Accepted refereed manuscript of: Tahtinen RE, Shelley J & Morris R (2021) Gaining Perspectives: A Scoping Review of Research Assessing Depressive Symptoms in Athletes. *Psychology of Sport and Exercise*. https://doi.org/10.1016/j.psychsport.2021.101905

Introduction

Depression is one of the leading causes of non-fatal health loss in the world (James et al., 2018). An estimated 4-6 % of the world´s population is currently living with depression (World Health Organization, 2017), and approximately 16% will meet criteria for a major depressive disorder during their lifetime (American Psychiatric Association, 2013). Depression tends to emerge by mid-20´s, but a large proportion of first onset cases are observed even before the age of 20 (Hankin et al., 1998; Malhi & Mann, 2018). It is however important to define the concept of depression. Depression can be defined as Major Depressive Disorder (MDD), which is a condition diagnosed by a clinician and constitutes of a certain number of symptoms (i.e. 5 or more) rather than a certain constellation of symptoms (Ingram et al., 2015). Hence, although the defining features, depressed/sad mood and/or anhedonia/decreased interest, are required for a diagnosis of the disorder, individuals with the same MDD diagnosis may suffer from different subsets of cognitive (e.g., guilt/worthlessness), emotional (e.g., feeling sad/low mood), and physiological or neurovegetative (e.g., problems with sleep/ slowed movement or speech) symptoms (American Psychiatric Association, 2013; Ingram et al., 2015). Furthermore, the behavioural patterns associated with different symptoms may be highly variable across individuals, such as while some individuals may show increased sadness and related behaviours (e.g. tearfulness), others may show increased irritability and related behaviours (e.g. angry outbursts) (American Psychiatric Association, 2013). These symptoms must cause significant impairment in the individual´s life, be present nearly every day, for at least two consecutive weeks, and cannot be better explained by other conditions (American Psychiatric Association, 2013). Depression can also be defined as a subclinical condition, in which the same or similar symptoms as identified in MDD are assessed through depression questionnaires

(Ingram et al., 2015). Subclinical depression is hence representative of MDD symptomatology but does not meet the diagnostic criteria required for a diagnosis of MDD, instead, severity or clinical relevance of symptomatology is often defined and reported by specific cut-off scores on the scale (Ingram et al., 2015). To-date, depression research in athletes has mostly utilized depression questionnaires (Golding et al., 2020), therefore, in this study we reviewed literature that has assessed subclinical depression rather than MDD in athletes. We used the term 'depression' to refer more generally to clinical and/or subclinical depression, and 'depressive symptoms' when referring specifically to subclinical depression.

Although empirical evidence on depression and other mental health issues in athletes is still scarce, there has been a notable increase in the research output within the past decade (Gouttebarge et al., 2019). This trend is also reflected in the recent influx of review articles on athlete depression, which suggests that much of the emerging primary research has focused on prevalence rates and risk factors (Frank et al., 2013; Golding et al., 2020; Wolanin et al., 2015) and differences between athletes and non-athletes (Armstrong et al., 2015; Golding et al., 2020; Gorczynski et al., 2017).

There is still an on-going debate whether depression is higher or more prevalent in athletes than in non-athletes; while some reviews suggest that athletes do not significantly differ from non-athletes (Gorczynski et al., 2017), others suggest that athletes are in fact less susceptible to depression than non-athletes (Armstrong et al., 2015). These discrepancies may partly be explained by different methodological approaches used to assess depression and the type of athletes and comparison groups utilized in the included studies (Gouttebarge et al., 2019). Despite these discrepancies, ~~there seems to be an overall consensus that competitive athletes are a specific population that are confronted with both~~ research has identified a range of different

generic and (unique) sport-related stressors and risk factors that ~~may contribute to~~correlate with ~~athlete~~to depressive symptoms~~on~~ and other mental health issues in athletes (Küttel & Larsen, 2019; Reardon et al., 2019; Wolanin et al., 2015). For example, while normative sex differences in depression (Breslau et al., 2017; Hankin et al., 1998) have also been reported in athletes (Golding et al., 2020), sport-specific determinants or characteristics such as the type of sport (Beable et al., 2017; Golding et al., 2020; Nixdorf et al., 2016) and the level of competition (Hammond et al., 2013) have also shown to relate to differences in athlete depression. Stressors inherent in the context of sports may also contribute, such as public evaluation of performance (Doherty et al., 2016), athletic injury (Rice et al., 2018), performance failure (Hammond et al., 2013), and overtraining (Peluso & Andrade, 2005). Understanding this sport-specificity ~~in athlete depression~~ is vital, as it allows preventive and support initiatives to be more accurately tailored for athlete populations.

Several previous reviews have improved our understanding ~~on~~ of different depression-related topics in athletes. For example, as identified by Golding et al. (2020), a number of different measures and cut-off scores have been utilized when assessing and reporting prevalence rates in athletes. This is an important finding as it allows for the identification of the strengths and weaknesses in current knowledge and practices and informs improvements in future research and practice. However, Golding et al. (2020) review included only studies that reported prevalence rates and hence, does not allow for a comprehensive exploration of the overall trends in studies assessing depressive symptoms in athletes. Other reviews to-date have also been limited in their breadth of scope in terms of the type of included studies. For example, one systematic review included merely comparative studies, with samples consisting of student athletes and non-athletes with ≥ 100 participants (N=10) (Armstrong et al., 2015), one

study included only elite-athletes (N=10) (Frank et al., 2013), and in a more recent meta-analysis, only comparative studies reporting prevalence rates for high--level athletes and non-athletes were included (N=5) (Gorczynski et al., 2017).

