What Lies Beneath: Exploring Specific Depressive Symptoms across Selected Risk Factors in Icelandic Team Sport Athletes

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Abstract: The aim of the study was to explore the prevalence of specific symptoms of depression in athletes, and to test differences in the likelihood of exhibiting these symptoms across age, sex, type of team sport, and level of competition. A sample of Icelandic male and female team sport athletes (N=894, 18-42 years) were included in the study. Of the athletes exhibiting clinically significant depressive symptoms on the Patient Health Questionnaire (PHQ-9), 37.5% did not exhibit core symptoms of depression. Compared to males, females were significantly more likely to exhibit depressed mood, feelings of worthlessness/guilt, problems with sleep, fatigue, appetite, and concentration. Within males, differences were mostly related to neurovegetative aspects of depression (sleep and appetite), whereas in females, differences were related to cognitive/emotional aspects (e.g. depressed mood, guilt/worthlessness). The findings underline the importance of exploring specific symptoms of depression to provide a richer understanding of depressive symptomology in athletes.

Keywords: Patient Health Questionnaire, Screening, Prevalence, Sex differences, assessment

Within the past decade, depression-related research in athletes has aimed at establishing an improved understanding of athletes' susceptibility to depression and depressive symptoms (Golding et al., 2020; Gorczynski et al., 2017; Wolanin et al., 2015). There is now an empirically grounded consensus that athletes are a unique population challenged by a range of generic and sport-specific stressors (Küttel & Larsen, 2019; Reardon et al., 2019; Wolanin et al., 2015), **and that prevalence rates of depressive symptoms in athletes may be comparable to those observed in the general population (Gorczynski et al., 2017; Junge & Feddermann-Demont, 2016; Nixdorf et al., 2013; Wolanin et al., 2016). As reported in a recent review by Golding et al. (2020), depressive symptom prevalence has ranged from 6.7% to 34.0% across athlete samples, and that several demographic risk factors such as sex, level of competition, and type of sport have been linked with elevated depressive symptoms in this population**. **Similar to research on normative sex differences (Breslau et al., 2017; Hankin et al., 1998),** female athletes have shown to **report** higher levels of depressive symptoms than male athletes (Gorczynski et al., 2017; Wolanin et al., 2015)**. It has also been suggested that** athletes competing at lower levels exhibit higher **prevalence of** depressive symptoms than those competing at higher levels (Junge & Prinz, 2018; Nixdorf et al., 2013). **However,** younger age has also shown to correlate with elevated depressive symptoms in athletes (Beable et al., 2017), and it is therefore uncertain whether the observed difference between higher- and lower-level athletes is due to the level of competition per-se, or whether this relationship is better explained by potential age-effects**. Recent evidence also shows that susceptibility to depression and depressive symptoms may vary across different types of sports (Schaal et al., 2011; Wolanin et al., 2016). However, as discussed by several authors (e.g. Nixdorf et al., 2013; Tahtinen et al., 2020; Wolanin et al., 2016), samples have often consisted of a relatively small number of athletes across different sports, and therefore, comparisons have tended to focus on differences between broader sport categories such as team and individual sports (e.g. Beable et al., 2017; Nixdorf et al., 2013). Consequently, to better understand potential sport-specific differences, scholars**

have underlined that future studies should aim to include larger samples across specific sports (Golding et al., 2020; Junge & Feddermann-Demont, 2016; Junge & Prinz, 2018; Nixdorf et al., 2013; Wolanin et al., 2016).

While the evidence-base on various depression-related topics in athletes has been growing rapidly, less attention has, however, been paid to the heterogeneous subset of symptoms that underlie the construct of depression itself (Ringland, 2016; Schuch, 2015), and the potential implications this heterogeneity may have on the interpretation and dissemination of research findings (Golding et al., 2020; Schuch, 2015). Therefore, we will shortly discuss the definition and assessment of depression, and how the current study aims to address these issues.

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), major depressive disorder (MDD) is defined as consisting of nine potential symptoms; depressed mood, decreased interest or pleasure (anhedonia), changes in weight or appetite, problems with sleep, psychomotor agitation or retardation, fatigue/loss of energy, worthlessness/guilt, problems with concentration, and thoughts of death. MDD is diagnosed by structured **or semi-structured** clinical interviews, and **to receive a diagnosis, individuals must exhibit five (or more) depressive symptoms of which at least one must be depressed mood or decreased interest/pleasure** (American Psychiatric Association, 2013). **Considering that depressed mood or decreased interest/pleasure is the only specified symptom required** for a diagnosis, the symptom presentation across individuals **diagnosed** with MDD can be highly heterogeneous (individuals exhibit different type**s** of symptoms) (Zimmerman et al., 2015). **There are, in fact** "…roughly 1,000 unique combinations of symptoms that all qualify for a diagnosis of MDD, some of which do not share a single symptom" (Fried & Nesse, 2015, p.2).

