive review, taxonomy, and feature analysis. *BMC Medical Research Methodology*, *20*(1), 1–24. https://doi.org/10.1186/s12874-020-0911-9

Krahn, G., Robinson, A., Murray, A., Havercamp, S., Havercamp, S., Andridge, R., Arnold, L. E., Barnhill, J., Bodle, S., Boerner, E., Bonardi, A., Bourne, M. L., Brown, C., Buch, A., Burkett, S., Chapman, R., Cobranchi, C., Cole, C., Davies, D., … Witwer, A. (2021). It's time to reconsider how we define health: Perspective from disability and chronic condition. *Disability And Health Journal*, *14*(4), 101129. https://doi.org/10.1016/j.dhjo.2021.101129

*Kristiansen, E., Abrahamsen, F. E., & Stensrud, T. (2012). Stress-Related breathing problems: An issue for elite swimmers. *Journal of Swimming Research*, *19*(2), 1–9.

*Lee, K., Kang, S., & Kim, I. (2017). Relationships among stress, burnout, athletic identity, and athlete satisfaction in students at Korea's physical education high schools: Validating differences between pathways according to ego resilience. *Psychological Reports*, *120*(4), 585–608. https://doi.org/10.1177/0033294117698465

*Li, C., Ivarsson, A., Stenling, A., & Wu, Y. (2018). The dynamic interplay between burnout and sleep among elite blind soccer players. *Psychology of Sport and Exercise*, *37*(2018), 164–169. https://doi.org/10.1016/j.psychsport.2017.08.008

Lin, C., Lu, F., Chen, T., & Hsu, Y. (2021). Relationship between athlete stress and burnout: A systematic review and meta-analysis. *International Journal of Sport and Exercise Psychology*, *20*, 1295–1315. https://doi.org/10.1080/1612197x.2021.1987503

Madigan, D., Olsson, L., Hill, A., & Curran, T. (2022). Athlete burnout symptoms are increasing: A cross-temporal meta-analysis of average levels from 1997 to 2019. *Journal Of Sport & Exercise Psychology*, *44*(3), 153–168. https://doi.org/10.1123/jsep.2020-0291

Madigan, D. J., Gustafsson, H., & Olsson, L. F. (2023). Reducing burnout in athletes. In I. Nixdorf, J. Beckmann, T. MacIntyre, S. B. Martin, & R. Nixdorf (Eds.), *Routledge handbook of mental health in elite sport* (pp. 177–187). Routledge.

Madigan, D. J., Gustafsson, H., Smith, A., Raedeke, T., & Hill, A. P. (2019). The BASES expert statement on burnout in sport. *The Sport and Exercise Scientist*, *61*, 6–7. https://www.bases.org.uk/BASES-Expert-Statements.

*Markati, A., Psychountaki, M., Kingston, K., Karteroliotis, K., & Apostolidis, N. (2019). Psychological and situational determinants of burnout in adolescent athletes. *International Journal of Sport and Exercise Psychology*, *17*(5), 521–536. https://doi.org/10.1080/1612197X.2017.1421680

Martin, J., Byrd, B., Hew-Butler, T., & Moore, E. W. G. (2021). A longitudinal study on the psychological and physiological predictors of burnout in NCAA collegiate swimmers. *Journal of Applied Sport Psychology*, *34*(6), 1295–1311. https://doi.org/10.1080/10413200.2021.1974603

Martinent, G., Decret, J.-C., Guillet-Descas, E., & Isoard-Gautheur, S. (2014). A reciprocal effects model of the temporal ordering of motivation and burnout among youth table tennis players in intensive training settings. *Journal of Sports Sciences*, *32*(17), 1648–1658. http://dx.doi.org/10.1080/02640414.2014.912757.