Considering the aims and the corresponding inclusion/exclusion criteria of previous reviews, and the increasing research output on athlete mental health issues in the past decade (Gouttebarge et al., 2019), it is likely that several studies have not been included in previous reviews. A comprehensive review of the research output, especially in terms of the methodological characteristics, and the variables that have been tested in relation to depressive symptomatology in athletes is thus essential. This would not only allow for an increased understanding of the methodological approaches utilized across various athlete samples - but also provide a map of the correlating variables that have, and have not, received scholarly attention in depression-related research within the field of sport psychology. Although there have been some reviews that have scoped the broader trends in the emerging literature (Gouttebarge et al., 2019; Küttel & Larsen, 2019), these have focused on a range of different mental health issues, limiting their depth of information concerning research on depressive symptoms.

Against this backdrop, the overarching goal of this review ~~is~~ was to gain a more comprehensive understanding on how depressive symptoms research has been conducted, what type of correlating variables scholarly attention has been given precedence to, and where more attention may be warranted. By taking this approach we hoped to fill in an important gap that has been left uncovered by previous reviews in the field.

The current review

As a scoping review is often utilized when the emerging literature has not been reviewed comprehensively (Peterson et al., 2017), this approach was deemed the most

appropriate for conducting the current review. A scoping review is especially useful when the aim is to identify how research has been conducted, the factors that relate to the concept of interest, and the gaps that exists in the empirical knowledge base (Munn et al., 2018). As the focus of this review ~~is~~ was not to collate empirical evidence from a narrowly defined research topic (Munn et al., 2018), we did not undertake a risk of bias or quality appraisal of the included studies (Tricco et al., 2018). However, by exploring the methodological and sample characteristics (e.g., assessment tools, type of sport or sex of the athletes across a range of studies) and what the research has focused on (e.g., concussion and depressive symptoms), findings from this review can inform future research of the methodological issues that may warrant further attention (Daudt et al., 2013).

A diagnostic interview is the gold standard for the assessment and diagnosis of clinical depression (MDD), while depression questionnaires are utilized to assess level and severity of depressive symptoms (Ingram et al., 2015). It has been noted that most studies in athletes have utilized questionnaires to assess depression, and that more research on MDD in athletes is needed (Golding et al., 2020; Gorczynski et al., 2017). We agree with this notion, however, it is likely that the challenges with cost and time, as well as the availability of qualified clinicians for conducting clinical interviews, will continue to influence the choice of utilizing questionnaires over diagnostic interviews in research. Depressive symptoms in themselves can also be a significant source of distress and impairment, and has been linked with an increased risk for developing MDD (Ingram et al., 2015). Indeed, the study of depressive symptomatology has been highlighted as an important area of research in athletes (Reardon et al., 2019). With these considerations in mind, in this review we focused specifically on research that has assessed depressive symptoms in athletes.

Individual differences in depression can be understood from a cognitive vulnerability perspective - individuals differ in their thoughts, inferences, attitudes, attention, and memory processes – laying the foundation by which individuals differ in their responses to stressors (e.g. negative life-events; Joormann & Arditte, 2015). Cognitive vulnerability theories posit that vulnerable individuals are more likely to engage in maladaptive thought processes (e.g. rumination) in response to negative events, and are therefore at an increased risk for developing depression (Abramson et al., 2002; Joormann & Arditte, 2015). Within the clinical psychology domain, Hankin (2012), however, underlined the importance of considering cognitive vulnerability from a multilevel perspective (Hankin, 2012). As proposed in his conceptual model, a more comprehensive understanding of the development of depression can be gained by considering the interaction between several within person vulnerabilities (e.g. genes, physiology, cognitive vulnerabilities), social and interpersonal influences, and the proximal environmental contexts (micro- and meso-level factors), and influences emanating from the broader sociocultural contexts (i.e. macro-level influences). Similar ideas have recently been echoed in the sport psychology domain, calling for a broader, multilevel approach to understanding mental health in athletes (Purcell et al., 2019). With these considerations in mind, in our review we adapted the multi-level model proposed by Hankin (2012) to categorize and visually illustrate the different variables/topics that research has tested in relation to depressive symptoms in athletes.

In sum, the first aim of this scoping review ~~is~~ was to systematically identify the methodological characteristics of the research that has assessed depressive symptoms in athletes. The second aim ~~is~~ was to identify the variables/topics that have been directly tested (statistically) in relation to these symptoms.

Methods

The review process was guided by the framework proposed by Arksey and O'Malley (2005), which includes five distinct stages - 1) identifying the research question; 2) identifying relevant studies; 3) study selection; 4) charting the data; 5) collating, summarizing, and reporting the results.

Identifying the Research Question

We formulated our broad research question as follows - 'what are the characteristics of the studies that have assessed depressive symptoms in athletes and what type of variables has been tested in relation to these symptoms'. The specific objectives related to these research questions were to: 1) identify the overall publication trends including number of primary studies by year, and country; 2) identify the study methodology and instrumentation; 3) identify sample characteristics; and 4) identify the variables/topics that have been explicitly measured in relation to depressive symptoms.