Depression can also be assessed via self-report questionnaires in which **the overall symptom severity**, rather than a formal diagnosis, is the main outcome measure (Fried & Nesse, 2015b; Ingram et al., 2015). Questionnaires can vary in terms of their assessment period

(e.g. symptoms present the past week or past two weeks), and the number and type of symptoms assessed. For example, the Center for Epidemiologic Studies Depression Scale (CES-D, Radloff, 1977) **is a 20-item** questionnaire, **and assesses the presence of both positive and negative affect items** in the past week. Another commonly utilized self-report measure (Golding et al., 2020; Trojian, 2016) is the nine-item Patient Health Questionnaire (PHQ-9, Kroenke & Spitzer, 2002), which is specifically designed to assess the **presence of the** nine **depressive** symptoms listed in DSM over the past two weeks. Despite the structural differences of depression questionnaires or screening tools, a common feature is that the overall symptom severity is calculated by summing scores from individual symptom items. Specified cut-off points are then imposed to indicate the clinical significance of symptom **severity**, that is, whether the summed scores reach severity levels that may call for intervention or further assessment (Kroenke & Spitzer, 2002; Radloff, 1977). However, when summed symptom **scores** are utilized to determine clinical significance, **there is no criteria for the type or number of symptoms that must be present** (Fried et al., 2016). Consequently, the symptom heterogeneity discussed **concerning** MDD is further escalated when depression is operationalised in terms of summed symptom scores (Fried et al., 2016).

While questionnaires have been the most common method of assessment in depression-related research in athletes (Golding et al., 2020), **studies sometimes identify this method as a limitation of their study - highlighting that questionnaires do not provide a diagnosis of depression (e.g. Beable et al., 2017; Weber et al., 2018). However, if questionnaires are not designed to diagnose depression (Levis et al., 2020), then identifying them as a limitation in this context may convey a paradoxical message - implicitly suggesting that, in essence, the objective of the research is to estimate the prevalence of MDD**. When this is coupled with the interchangeable use of terms depression and depressive symptoms, there is an increased risk that sum-scores on **questionnaires** become interpreted as a proxy for MDD (Schuch, 2015). This would be problematic, however, considering that clinically significant scores identified by questionnaires could be acquired in the absence of the core **symptoms** of

depression, and that clinically significant sum-scores do not require the presence of any specified number of symptoms (Fried & Nesse, 2015a). **Consequently, on some screening tools such as the PHQ-9, it would be plausible for an athlete to report an elevated score merely on a single symptom, and still receive a clinically significant sum-score. In-fact, clinically significant scores could be attained by athletes who would not fulfil a single criterion for a diagnosis of MDD, if assessment would be performed via clinical interviews**. **Indeed, recent findings suggest that screening tools such as the PHQ-9 significantly over-estimate rates of MDD (Levis et al., 2020).**

Considering the heterogeneity of depressive symptoms, there is also an inherent disadvantage in interpreting questionnaire data solely in relation to sum-scores, as **they** may mask important information of the underlying symptomology (Fried et al., 2014; Ingram et al., 2015; Moriarity & Alloy, 2020). Consequently, the interpretation of findings could in some cases turn out to be "…as inadequate as the count of broken bones in a trauma victim" (Fried & Nesse, 2015a, pp., 6-7). This is, however, not to mean that sum-scores should not be applied or that they are not meaningful in research **or practice**, but rather, that there may be several opportunities over and beyond sum-scores that symptom-based assessment could offer. For example, while elevated depressive symptoms have shown to increase the risk for developing MDD over time (Ingram et al., 2015), **experiencing issues with a specific** depressive symptom**, such as problems with sleep,** can in itself be a significant source of distress and impairment for athletes (Moesch et al., 2018; Reardon et al., 2019; Roberts et al., 2016). **D**epressive symptoms may also vary in their impact on individuals' psychosocial functioning, and can differ in their salience across different life domains (e.g. work and interpersonal relationships) (Fried et al., 2016; Fried & Nesse, 2014). There is also evidence suggesting that **depressive** symptoms may be differentially related to risk factors. Lux and Kendler (2010) for example observed that in a sample of individuals diagnosed with MDD, females were more likely to exhibit depressed mood, appetite/weight changes, and fatigue, while males were more

likely to exhibit psychomotor agitation/retardation. Furthermore, elevated symptoms of depressed mood and psychomotor agitation/retardation were related to older age.