Maslach, C. (1986). Stress, burnout, and workaholism. In R. R. Kilburg, P. E. Nathan, & R. W. Thoreson (Eds.), *Professionals in distress: Issues, syndromes, and solutions in psychology* (pp. 53–75). American Psychological Association. https://doi.org/10.1037/10056-004

Maslach, C., & Jackson, S. (1981). The measurement of experienced burnout. *Journal of Organizational Behavior*, *2*(2), 99–113. https://doi.org/10.1002/job.4030020205

Maslach, C., & Leiter, M. (2016). Understanding the burnout experience: Recent research and its implications for psychiatry. *World Psychiatry*, *15*(2), 103–111. https://doi.org/10.1002/wps.20311

Mathers, C., Murray, C., Ezzati, M., Gakidou, E., Salomon, J., & Stein, C. (2003). Population health metrics: crucial inputs to the development of evidence for health policy. *Population Health Metrics*, *1*(1), 1–4. https://doi.org/10.1186/1478-7954-1-1

McCartney, G., Popham, F., McMaster, R., & Cumbers, A. (2019). Defining health and health inequalities. *Public Health*, *172*, 22–30. https://doi.org/10.1016/j.puhe.2019.03.023

McEwen, B., & Stellar, E. (1993). Stress and the individual. Mechanisms leading to disease. *Archives of Internal Medicine*, *153*(18), 2093–2101. https://doi.org/10.1001/archinte.1993.00410180039004

*Moen, F., & Myhre, K. (2017). Can the working alliance between coaches and athletes explain athlete burnout among junior athletes? *The Sport Journal*, 1–22. https://thesportjournal.org/article/working-alliance-between-coaches-and-athletes-explain-athlete-burnout/.

*Moen, F., Myhre, K., Klockner, C., & Sandbakk, O. (2017). Physical, affective and psychological determinants of athlete burnout. *The Sport Journal*, 1–15. https://thesportjournal.org/article/psychological-determinants-of-burnout-illness-and-injury-among-elite-junior-athletes/.

*Moen, F., Myhre, K., & Sandbakk, O. (2016). Psychological determinants of burnout, illness and injury among elite junior athletes. *The Sport Journal*, 1–22. https://thesportjournal.org/article/physical-affective-and-psychological-determinants-of-athlete-burnout/.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ*, *339*(2009), b2535–b2535. https://doi.org/10.1136/bmj.b2535

*Monfared, S. S., Lebeau, J.-C., Mason, J., Cho, S. K., Basevitch, I., Perry, I., Baur, D. A., & Tenenbaum, G. (2021). A bio-physio-psychological investigation of athletes' burnout. *Research Quarterly for Exercise and Sport*, *92*(1), 189–198. https://doi.org/10.1080/02701367.2020.1715911

National Institute for Health and Care Excellence [NICE]. (2012). *Methods for the development of NICE public health guidance* [Ebook] (3rd ed.). National Institute for Health and Care Excellence.

Nicholls, A. R., Madigan, D. J., & Earle, K. (2022). Multi-wave analyses of coping, athlete burnout, and well-being among F. A. Premier League Academy players. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.979486

Pijpker, R., Vaandrager, L., Veen, E. J., & Koelen, M. A. (2019). Combined interventions to reduce burnout complaints and promote return to work: A systematic review of effectiveness and mediators of change. *International Journal of Environmental Research and Public Health*, *17*(1), 55. https://doi.org/10.3390/ijerph17010055

Purcell, R., Gwyther, K., & Rice, S. M. (2019). Mental health in elite athletes: Increased awareness requires an early intervention framework to respond to athlete needs. *Sports Medicine – Open*, *5*(1). https://doi.org/10.1186/s40798-019-0220-1

Raedeke, T., & Smith, A. (2001). Development and preliminary validation of an athlete burnout measure. *Journal of Sport and Exercise Psychology*, *23*(4), 281–306. https://doi.org/10.1123/jsep.23.4.281

*Raedeke, T. D., Arce, C., De Francisco, C., Seoane, G., & Ferraces, M. J. (2013). Validez de constructo de la versión española del ABQ a través de aproximación multi-rasgo/multi-método. *Anales de Psicología*, *29*(3), 693–700. https://doi.org/10.6018/analesps.29.3.175831