Identifying Rrelevant Sstudies

Initially we conducted searches between September 2018 and February 2019. Considering that depression and depressive symptoms have often been used interchangeably in the athlete literature (Schuch, 2015), our search strategy was to allow for the inclusion of both these terms. We first used the search terms 'Depress* AND athlete*' across all the databases including; Academic Search Complete, CINAHL Plus with Full Text, Education Research Complete, ERIC, Medline, OpenDissertations, SportDiscus with Full Text, PsychArticles, PsychInfo, OpenGrey, Science Direct, Google Scholar, and PubMed. Following our initial search, we utilized more specified Boolean search terms in the following databases; Medline (MM "Depression" OR MM "Mental Health" OR MM "Mental Disorders") AND (MM "Athletes" OR MM

"Sports"), PubMed (("Depression"[Mesh] OR "Depressive Disorder"[Mesh] OR "Depressive Disorder, Major"[Mesh]) AND "Athletes"[Mesh]), SportDiscuss (DE "MENTAL depression" OR DE "MENTAL health" OR DE "MENTAL health of athletes" OR DE "MENTAL illness") AND (DE "ATHLETES" OR DE "SPORTS"), and Cinahl (MM "Depression" OR MM "Mental Health" OR MM "Mental Disorders") AND (MM "Athletes" OR MM "SPORTS"). Finally, we conducted hand searches for additional research papers in key articles' reference lists, and in seven different sport psychology journals including; *Journal of Clinical Sport Psychology, International Journal of Sport and Exercise Psychology, Journal of Applied Sport Psychology, Journal of Sport Psychology in Action, Psychology of Sport and Exercise, Sport, Exercise, and Performance Psychology, and The Sport Psychologist*. All search results were exported to a referencing software (Zotero) and then to a systematic review software (DistillerSR, Evidence Partners, Ottawa, Canada). We used the DistillerSR systematic review software version 2.27.0 for removing duplicate records, and for the screening, and extraction of articles for the review. All searches were repeated 10.9.2019 - 24.9.2019 to search for additional research published between September 2018 and September 2019.

~~[Table 1 here]~~

Study Sselection

The following inclusion criteria for articles were set: ~~1)~~(a) primary research utilizing depression questionnaires to assess depressive symptoms ~~2)~~(b) any design such as cross-sectional, longitudinal, or intervention design, ~~2)~~(c) sample defined as able bodied or disabled athletes or competitors in a sport (current or former); including any competition level such as professional, Olympic/Paralympic, elite, national, international, or regional, or student athletes, ~~3)~~(d) all ages, and ~~5)~~(e) manuscripts or

abstracts written in the English language. Although we utilised only English search terms, non-English articles with English abstracts were included if all other criteria were met.

The following exclusion criteria were set: ~~1)~~(a) secondary data (e.g. reviews or commentaries), ~~2)~~(b) studies not identifying participants as athletes or competitors in a sport, ~~3)~~(c) sample defined merely as participants engaging in physical activity, ~~4)~~(d) no depression questionnaire or measures assessing merely mood or affect, and ~~5)~~(e) measures that produce a global score without specifically referring to depressive symptoms.

Based on the final inclusion/exclusion criteria, each article identified by our search was screened for title by the first author (RT). Articles that were included or articles that needed further screening based on the title advanced to the abstract and full-text screening stage. RT conducted all screening and extraction procedures; however, an integrity check was conducted at the level of abstract and full text screening on 20% (n=136) of the articles by the third author (RM). Of these randomly selected records, RT and RM agreed on inclusion of 29 records and exclusion of 96, and hence, the proportional overall agreement was 92% [(29+96)/136]. None of the studies initially included by RT were excluded, however, one study that was initially excluded by RT (Donohue et al., 2015) was included after the integrity check by RM.

We identified 8062 records through our initial database searches in 2018. With the additional searches conducted in September 2019, the total number of records identified ~~were~~ was 9035 (Figure 1). After removing duplicates, 6983 records were screened for title, of which 679 records advanced to full text/abstract screening. Of the 679 texts assessed for eligibility, 148 articles were included. We identified seven additional articles through hand searches, and we added two additional records

following the integrity checks. Hence, 157 articles were included in the final scoping review. Of the included studies, 146~~7~~ were in full-text format and 11~~0~~ in abstract format.

[Figure 1 here]

Following the screening process, RT extracted information from all the included studies. The second author (JS) utilized the same extraction sheet as RT to independently extract information on 31 (20%) randomly selected studies. No significant disagreements emerged between the authors. However, one dissertation included two studies, and this record was included as two separate studies instead of one (Fraser, 2017). The following information was extracted for data synthesis; *article format (i.e. abstract or full text), title, journal, author(s), year of publication, country/countries, aim(s), design, number of depression symptom assessments (in longitudinal/intervention studies), sample size, response rate reported (yes/no), sample sex, sample age, sample sport and competition level, competitive status (current and/or former athletes), non-athlete control/comparison group, depressive symptoms measure, reliability coefficients and cut-off scores utilized for the measure, theoretical approach to depressive symptoms, variables tested (statistically) in relation to depressive symptoms.*

Charting the data

~~We reported number of publications by year and country in figures.~~ The research designs and number of depressive symptoms assessments~~,~~and the depressive symptoms measures and their reported reliability coefficients, ~~age across sample gender, and competition level across competition status (current/former)~~ were collated in tables.