Despite the recent **developments** in **research on** depressive symptom prevalence and associated risk factors in athletes (Golding et al., 2020; Moesch et al., 2018; Reardon et al., 2019; Wolanin et al., 2015), to our knowledge, previous studies have not explored the prevalence of **the specific** symptoms that may lie beneath summed symptom scores. We propose that exploring specific **symptoms** in addition to sum-scores offers an opportunity for establishing a richer understanding of the **underlying issues that may be especially relevant** in athletes. Exploring specific symptomology may also be especially fruitful as this "…may enable the development of personalized prevention that focuses on specific problems and symptoms before they transition into a full-fledged depressive episode" (Fried & Nesse, 2015b, p.4). Against this backdrop, in this preliminary investigation, we first aim to c*omplement* previous research by reporting the overall prevalence rates of depressive symptoms and compare these across age, sex, type of team sport, and **level of** competition. We also aim to *extend* current symptom-based research by 1) exploring the prevalence of the core symptoms of depression **(i.e. depressed mood and lack of interest/pleasure)** across different sum-score severity, and by identifying the number of additional symptoms exhibited by athletes with or without these core symptoms, and 2) by testing potential differences in the likelihood of exhibiting specific depressive symptoms across age, sex, type of team sport, and **level of** competition.

Methods

Participants

The data for the current study were derived from a project exploring gambling **behaviours** in Icelandic athletes competing in football, basketball, and handball. Of the estimated population of Icelandic competitive adult athletes in these sports (N=3641), a total of 1241 athletes (34.1%) participated in the research project. For the current study, however, only

athletes with valid responses to one or more depressive symptom items were included. Therefore, of the 1241 participants, 894 athletes (72.0%) were included in the current study (football=63.2%; basketball=100%; handball=70.5%). More specifically, the current sample for football represented 20.3% of the Icelandic football population (N=2170 across 105 teams) with a total of 441 participants included (age range 18-41 years, male 70.1%). For basketball, **the** sample represented 36.1% of the Icelandic basketball population (N=659 across 56 teams) with a total of 238 participants (age range 18-41 years, male 62.6%). For, handball, sample represented 26.5% of the Icelandic handball population (N=812 across 20 teams) with a total of 215 participants (age range 18-42 years, male 51.2%).

Measures

Depressive symptoms were assessed by the Patient Health Questionnaire 9 (PHQ – 9) (Kroenke & Spitzer, 2002), which assesses the presence of the nine depressive symptoms listed in DSM during the past two weeks: "little interest or pleasure doing things" (interest), "feeling down, depressed, or hopeless" (depressed mood), "trouble falling or staying asleep, or sleeping too much" (sleep), "feeling tired or having little energy" (fatigue), "poor appetite or overeating" (appetite), "feeling bad about yourself - or that you are a failure or have let yourself or your family down" (worthlessness/guilt), "trouble concentrating on things, such as reading the newspaper or watching television" (concentration), "moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual" (psychomotor), and "thoughts that you would be better off dead or of hurting yourself in some way" (**suicidal thoughts**) (Kroenke & Spitzer, 2002). Each item is scored on a range from 0 to 3, where 0 = "not at all", 1= "several days", 2 = "more than half the days", and 3 = "nearly every day", with **sum-scores** ranging from 0 to 27. Kroenke and Spitzer (2002) suggested a cut-off score of ≥10 (at least moderate severity) for identifying individuals with clinically relevant symptoms. **However**, it has also been noted that **it is important to report prevalence rates using different cut-off points to offer more valid**

comparisons across studies (Manea et al., 2012). Considering the exploratory nature of the current study we **report the** prevalence of clinically significant symptoms utilizing cut-offs, ≥10 (at least moderate symptoms) and ≥15 (at least moderately severe symptoms) (Kroenke & Spitzer, 2002). Furthermore, the PHQ-9 scores **can also be** analysed using an algorithm method. As described by Manea et al. (2015), when using the algorithm method, clinical significance is determined based on the DSM criteria where at least five symptoms must be present (item scored ≥2, except for suicidal ideation scored ≥ 1)[1], **of which** at least **one** must be depressed mood or lack of interest/anhedonia. The algorithm method has low sensitivity (**increased risk for false-negatives**) but shows excellent specificity (**decreased likelihood of false-positives**), while **the sum-score method has shown to have more optimal trade-off between sensitivity and specificity** (Manea et al., 2015). As the goal of questionnaires (or screening **tools**) is to overestimate true rates to minimize potential false-negative cases (**failing to identify cases** with the condition), the **sum-score** method has been more commonly utilized (Manea et al., 2015). However, as the aim of this study is to explore the underlying symptomology in more detail, we also explore prevalence rates using the algorithm method. The psychometric properties of PHQ-9 have shown to be good among the clinical (Kroenke & Spitzer, 2002) and the general populations (Martin et al., 2006), **including the Icelandic population** (Palsdottir, 2007). **T**he internal consistency of the scale in the current sample was α=.86.

Procedure

In collaboration with the Icelandic national associations in football (Knattspyrnusamband Íslands, KSÍ), basketball (Körfuknattleikssamband Íslands), and handball (Handknattleikssamband Íslands, HSÍ), the general managers of all clubs in Iceland were contacted and requested to participate and to co-operate in recruiting gatekeepers

[1] When we report **the** overall prevalence of each symptom (see table 2), to make interpretations of the prevalences across symptoms comparable, a score ≥2 was used to identify symptom presence for all symptoms.