R Core Team. (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/

*Reche, C., De Francisco, C., Martínez-Rodríguez, A., & Ros-Martínez, A. (2018). Relationship among sociodemographic and sport variables, exercise dependence, and burnout: A preliminary study in athletes. *Anales de Psicología*, *34*(2), 398–406. https://doi.org/10.6018/analesps.34.2.289861

*Reinboth, M., & Duda, J. L. (2004). The motivational climate, perceived ability, and athletes' psychological and physical well-being. *The Sport Psychologist*, *18*(3), 237–251. https://doi.org/10.1123/tsp.18.3.237

Rice, S., Purcell, R., De Silva, S., Mawren, D., McGorry, P., & Parker, A. (2016). The mental health of elite athletes: A narrative systematic review. *Sports Medicine*, *46*(9), 1333–1353. https://doi.org/10.1007/s40279-016-0492-2

Rothe, N., Schulze, J., Kirschbaum, C., Buske-Kirschbaum, A., Penz, M., Wekenborg, M. K., & Walther, A. (2020). Sleep disturbances in major depressive and burnout syndrome: A longitudinal analysis. *Psychiatry Research*, *286*(2020), 112868. https://doi.org/10.1016/j.psychres.2020.112868

*Ryu, K., Kim, J., Ali, A., Choi, S., Kim, H., & Radlo, S. J. (2015). Comparison of athletes with and without burnout using the stroop color and word test. *Perceptual and Motor Skills*, *121*(2), 413–430. https://doi.org/10.2466/22.PMS.121c16x7

Sabagh, Z., Hall, N., & Saroyan, A. (2018). Antecedents, correlates and consequences of faculty burnout. *Educational Research*, *60*(2), 131–156. https://doi.org/10.1080/00131881.2018.1461573

Sabato, T., Walch, T., & Caine, D. (2016). The elite young athlete: Strategies to ensure physical and emotional health. *Open Access Journal of Sports Medicine*, *7*(2016), 99–113. https://doi.org/10.2147%2FOAJSM.S96821

Salvagioni, D., Melanda, F., Mesas, A., González, A., Gabani, F., & Andrade, S. (2017). Physical, psychological and occupational consequences of job burnout: A systematic review of prospective studies. *PLOS ONE*, *12*(10), e0185781. https://doi.org/10.1371/journal.pone.0185781

*Sánchez-Romero, E. I., Ponseti Verdaguer, F. J., Cantallops Ramón, J., & García-Mas, A. (2021). The quantity and quality of anxiety are mediating variables between motivation, burnout and fear of failing in sport. *International Journal of Environmental Research and Public Health*, *18*(23), 12343. https://doi.org/10.3390/ijerph182312343

Saw, A. E., Main, L. C., & Gastin, P. B. (2015). Monitoring athletes through self-report: Factors influencing implementation. *Journal of Sports Science & Medicine*, *14*(1), 137–146. https://pubmed.ncbi.nlm.nih.gov/25729301.

Shirom, A. (2005). Reflections on the study of burnout. *Work & Stress*, *19*(3), 263–270. https://doi.org/10.1080/02678370500376649

*Smith, E. P., Hill, A. P., & Hall, H. K. (2018). Perfectionism, burnout, and depression in youth soccer players: A longitudinal study. *Journal of Clinical Sport Psychology*, *12*(2), 179–200. https://doi.org/10.1123/jcsp.2017-0015

Smith, R. (1986). Toward a cognitive-affective model of athletic burnout. *Journal of Sport Psychology*, *8*(1), 36–50. https://doi.org/10.1123/jsp.8.1.36

*Sorkkila, M., Ryba, T. V., Aunola, K., Selänne, H., & Salmela-Aro, K. (2020). Sport burnout inventory–Dual career form for student-athletes: Assessing validity and reliability in a Finnish sample of adolescent athletes. *Journal of Sport and Health Science*, *9*(4), 358–366. https://doi.org/10.1016/j.jshs.2017.10.006

*Souza, R. O., Alves, D. L., de Assis, F., Palumbo, D. d. P., & Moiano, J. V. M. (2018). Analysis of dehydroepiandrosterone sulphate, cortisol and testosterone levels in performance athletes affected by burnout syndrome. *Journal of Exercise Physiology Online*, *21*(2), 1–8.