Variables that were statistically tested and reported in relation to depressive symptoms were recorded for each individual study and collated in figures. Variables that were included in statistical models without being individually tested and/or reported in relation to depressive symptoms (e.g., as control variables), were not, however, included. All identified variables were organized under categories within a multilevel conceptual model adapted from Hankin (2012) as follows; within-individual variables (e.g., genetic, biophysiological, cognitive/behavioural), proximal contexts and social and interpersonal influences (i.e. micro- and meso-level variables), and macro-level variables (e.g. culture, ethnicity). Overall frequencies of the occurrence (i.e. tested in relation to depressive symptoms) of each variable across the studies ~~was~~ were also reported in figures separately for cross-sectional and longitudinal studies.

Results

The included studies were published between the years 1987 and 2019 (as of ~~by~~ September 2019~~; Figure 2~~). From 1987 to 2013, the frequency of studies ranged from 0 to 6 studies per year. Sixty-nine percent of studies were published after the year 2013, ~~and~~ with publication frequency ~~ranged~~ ranging from 11 to 27 studies per year (as of ~~by~~ September 2019). Excluding dissertations (n=13), studies were published in 91 different scientific journals. Journals in which studies were most often published ($n \geq 3$) included; *British Journal of Sports Medicine* (n=3), *Clinical Journal of Sport Medicine* (n=5), *European Journal of Sport Science* (n=3), *Frontiers in Psychology* (n=4), *Journal of Clinical Sport Psychology* (n=19), *Journal of Science and Medicine in Sport* (n=6), *Psychology of Sport & Exercise* (n=4), and *The American Journal of Sports Medicine* (n=4).

~~[Figure 2 here]~~

Studies were conducted in 28 different countries with the majority conducted in the United States (n= 77, 49.0%~~; Figure 3~~). Twelve (7.6%) studies were conducted in Germany and 10 in Canada (6.4%). Three studies (2%) were conducted in multiple countries (e.g., Sweden/Denmark and New Zealand/Australia).

~~[Figure 3 here]~~

Methodology and Instrumentation

Most studies utilized a cross-sectional design (n=116, 73.9%) and 35 studies (22.3%) were longitudinal. Approximately 20% of the longitudinal studies measured depressive symptoms only at one time point, either as a predictive variable for other prospective outcome measures (measured at baseline), or as an outcome measure of other prospective predictors (measured at follow-up) (Table ~~2~~1). Six (3.8%) of the included studies utilized an intervention design, of which 2 studies were identified as randomized controlled trials (Donohue et al., 2018; Glass et al., 2019).

[Table ~~2~~ 1 here]

Of the 28 different self-report measures identified, the most commonly utilized was the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), with 32 studies (20.4%) utilizing the standard CES-D and an additional 5 studies utilizing modified versions (Table ~~3~~2). Other measures that were commonly utilized were the Beck Depression Inventory-II (12.5%; BDI-II; Beck et al., 1996), the Beck Depression Inventory (11.9%; BDI; Beck et al., 1961), and the nine-item Patient Health Questionnaire (13.1%; PHQ-9; Kroenke ~~and~~ & Spitzer, 2002). Two studies utilized

depression measures specifically designed for athletes, that is, the Baron Depression Screener for Athletes (BDSA; Polat et al., 2015) and the Stress Response Scale for athletes – depression scale (Hagiwara et al., 2017).

Thirty-six studies (23.0%) assessed internal consistency coefficients at one time point or across several time points, with alpha coefficient ranging from α = .38 for the Brief Symptom Inventory (BSI), to α = .94 for the BDI and the BDI-II (Table ~~3~~2). Six studies reported reliability coefficients over time; Manuel et al. (2002; BDI =.88-.95), McGuire et al. (2017; PHQ-9 = .67-.85), Lancaster et al. (2016; Brief Symptom Inventory =.38-.76), Smith et al. (2018; CES-D = .86 - .89), Shanmugam et al. (2014; Symptom Checklist-90-Revised = .89- .91, and Wang et al. (2017; Symptom Checklist-90-Revised = .88-.90).

[Table ~~3~~ 2 here]

Half of the studies (n= 79, 50.3%) reported prevalence rates (table ~~3~~2). For the BDI three studies reported prevalence across different severity (Barmi, 2011; Leddy & Lambert, 1994; Rodrigues et al., 2017), one study used cut-off >10 (Haslacher et al., 2015), one study >13 (Willer et al., 2018), one study >15 (Manuel et al., 2002), and one study >17 (Levit et al., 2018) when reporting prevalence rates. For the BDI-II, four studies reported prevalence across different severity (Brett et al., 2019; Bunce, 2014; Chen et al., 2008; Covassin et al., 2012), two studies used cut-off >10 (Covassin et al., 2019; Didehbani et al., 2013), two studies ≥ 12 (Lodis et al., 2012; Uglesić et al., 2014), three studies >13 (Baker et al., 2018; Hammond et al., 2013; Strain et al., 2017), and one study ≥17 (Thomson & Jaque, 2016) when reporting prevalence. For CES-D all except one study (Nixdorf et al., 2013, ≥ 23) used a cut-off score ≥16 (n=19). Eight

studies reported prevalence using additional cut-offs scores (i.e. 21, 23 and/or 27). Finally, in ten studies utilizing PHQ-9, prevalence was reported using a cut-off score ≥10, a cut-off > 14 was used in one study (Gerber et al., 2018), and one study reported prevalence across different levels of severity (McGuire, 2014) (for information on cut-off scores for all included studies see appendix 1).