(coaches) from their respective clubs. Only one football club declined the invitation to participate in the study. Following approval for co-operation, a link to the questionnaire was sent to the gatekeepers within every team, who then shared the link with their players (age ≥18) and encouraged them to participate in the study. Gatekeepers were contacted approximately 2-3 weeks following the initial contact, requesting them to remind the players about the study. All potential participants were informed that participation in the study was optional, responses on the questionnaire were anonymous, and that they could withdraw from the study at any point. Participants were also provided with contact information for psychological support and encouraged to seek help if they were experiencing any type of distress. Participants did not receive any form of compensation for their participation. Permission for the study was obtained from the National Bioethics Committee in Iceland (B20171100004 and S1512-00001) and the Icelandic Data Protection Authority.

Statistical Analyses

We utilized logistic regression models with adjusted odds ratios and 95% confidence intervals to test differences across two generic (sex and age), and two sport-specific (level of competition and type of team sport) variables on the odds of exhibiting **specific** depressive symptoms.

Binary dependent variables (specific symptoms) were coded as "0" = not present and "1" = present. For eight symptoms the score of ≥2 ("more than half the days" or "nearly every day") signified the presence of the symptom, however, for the 9th symptom "**suicidal thoughts**" a score of ≥1 (at least "several days") implied the presence of the symptom (Lux & Kendler, 2010; Manea et al., 2015). We coded predictors as binary dummy variables with **the** reference category coded as "0" and each remaining level within the predictor as "1". Each level ("1") was then tested separately against the reference category **("0")**. The reference group was chosen based on the literature when possible, such as that the reference category was assumed to exhibit the lowest levels of depressive symptoms. The reference categories across

predictive variables were; male (sex), older (age), and top-level (level of competition). As previous literature has not explored differences across the specific sports included in our study, football (type of team sport) was chosen as the reference group (lowest mean sum-score). Due to **a** low number of female athletes 27 and older – the older female group (reference category) included ages ≥24, while for males the reference group consisted of athletes ≥27 years old.

The regression models for comparing male and female athletes across specific symptoms were adjusted for age, type of sport and level of competition, while the models comparing different sports were adjusted for sex, age, and level of competition. Analyses on sex differences within athletes with clinically significant scores (PHQ-9 ≥10) were, however, un-adjusted due to the low number of athletes in this sub-group (n=72). Models testing differences across age and level of competition were conducted separately for male and female athletes adjusting for the remaining predictors.

Two participants had one missing value on the PHQ-9 scale (case 1, response on sleep missing, and case 2, response on concentration missing) but were included in the sum-score analyses by replacing **the** missing value with 0 (symptom not present). Results for sum-score and logistic regression analyses were tested with and without this correction and there were no notable differences in the outcome. Nine other cases had **more than one missing item** on the PHQ-9 scale and were therefore not included in the sum-score analyses. However, all cases with valid responses to specific items were included **in** the logistic regression analyses **across specific** symptoms. All analyses were conducted using the IBM SPSS version 25.0.

Results

Sum-score Means and Prevalence across determinants

The overall prevalence of clinically significant depressive symptoms in the sample (N=885) was 8.1 % and 2.7% when applying a cut-off score ≥10 and ≥ 15, respectively. As shown in **T**able 1, the corresponding prevalence rates **when applying cut-offs ≥10 and ≥ 15**, were 5.8% and 2.3% for male athletes (N=565), and 12.2% and 3.4% for female athletes

(N=320). Kruskall-Wallis test showed that female athletes had **a** significantly higher prevalence than male athletes when cut-off score 10 was applied [$H(1) = 11.00$, $p = .001$], however, no significant difference was observed when cut-off 15 was applied. In female athletes, Kruskall-Wallis test showed that prevalence (cut-off 10) was significantly different between age groups [$H(4) = 11.55$, $p = .02$], with 18-20-year-olds having significantly higher prevalence rate (19%) than 21-23-year-olds (8.3%, $p = .02$), 24-26 year-olds (6.3%, $p = .20$), and 27-29 year olds (3.8%, $p = .03$). When **applying the** cut-off score of 15, no significant differences were observed in female athletes across the predictive variables. **Independent of** the cut-off score used, there were no significant differences in prevalence rates across the predictive variables in male athletes.