Taris, T. W. (2006). Is there a relationship between burnout and objective performance? A critical review of 16 studies. *Work & Stress*, *20*(4), 316–334. https://doi.org/10.1080/02678370601065893

Tóth-Király, I., Morin, A. J. S., & Salmela-Aro, K. (2021). Reciprocal associations between burnout and depression: An 8-year longitudinal study. *Applied Psychology*, *70*(4), 1691–1727. https://doi.org/10.1111/apps.12295

Valentine, J. C., Pigott, T. D., & Rothstein, H. R. (2010). How many studies do you need? *Journal of Educational and Behavioral Statistics*, *35*(2), 215–247. https://doi.org/10.3102/1076998609346961

van der Horn, H., Out, M., de Koning, M., Mayer, A., Spikman, J., Sommer, I., & van der Naalt, J. (2020). An integrated perspective linking physiological and psychological consequences of mild traumatic brain injury. *Journal of Neurology*, *267*(9), 2497–2506. https://doi.org/10.1007/s00415-019-09335-8

*Vaughan, R. S., Edwards, E. J., & MacIntyre, T. E. (2020). Mental health measurement in a post Covid-19 world: Psychometric properties and invariance of the DASS-21 in athletes and non-athletes. *Frontiers in Psychology*, *11*(2020), 1–14. https://doi.org/10.3389/fpsyg.2020.590559

Verhagen, E., Mellette, J., Konin, J., Scott, R., Brito, J., & McCall, A. (2020). Taking the lead towards healthy performance: The requirement of leadership to elevate the health and performance teams in elite sports. *BMJ Open Sport & Exercise Medicine*, *6*(1), e000834. https://doi.org/10.1136/bmjsem-2020-000834

*Verkooijen, K. T., van Hove, P., & Dik, G. (2012). Athletic identity and well-being among young talented athletes who live at a Dutch elite sport center. *Journal of Applied Sport Psychology*, *24*(1), 106–113. https://doi.org/10.1080/10413200.2011.633153

Wang, Q., Sun, W., & Wu, H. (2022). Associations between Academic Burnout, resilience and life satisfaction among medical students: A three-wave longitudinal study. *BMC Medical Education*, *22*(1). https://doi.org/10.1186/s12909-022-03326-6

*Werner, C., Waite, L., Turner, K., Storch, E., Bjorgvinsson, T., & McIngvale, E. (2021). The pre-performance ritual: A recipe for success of a path to burnout? *Journal of Issues in Intercollegiate Athletics*, *14*(2021), 325–341.

Williams, E., Rathert, C., & Buttigieg, S. (2019). The personal and professional consequences of physician burnout: A systematic review of the literature. *Medical Care Research and Review*, *77*(5), 371–386. https://doi.org/10.1177/1077558719856787

World Health Organization. (2022). *ICD-11: International classification of diseases* (11th revision). https://icd.who.int/

Wren-Lewis, S., & Alexandrova, A. (2021). Mental health without well-being. *The Journal of Medicine and Philosophy: A Forum for Bioethics and Philosophy of Medicine*, *46*(6), 684–703. https://doi.org/10.1093/jmp/jhab032

*Wu, X., Abidin, N. E. Z., & Jaladin, R. A. M. (2021). Motivational processes influencing mental health among winter sports athletes in China. *Frontiers in Psychology*, *12*(2021), 1–12. https://doi.org/10.3389/fpsyg.2021.726072

*Yildirim, S., & Koruç, Z. (2021). The effect of transformational leadership and well-being on performance of soccer players: An inclusive model. *The Sport Psychologist*, *35*(4), 261–269. https://doi.org/10.1123/tsp.2020-0064

*Zhang, C.-Q., Li, X., Chung, P.-K., Huang, Z., Bu, D., Wang, D., Guo, Y., Wang, X., & Si, G. (2021). The effects of mindfulness on athlete burnout, subjective well-being, and flourishing among elite athletes: A test of multiple mediators. *Mindfulness*, *12*(8), 1899–1908. https://doi.org/10.1007/s12671-021-01644-2