Sample Characteristics

In 58 studies (36.9%) the athlete sample consisted of < 100 participants. In 35 studies (22.3%) sample size was 100 -199~~,~~ and in 25 studies (15.9%) the sample size was 200-299. Twelve studies (7.6%) reported an athlete sample of 300-399, and four studies (2.5%) 400-499 athletes. Finally, 22 studies (13.8%) consisted of ≥500 athletes. One study did not report the sample size of athletes (Dishman et al., 2006). Response rate for the sample was reported in 67 studies (42.7%). In studies that reported prevalence rates (N=79), response rate was reported in 38 studies (48.1%). In studies where prevalence was reported for samples with less than 100 participants (N=27, 34.2%), response rate was reported in nine studies (33.3%). In studies that reported prevalence rates for samples ranging between 100 and 299 participants (N=29, 36.7%), response rate was reported in 15 studies (51.7%). Furthermore, in the 23 studies that reported prevalence rates for samples including ≥300 participants, 10 studies (43.5%) reported response rates.

~~Mean age range by sample sex is shown in Table 4.~~ Sample overall mean age range was coded for 134 studies (85.4%), with majority of athlete samples consisting of athletes with a mean age between 16 and 30 years (n=96, 61.2%). Twelve studies (7.6%) focused on athletes with a mean age under the age of 16, and 26 studies (16.5%) included athletes with mean age 31 years or older. We were unable to code mean age for 23 (14.6%) studies. While five studies (3.2%) did not report sample sex for athletes,

most studies included male and female athletes (n = 97, 61.8%). Of the studies that focused on one sex (n= 55, 35.1%), 81.8% focused on male athletes (n=45) and 18.2% (n=10) on female athletes.

~~[Table 4 here]~~

Samples included athletes from multiple (≥ 2) sports (n = 89, 56.7%), or one specific sport (n=39, 24.8%), and 29 studies (18.5%) did not specify the included sports. Although most multisport samples included a range of different sports, some included a more select group of sports such as boxing (and athlete controls, n=1), Gaelic games (n=1), swimming and track and field (n=1), marathon and endurance cycling (n=1), ice hockey and American football (and athlete controls, n=2), Wheelchair basketball and rugby (n=1), and rugby (and athlete controls, n=1). In the studies that focused specifically on one sport, the most frequently included sports were American football (n=13) and soccer (n = 10). The remaining single-sport samples included athletes from baseball (n = 2), cross-country running (n=1), ice hockey (n = 3), rhythmic gymnastics (n = 1), rugby (n = 1), running (n = 2), rowing (n = 1), swimming (n = 1), (para) track and field (n = 1), ultra-marathon (n = 1), wheelchair rugby (n = 1), and wrestling (n = 1). Only five studies explicitly reported the inclusion of disabled athletes.

~~As can be seen in Table 5, m~~Most studies focused on current athletes (n = 133), in which the samples most frequently consisted of university/collegiate athletes (39.8%), followed by athletes from multiple (≥ 2) competition levels (19.5%) and elite athletes (14.3%). In studies where the sample consisted of former athletes (n = 18), professional athletes were most frequently represented (33.3%). In five studies both current and former athletes were included, and in one study it was unclear whether participants were current or formers athletes (Jewett et al., 2014).

~~[Table 5 here]~~

Non-athlete comparison groups were included in 45 studies (28.7%), of which 28 studies (62.2%) included student samples, 7 studies (15.6%) matched controls, 7 (15.6%) studies other specified samples (e.g. patients entering eating disorder treatment), and 3 studies (6.7%) non-athletes that were not specified. Additionally, six studies (3.8%) compared athletes' depressive symptom scores to existing population norms.

Research emphasis

We identified 40 studies (25.5%) that were explicitly informed by a theory or theories to explore depressive symptoms in athletes (appendix 1). These studies were informed by several different theories; however, most theoretical approaches were ingrained in vulnerability (diathesis)-stress models (n=12, 30.0%), and theories of identity and psychosocial development (n=7, 17.5%), and motivation (n=5, 12.5%).

Seventy-two different variables/topics were identified as being tested in relation to depressive symptoms across the included studies, with variables/topics occurring 497 times across the 157 studies. As can be seen in Figure ~~4~~ 2 (for study specific information see appendix 1), research measured sport-specific (e.g. type of sport) (36.4%) and generic (e.g. age) (31.5%) variables/topics in relation to depressive symptoms, relating to social, interpersonal, and contextual variables (i.e. micro- and meso-level). Within-individual vulnerabilities (e.g. neurocognitive performance, identity, genetics) accounted for 17.2%, while only 5% of all 497 observations accounted for macro-level variables (e.g. population norms, ethnicity).

[Figure ~~4~~ 2 here]

In the 116 cross-sectional studies, the most frequently tested variables/topics in relation to depressive symptoms were ~~-~~ age (n= 19), athletes vs. non-athletes (n= 37), anxiety (n= 11), concussion (n= 15), sex (n= 34), injury (n= 16), level of sport (n= 13), pain/ache (n= 10), retirement related issues (n= 11), and type of sport (n=25) (Figure ~~3~~5). Collectively these variables/topics accounted for 51.5% of all 371 observations recorded across the 116 cross-sectional studies.