As also shown in table 1, female athletes had significantly higher mean symptom scores (M=5.11, SD= 4.38) than male athletes (M=3.05, SD=3.70) [$t(575.17) = -7.10$, $p < .001$]. **In** male athletes, the only mean depressive symptom score difference was found between type of sports [$F(2, 562) = 4.04$, $p = .018$], with Tukey post hoc test revealing a significantly higher score for male handball players (M=3.93, SD=3.82) than football players (M=2.77, SD=3.35) ($p = .013$). In female athletes, the only significant **difference was found across age** [$F(4, 315) = 3.90$, $p = .004$], and **according to** Tukey post hoc test, this difference was significant between the youngest (18-20 year-old, M= 6.02, SD=4.63) and oldest athletes (30-42 year-old, M= 2.80, SD=3.29) ($p = .004$).

Prevalence of Specific and Total Number of Symptoms

Table 2 shows the overall prevalence of the **specific** depressive symptoms in the sample, and **among** athletes with and without clinically significant sum-scores. Prevalence of specific symptoms **for the whole sample** ranged from 1.6 % for suicidal ideation to 12.2 % for fatigue. The core symptoms of depression, lack of interest and depressed mood, were present for most of the days in the past two weeks in 6.8% and 5.9% of the sample, respectively. Approximately half of the athletes with clinically significant sum-scores exhibited the core

symptoms of depression. In terms of **the** total number of symptoms (table 2), 75.7% of the sample did not exhibit any symptoms, and 16.3% exhibited 1-2 symptoms. Within athletes **who had** clinically significant scores, 51.4 % reported 3-4, and 38.9% five or more symptoms.

Prevalence of Core Symptoms of Depression across Sum-score Severity

Table 3 illustrates the prevalence of the core symptoms (i.e. depressed mood and lack of interest/pleasure) across athletes with different sum-score severity. Of the male athletes **with PHQ-9 sum-scores in the 10-14 range** (moderate depressive symptoms, n=20), 45% did not exhibit either of the core symptoms of depression. **Of** the male athletes with **PHQ-9 scores in the 15-27 range (moderately severe to severe symptoms**, n=13), 23.1% did not exhibit the core symptoms. In females, 53.6% of athletes **within the 10-14 range** (n=28) did not exhibit the core symptoms, while all female athletes within the **15-27 range** (n=11) exhibited at least one of the core symptoms. Overall, 37.5% (27/72) of all athletes **with** clinically significant sum-scores (PHQ-9 ≥10) did not exhibit the core symptoms of depression. However, when the **PHQ-9 cut-off** ≥15 was applied, **only** 12.5% (3/24) of athletes **with clinically significant scores** did not exhibit the core symptoms.

Number of Additional Symptoms across Athletes with and without Core Symptoms of Depression

The total number of additional symptoms across athletes with or without the core symptoms of depression are presented in table 4. Of the athletes that did not exhibit the core symptoms of depression (n=813), the vast majority exhibited no other depressive symptoms (82.4%) or 1-2 symptoms (15.1%). Of those athletes that presented only lack of interest (n=20) or only depressed mood (n=11), two athletes (6.5%) exhibited 4 additional symptoms. Of the athletes presenting with both core symptoms of depression (n=39), 61.5% exhibited three or more additional symptoms. Hence, overall, 2.9 % (n=26) of athletes exhibited a total of five symptoms of which at least one was either depressed mood or lack of interest.

312

313 **Differences in the Odds of Experiencing Specific Depressive Symptoms across Selected**
314 **Determinants**

315

316 Table 5 shows adjusted logistic regression models, for each depressive symptom across
317 the selected determinants. Compared to male athletes, female athletes were **significantly more**
318 **likely to report** depressed mood, sleep problems, fatigue, problems relating to appetite,
319 feelings of worthlessness/guilt, and problems with concentration **(controlling for the effects of**
320 **age, level of competition, and type of sport)**. The highest odds for females in comparison to
321 males was found in fatigue (OR=3.88, CI95%=2.37-6.37), depressed mood (OR=2.08,
322 CI95%=1.91-3.97), and appetite-related issues (OR=2.08, CI95%= 1.15-3.74). When sex
323 differences were explored **among** athletes **with** clinically significant sum-scores (PHQ-9 ≥10)
324 (not included in table 5), female athletes showed significantly higher odds of fatigue
325 (OR=6.60, CI95%=2.18-19.97), while males showed significantly higher odds of psychomotor
326 issues (OR=.26, CI95%=.08 -.84) than females.

327 When football players were compared to players from the two other team sports,
328 handball players had significantly higher odds of experiencing depressed mood, and issues
329 with sleep and appetite, while basketball players showed higher odds of sleep and appetite-
330 related issues than football players **(adjusting for sex, age, and level of competition)**. Most
331 notably, the likelihood of experiencing appetite-related issues more than half the days in the
332 past two weeks was more than four-fold (OR=4.31, CI95%= 2.03-9.18) in basketball players
333 than in football players.