[Figure ~~3~~5 here]

Out of the 35 longitudinal studies (defined as studies including at least two prospective time points of analysis, excluding intervention designs), two studies measured depression only in relation to time. Out of the remaining 33 longitudinal studies, the most frequently measured variables included ~~–~~age (n= 8), anxiety (n=5), concussion (n=11), ethnicity (n= 6), injury (n= 9), sex (n=16), and type of sport (n=7; Figure ~~6~~4). Collectively these variables/topics accounted for 50% of all 124 observations recorded for the 33 longitudinal studies.

[Figure ~~6~~ 4 here]

Six studies used an intervention design of which one was conducted with amateur baseball players in Taiwan (Chen et al., 2019), one with elite athletes (sport not specified) and non-athletes in Turkey (Feyzioğlu et al., 2019), and four with collegiate athletes from multiple sports in the United States (Donohue et al., 2015, 2018; Glass et

al., 2019; Goodman et al., 2014). While all intervention studies measured depressive symptoms over time, only two studies measured other correlates in relation to depression. One study measured depression in relation to diagnosed mental disorders (Donohue et al., 2018) and one study compared differences between athletes and non-athletes (Feyzioğlu et al., 2019). ~~None of the intervention studies were specifically focused on treatment of depression - f~~Five interventions were aimed at improving mental health/well-being and/or performance related outcomes, and one intervention was focused on pain and functionality following an anterior cruciate ligament (ACL) surgery (Feyzioğlu et al., 2019). Two studies utilized the same multi-component cognitive-behavioural approach (Donohue et al., 2015, 2018), while three interventions utilized a mindfulness-based approach (Chen et al., 2019; Glass et al., 2019; Goodman et al., 2014). In one study, the intervention consisted of an accelerated physiotherapy (physiological) rehabilitation program (Feyzioğlu et al., 2019).~~For one study the intervention protocol was not clear as we were unable to acquire a full text version of the study.~~

Discussion

In this scoping review, we systematically reviewed research that has assessed depressive symptoms in athletes and collated the methodological characteristics of these studies. We also mapped correlate variables that have been directly tested in relation to depressive symptoms. Similar to research on mental health issues in more general (Gouttebarge et al., 2019), there has been a notable increase in depression-related research in athletes within the past few years. Our findings showed that 69% of studies assessing depressive symptoms in athletes were published after 2013 (as of by the end

of September 2019). Another notable finding was that more than half of the studies included in our review were conducted in North America. It is important to note, however, that our search included merely research published in the English language and hence our findings should be interpreted with this bias in mind. Nevertheless, our findings underline the importance of further stimulating depression-related research projects and publications in athlete samples across different cultural contexts.

Methodological characteristics

Most studies were cross-sectional (73.9%), while 35 studies (22.3%) utilized a longitudinal design. This is in line with findings from previous reviews (Golding et al., 2020; Küttel & Larsen, 2019; Rice et al., 2018; Rice et al., 2016), suggesting that we know little about the temporal relationships between potential risk factors and depressive symptoms. Furthermore, although most longitudinal studies assessed depressive symptoms at least two or more time points, approximately 20% of the longitudinal studies measured depressive symptoms only at one time point, either as a predictive variable (measured only at baseline) for other prospective outcome measures, or as an outcome measure (measured only at follow- up) of other prospective predictors. As Reardon and Factor (2010) note:

> …athletes' depression might have nothing to do with their athletic pursuits or the athletic pursuits could be their way of coping with depression, or it even could be caused by athletic participation. These possibilities have not been studied *per se*. (p. 963).

A decade later, many of these unanswered questions remain. Although it is unlikely that a single causal pathway or mechanism can ever fully explain the development, maintenance, and/or recurrence of depression (Hankin, 2012), prospective designs are needed to disentangle the relative influence of sport-specific and generic factors on

depressive symptoms. An improved understanding of these relationships would significantly enhance our ability to prevent and treat depression in the athlete population. We also identified that there is a general lack of intervention studies that have assessed depressive symptoms. Only one study tested an athlete specific treatment program to traditional counselling program, and reported overall more beneficial mental health outcomes in the athlete specific program (Donohue et al., 2018). However, more research is needed to test and develop effective and feasible interventions for athletes.

Previous findings suggest that there is an on-going debate concerning athletes' risk status in comparison to non-athletes (Armstrong et al., 2015; Gorczynski et al., 2017). As discussed by Gouttebarge et al. (2019) in relation to mental health issues in general, drawing conclusions about the differences between athletes and non-athletes has been problematic as studies have not utilized reference groups from the general population. This is an important dimension to the debate as findings will have different implications depending on whether comparisons are made against student samples, clinical samples, or age matched controls from the general population. In our review, in the studies that included non-athlete comparison groups, 62% consisted of student samples. Furthermore, our findings suggested that approximately one third of studies reporting prevalence rates consisted of less than 100 participants. Also, less than half of the studies that reported prevalence rates reported response rates for the sample. Hence, to date our understanding of the representativeness of findings concerning the prevalence of clinically significant depressive symptoms ~~athletes' risk status~~ in athletes is largely unknown. Furthermore, evidence concerning athletes' risk status in comparison to non-athletes is largely based on comparisons to ~~this specific population~~ student populations, rather than the general population. Future studies exploring prevalence rates in athletes would therefore benefit from including more representative

samples of athletes to better inform of their susceptibility to depressive symptoms in relation to the rates observed in the general population.