334 **Due to sex-differences in the distribution of scores in age and level of competition,**
335 **these variables** were explored separately for male and female athletes. Models for age were
336 adjusted for level of competition and type of sport, and models for **the** level of competition
337 were adjusted for type of sport and age. As shown in **T**able 5, when male athletes 27 years and
338 older were compared to the other age groups, **21-23- a**nd 18-20-year-olds had significantly
339 **higher** odds of exhibiting depressed mood and issues with sleep and appetite. Odds of

experiencing issues with appetite were notably high, with 21-23-year-olds showing almost five-fold (OR=4.90, CI95%=1.01-23.90), and 18-20-year-olds seven-fold increase in odds (OR=7.06, CI95%=1.52-32.79) when compared to male athletes 27 years and older. Furthermore, male athletes 18-20-years-old showed significantly higher odds of experiencing lack of interest than male athletes 27 years and older. Within female athletes, 18-20-year-olds showed significantly higher odds of exhibiting the core symptoms of depression (lack of interest and depressed mood) than female athletes 24 years and older. Female athletes 18-20-years-old also had a higher likelihood of feeling worthlessness/guilt and having problems with concentration. In these comparisons the most notable difference was found in the likelihood of experiencing depressed mood, with the youngest female athletes having an almost five-fold increase in odds (OR=4.78, CI95%=1.37-16.65) compared to female athletes 24 years and older.

Concerning the level of competition, the only differences were observed between male top-level and male first division players. Male athletes competing in first division (second-highest level) had significantly higher odds of experiencing worthlessness/guilt and psychomotor issues than top-level players. Most notably, first division players had more than a four-fold increase in odds (OR=4.50, CI95%=1.16-17.43) of experiencing psychomotor issues when compared to top-level players.

Discussion

In this preliminary investigation, we aimed to complement previous research by exploring the overall prevalence of depressive symptoms, and to test potential differences across generic and sport-specific determinants in a large representative sample of Icelandic team sport athletes. Additionally, to further extend knowledge-advancement in the field, we explored the prevalence of specific depressive symptoms, and tested potential within factor

differences **(e.g. different age groups)** in the odds of experiencing different **types of** depressive symptoms.

Sum-score Means and Prevalence across Determinants

The overall prevalence of depressive symptoms in the sample **was** 8.1 % and 2.7% when applying a cut-off score ≥10 and ≥ 15, respectively. **In comparison, Tahtinen and Kristjansdottir (2019) reported a 20.9% prevalence rate in Icelandic individual sport athletes using the PHQ-9 with a cut-off score of 10.** This supports some previous findings which have suggested that elevated depressive symptoms may be more prevalent in individual sport **athletes when compared to** team sport athletes (Beable et al., 2017; Nixdorf et al., 2013, 2016). **Female athletes in our sample had a significantly higher prevalence of depressive symptoms than male athletes when a cut-off score of 10 was applied, which is in-line with previous findings on sex differences in athletes (Golding et al., 2020)**. However, no sex differences were observed when **applying** a cut-off **score of** 15, suggesting that while female athletes may be more likely than males to experience moderate levels of depressive symptoms, **the rates of** more severe symptomology may be comparable between the sexes. Within female athletes, the only significant **mean** differences emerged between younger and older athletes, and in male athletes, the only difference was found between **different** sports. This latter finding is somewhat surprising considering that football, handball, and basketball are all team ball sports in which the nature of competition **(e.g. team-based with competition outcome evaluated objectively, i.e. scoring point/goals)** and related stressors such as public evaluation of performance (Doherty et al., 2016), could be expected to be somewhat similar. We did not, however, assess other factors that could have explained the observed differences, such as injury or concussion (Rice et al., 2018) overtraining (Peluso & Andrade, 2005) or burnout (Gerber et al., 2018), which have all shown to relate to higher depressive symptoms. Nevertheless, our findings highlight that while the broader sports categories such as individual and team sports have shown to differ in rates of depressive symptoms (Beable et al., 2017; Nixdorf et al.,

2016); there may also be important differences across different sports within these broader categories (Rice et al., 2016). In line with recent research (Golding et al., 2020; Junge & Feddermann-Demont, 2016; Junge & Prinz, 2018; Nixdorf et al., 2013; Wolanin et al., 2016)**, our study emphasizes the need for more fine-grained analyses across different sports to better understand factors that may contribute to elevated depressive symptoms in athletes.**

Prevalence of Specific Symptomology

In the current sample, the prevalence of specific depressive symptoms **(symptom present at least most of the days in the past two weeks)** ranged from 1.6 % for suicidal ideation to 12.2 % for fatigue. As shown in our data and previous research, fatigue (low energy/tiredness) is a common symptom in athletes (Birrer et al., 2013; Matos et al., 2011) and could therefore represent an important target for future prevention programs independent of the type of athletes the program is designed for.