As shown in our review, a range of different assessment tools have been utilized, imposing different cut-off criteria for reporting prevalence rates. There seems, however, to be a positive trend towards utilizing screening tools that have been well-validated, such as the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), the Beck Depression inventory-II (BDI-II; Beck et al.,~~, Steer, & Brown,~~ 1996), the Beck Depression inventory (BDI; Beck~~, Ward, Mendelson, Mock, and Erbaugh,~~ et al., 1961), and the Patient Health Questionnaire (PHQ-9; Kroenke and Spitzer, 2002). These measures accounted for 57.3% of the measures utilized across the studies, and a continued use of these measures is important to promote consistency in the assessment of depressive symptoms in athletes. Future studies may, however, consider reporting prevalence rates across different levels of severity (rather than merely one single cut-off) to provide more transparent perspective of symptom prevalence in athletes.

Some scholars have suggested that screening tools for mental health issues should be validated or specifically developed for athletes (Baron et al., 2013; Gouttebarge et al., 2019; Küttel & Larsen, 2019; Polat et al., 2015). Two athlete specific measures were identified in our review; the Baron Depression Screener for Athletes (BDSA; Polat et al., 2015) and the Stress Response Scale for Athletes - depression scale (Hagiwara et al., 2017). However, internal consistency was reported only for the BDSA with internal consistency $\alpha = .65$ (Polat et al., 2015). Overall, only 23% of the studies reported internal consistency of the scale. Studies that utilized one of the four most commonly utilized measures reported alphas between .67 and .94, while some other measures reported significantly lower (e.g. PHQ-2 = .45; Ohlert et al., 2019). Hence,

echoing notions made by Gouttebarge et al. (2019), future research would benefit from more research on the psychometric properties of different depression scales in athletes.

Considering that questionnaires have been the most common method of assessment in depression-related research in athletes (Golding et al., 2020) – current knowledge concerning the prevalence of major depressive disorder (MDD) is almost non-existent in this population (for notable exceptions see Appaneal et al, 2009; Schaal et al., 2011). Nevertheless, research in athletes have rarely made an explicit distinction between clinical and sub-clinical depression – often utilising the terms depression and depressive symptoms interchangeably when discussing results concerning clinically significant depressive symptoms. This could potentially cloud the meaning and interpretation of findings across studies (Schuch, 2015). While some studies have been more explicit in terms of making this distinction (e.g., Belz et al., 2018; Weber et al., 2018), some studies also identify the inability of depression questionnaires to provide a diagnosis of MDD as a limitation of their study (e.g. Beable et al., 2017; Weber et al., 2018). It could, however, be argued that, in this context, utilising questionnaires would pose a limitation only if the objective of the research was to assess the prevalence of MDD. As depression questionnaires are not designed to provide this information (Levis et al., 2020), identifying them as a limitation in this context could potentially convey a paradoxical message - implicitly suggesting that the objective of the research was to estimate the prevalence of MDD. As underlined by Ingram et al. (2015), a clinically relevant score on a questionnaire can be observed in the absence of the two cardinal, mood-related symptoms required for the diagnosis of MDD. Hence, interpreting clinically significant depressive symptoms as a proxy for MDD would be problematic. Future research within the field may therefore consider using more precise terminology when discussing and interpreting findings concerning depressive symptoms in athletes.

Also, rather than perceiving the use of depression questionnaires as a limitation per se, future studies could explore the potential opportunities symptom-based assessment could offer. For example, considering that individuals may experience vastly different symptoms of depression (American Psychiatric Association, 2013; Ingram et al., 2015) a detailed exploration of athletes´ symptom profiles in future research (rather than merely reporting overall scale scores) may prove useful in providing a richer understanding of potential symptoms that may be especially relevant in athletes.

Sample Characteristics

Most studies included both male and female athletes (61.8%). Of the studies that focused on one gender, more than 80 percent focused on male athletes. This is in line with findings by Küttel and Larsen (2019) on athlete mental health in general, where 12 studies included male only samples, and three studies female only samples. This disparity is interesting (and perhaps troubling), considering that female athletes have shown to report higher prevalence of depressive symptoms than males (Golding et al., 2020; Wolanin et al., 2015).

In relation to the type of sports that have been prominent in research, more than 20% did not specify the type of sports athletes competed in. Additionally, of those who did report, only 1/3 of the studies focused on specific sports, with the majority focusing on American football and soccer. These findings support the notion made by Junge and Feddermann-Demont (2016) that relatively few studies have explored depressive symptoms within specific sports. Identifying the context which studies have taken place in and reporting findings for specific sports is important as this can further improve our understanding of the potential sport-specific variables that need to be considered in future prevention efforts. For example, although evidence suggests that the context of individual sports may pose a specific risk in athletes (Beable et al., 2017; Nixdorf et al.,

2016; Schaal et al., 2011), the sport-environment (and hence stressors) is likely to significantly differ depending on the specific type of individual (or team) sport (consider for example contextual differences in figure skating, tennis, fencing, boxing, or rallycross). As noted by Purcell et al. (2019):

> Any mental health framework that ignores wider ecological factors runs the risk of focusing exclusively on, and potentially pathologising the individual athlete, when other factors may be more influential in contributing to, or perpetuating, poor mental health (p.3).

If the context is not outlined or studies carried out in a broader range of sports, identifying relevant sport-specific ecological factors may not be possible, meaning ~~intervention~~ that multilevel approaches to prevention and intervention may not be tailored appropriately.