As most studies to-date have utilized questionnaires to assess depression in athletes – current knowledge of athletes' susceptibility to major depressive disorder (MDD) is largely unknown (for a notable exception see Schaal et al., 2011). Nonetheless, research in athletes has tended to utilize the terms depression and depressive symptoms interchangeably when **discussing** clinically significant depressive symptom sum-scores, potentially clouding the meaning and interpretation of findings across studies (Schuch, 2015). One of the aims of this study was therefore to explore sum-scores from the perspective of DSM criteria. Several studies in athletes have utilized PHQ-9 scores ≥10 as a cut-off for identifying clinically relevant cases and reporting prevalence rates (Bell et al., 2016; Du Preez et al., 2017; McGuire et al., 2017; Silva-Rocha et al., 2019; Tahtinen et al., 2020; Tahtinen & Kristjansdottir, 2019). **We, however, speculated that when applying this cut-off, athletes could attain clinically significant scores without exhibiting the core symptoms of depression (i.e. lack of interest and depressed mood). Indeed**, we found that 37.5% of all athletes who had clinically

significant sum-scores (PHQ-9 ≥10) did not exhibit the core symptoms of depression. However, this was reduced to 12.5% among athletes with moderately severe to-severe sum-scores (PHQ-9 ≥15). Furthermore, 45% of male and 53.6% of female athletes with moderate depressive symptoms (PHQ-9 scores 10-14) did not exhibit the core symptoms of depression. According to Kroenke et al. (2001)**,** the PHQ-9 shows increasing **specificity (decrease in potential false-positive cases)** but attenuated **sensitivity (increase in potential false-negative cases) as cut-off scores increase in the moderate depressive symptom range** (scores 10-14) and hence, this range has also been identified as the "grey zone". **Considering that approximately half of the athletes scoring within the "grey zone" did not exhibit the core symptoms of depression - it could have been deemed misleading to report our findings concerning prevalence rates as the proportion of "depressed" athletes when applying the cut-off ≥10. On the other hand, using a higher cut-off point could potentially lead to increased risk of missing "true" cases. Although we did not conduct diagnostic interviews to test the sensitivity and specificity of the PHQ-9 scale in our athlete sample, our findings provide new insights into the underlying symptomology in athletes with clinically significant sum-scores.**

We also speculated that it would be plausible for an athlete to report an elevated score merely on a single symptom, and still receive a clinically significant sum-score. However, 90% of athletes who had clinically significant depressive symptoms exhibited at least three symptoms. To further understand clinically significant symptoms in our sample, we **applied** an algorithm method to explore the number of athletes that self-reportedly fulfilled the DSM criteria for **exhibiting a minimum of** five symptoms, of which at least one symptom **was** either depressed mood or lack of interest. We found that overall, 2.9% of athletes self-reported meeting these criteria, which is considerably lower than the 8.1% prevalence observed when cut-off score 10 was applied, and closer to the prevalence rate obtained by a cut-off 15 (2.7%). This is also similar to **the 3.6% prevalence reported in a study among French elite athletes who were assessed using semi-structured diagnostic interviews** (Schaal et al., 2011). We

only know of one study to-date that has reported prevalence rates in athletes using both self-report questionnaires and clinical interviews. In their study, Hammond et al. (2013) found that 34% of elite swimmers met DSM criteria for a major depressive episode when assessed by clinical consultations, while 22% reported mild and only 4 % moderate levels of depressive symptoms when assessed by the Beck's Depression Inventory-II (BDI-II). Considering that screening tools are designed to over-estimate true cases (Manea et al., 2015), finding a higher number of cases by clinical interviews than questionnaires is surprising. **It has, however, been underlined that the optimal cut-off score may depend on the setting in which assessment is conducted, that is, the same cut-off score can result in many false-positives in one setting, while leading to more false-negatives in another (Manea et al., 2012). Hence, considering the findings in the current study and those reported by Hammond and colleagues (2013), future studies are needed to validate existing screening tools in the athlete populations.**

Differences in the Odds of Experiencing Specific Depressive Symptoms across Selected Determinants

When compared to male athletes, female athletes showed significantly higher odds of exhibiting depressed mood, sleep problems, fatigue, problems relating to appetite, feelings of worthlessness/guilt, and problems with concentration. Furthermore, we found that **among** athletes with clinically significant sum-scores, females were more likely than males to experience fatigue, while males were more likely to experience psychomotor issues. Our findings are in-line with those reported by Lux and Kendler (2010), where females diagnosed with MDD were more likely than males to exhibit depressed mood, appetite/weight changes and fatigue, while males were more likely to experience psychomotor issues. Our symptom-specific analyses extend current knowledge and suggests that **the** higher overall depressive symptom severity identified in females is reflected in several specific symptoms. It is interesting to note, however, that while the key symptoms differing within the male sample