Most studies focused on current university/collegiate athletes (39.8%), which could explain why most studies also utilized student sample comparison groups. Approximately 20% of the studies ~~in current athletes~~ included athletes from multiple competition levels (e.g. regional, national, or international) and about 14% included elite athletes. It should be noted though, that some of the athletes identified as University or collegiate athletes could have also been classified as elite athletes (Swann et al., 2015). Considering that a majority of studies have been conducted with multisport samples, evaluating the influence of competition level to depressive symptoms may be challenging. Although some studies do exist~~s~~ (Junge & Feddermann-Demont, 2016; Nylandsted Jensen et al., 2018), future studies may want to further explore the relationship between competitive level and depressive symptoms within the same sport context. Furthermore, it would be important to identify the mediators and/or moderators in the relationship between competitive level and elevated depressive symptoms. This

could subsequently allow for a better identification of the central factors that need to be attended to when optimizing athlete mental health across different levels.

In contrast to studies in current athletes, among retired athletes, professional athletes were most frequently represented (33.3%). This may suggest that access to professional athletes during their active careers may be challenging. Although some studies compared depression between current and former athletes, more longitudinal research is needed to understand the prospective patterns in the development of depressive symptoms across the athletic career.

Research emphasis

We identified a range of different variables that research has focused on in relation to depressive symptoms. We adapted a multi-level conceptual model from Hankin (2012) to visually contextualise the type of variables that have been of interest in relation to depressive symptoms. Overall, research tested a wide range of proximal sport-specific (e.g., concussion/injury, type of sport) and generic (e.g., age, sex) variables in relation to depressive symptoms. Although many of these can be considered as individual level risk factors (e.g. age, sex, injury, concussion, retirement), their effects on depression may also operate through the larger sports context. Also, many of these variables are unmodifiable (e.g. sex, ethnicity, type of sport). Therefore, it may be difficult to target these (and other) risk-factors at the individual level, and more multi-level approaches to prevention and treatment may be required instead (Purcell et al., 2019).

We found that few studies were explicitly informed by theory in their aim to explore depressive symptomatology in athletes. Of the 40 studies that were

identified (25.5%), most theoretical approaches were ingrained in vulnerability-stress models and theories of identity, psychosocial development, and motivation. As underlined by Joormann and Arditte (2015), one of the central topics in depression research in the clinical psychology domain has involved the study of vulnerability and resilience. According to our findings, however, a minority of studies have directly tested these ~~variables~~ in relation to depressive symptoms in athletes. For example, cognitive concepts that have been widely researched in clinically oriented psychology research (i.e. perfectionism, attributional style, schemas/beliefs, thought suppression, coping, resilience; (Hankin, 2012; Joormann & Arditte, 2015), collectively accounted for only 3% (n=14) of all the observed measurements in this review. Furthermore, although we identified several within-individual variables that have been measured in relation to depressive symptoms, few studies assessed the same variable(s), suggesting that research on within-individual vulnerability is fragmented. To better support athletes, future studies may hence want to increase focus on theoretically informed approaches to exploring within-individual processes or constructs that have been well-researched within the field of clinical psychology (e.g. rumination, negative cognitive styles, perfectionism), and their interaction with both generic and sport-specific social and contextual risk factors. Considering that interventions targeting both athletic performance and mental health issues may be appealing to athletes (Donohue et al., 2018), exploring attentional processes, such as rumination, could be especially interesting in athletes as they may significantly impact on athletic performance (Bennet et al., 2016; Swann et al., 2017) and depressive symptoms and other mental health issues (Watkins, 2009).

Limitations

Although we had a broad inclusion criterion in terms of the athlete samples, methodology, and research agenda, we focused merely on research that has assessed depression through self-report measures. Future reviews may hence want to ~~review~~ focus on depression literature that has assessed depression by other means not captured by our review (e.g. clinical interviews/scales that were not included in this review). Also, future reviews could focus on the research literature that has utilized in-depth interviews, especially in terms of mapping the specific contextual and with-in individual factors that may relate to depression or depressive symptoms. We also excluded studies that were not written in the English language, and therefore our findings should be interpreted with this cultural bias in mind. Finally, mapping such a broad area of variables was not without its challenges as several of the identified variables could be understood from a generic or sport-specific perspective, and may operate at multiple levels on depressive symptoms. Nevertheless, our review provides a new perspective on current research practices in the study of depressive symptoms in athletes. Findings in this review may hence allow future research to more systematically target research efforts in areas where knowledge is still lacking.

Conclusions

Research on athlete depression is rapidly increasing. We, however, identified several gaps that warrant more scholarly attention. Most studies have been cross-sectional, utilized athlete samples from several different sports, and utilized student samples as comparison groups. Hence, there is a need for longitudinal studies within specific sports to better disentangle the relative influence of, and interaction between, sport-specific and generic risk factors on the development of depressive symptoms in

athletes. Although most studies utilized screening measures that are well-validated in the general population, we identified 28 measures that have been utilized to measure depressive symptoms in athletes. Future research would benefit from more consistency in the utilization of screening tools, and evidence of the psychometric properties is also warranted. Although studies have explored generic and sport-specific factors within the athletes´ proximal environment, very few studies have explored the wider cultural or macro-level influences. Also, research on within-individual vulnerability is fragmented and needs to be further explored in relation to contextual determinants to improve individual-level support initiatives.

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