were related to neurovegetative symptoms (sleep and appetite), within female athletes, variability was more prominent in cognitive symptoms. For example, when compared to older female athletes the youngest female athletes in our sample **had** significantly **higher** odds of **exhibiting a** lack of interest, depressed mood, worthlessness/guilt, as well as concentration problems. Most notably, younger female athletes (18-20 years) had almost a five-fold increase in odds of **experiencing** depressed mood compared to female athletes 24 years and older. Relatively few studies in athletes have, however, explored depression, or other mental health issues, specifically in female athletes (Golding et al., 2020; Küttel & Larsen, 2019). Considering that female athletes exhibited higher prevalence **rates across** several **specific** symptoms **when compared to** male athletes, attention in future research, prevention, and applied efforts **should be** directed at this population. Furthermore, although sex differences have been noted in previous research, there is a gap in our knowledge **concerning the factors that could potentially explain these differences**. In this context, and as has been voiced by Nixdorf et al. (2020), **future research could benefit from exploring cognitive mechanisms to identify factors that may be especially relevant for targeted prevention and treatment among in-risk athletes.**

While our sum-score analyses identified overall differences between football players and handball players, symptom specific analyses revealed additional findings. Both handball and basketball players were more likely to report issues with sleep and appetite in comparison to football players. **Also**, handball players were more likely than football players to report experiencing depressed mood. Depressed mood, and issues with sleep and appetite were also the key symptoms in males when age differences were compared between older and younger athletes. The odds of experiencing issues with appetite were notably high, with 21-23-year-old males showing almost five-fold, and 18-20-year-olds a seven-fold increase in odds compared to male athletes 27 years or older. While it is difficult to speculate as to why we found these differences, regulation of sleep and appetite has shown to be related to similar biomarkers among depressed patients (Caroleo et al., 2019). Based on our findings these specific

symptoms could provide an interesting avenue for further research in depression-related research in athletes.

Level of competition did not contribute to differences in **across** depressive symptoms within female athletes. Considering that our adjusted analyses demonstrated more variability across age than **the** level of competition, the higher susceptibility of lower-level athletes found in previous studies (Junge & Feddermann-Demont, 2016; Junge & Prinz, 2018; Nixdorf et al., 2013) **may be** better explained by age-related differences. Nevertheless, while controlling for the effects of age and type of sport, we found that male athletes competing **in first** division (second-highest level) had significantly higher odds of experiencing worthlessness/guilt and psychomotor issues than top-level players. **While the findings concerning differences in psychomotor issues may be difficult to interpret**, the observed difference in worthlessness/guilt could perhaps be understood through the lens of athletic identity (Brewer & Petitpas, 2017). As there may be similar physical and psychosocial demands (e.g. training and competition load) for **first** division and **top-league** players in Iceland, a strong identification with the athlete role may be comparable between these groups. However, the threats to athletic identity **may be** more pronounced for **the first** division players as the sport career prospects may be less secure than for **the top-level players**.

Overall, our exploratory findings highlight the importance of applying an analysis of the underlying symptomology in parallel to reporting sum-scores when assessing depressive symptoms in athletes. If findings are interpreted only in terms of summed scores, important information may be lost, and interpretations may have limited utility in terms of knowledge advancement in the field. Applying a more detailed exploration of the underlying symptomology could also generate useful information for more theory-driven approaches to understanding depression and depressive symptoms in athletes – and therefore, the development of more targeted and tailor-made approaches to intervention in the future (Nixdorf et al., 2020). As noted by Purcell et al. (2019), it is also important to understand athlete mental health from a broader ecological perspective. We propose that

exploring individual symptoms, rather than only sum-scores, could significantly contribute to this understanding in future research. For example, by providing more detailed information about the specific symptoms that may be especially prevalent in different athlete populations, future research could more systematically map the relevant contextual risk factors that may contribute to these symptoms.

Clinical Implications

Service provision for athletes can vary largely across different sport settings (Kroshus, 2016; Moesch et al., 2018). In Iceland there are currently no systematic protocols in place for the assessment or treatment of mental health issues in athletes. However, as the current and previous findings (e.g. Kristjánsdóttir et al., 2019; Tahtinen & Kristjansdottir, 2019) suggest, more systematic approaches to providing mental health support among the Icelandic athlete population may be warranted.

While systematic screening of depressive symptoms has been highlighted as an important objective for identifying and supporting in-risk athletes (Donohue et al., 2019; Wolanin et al., 2016), "routine" screening has also been questioned. Particularly, the potentially high number of false-positive cases identified by screening tools could lead to adverse consequences, such as over-diagnosis of depression, and increased risk of labelling and stigma among individuals screened with elevated symptom scores (He et al., 2020; Joffres et al., 2013; Mojtabai, 2017). This may be especially relevant in athletes considering that screening tools have not yet been properly validated in this population (Moesch et al., 2018). As shown in our study, while 90% of athletes with clinically significant sum-scores exhibited at least three different depressive symptoms, almost 40% of athletes with moderate symptom severity (clinically significant score 10-14), did not exhibit the core symptoms of depression (depressed mood and lack of interest).

If systematic screening is conducted in settings where there is already a suitable support infrastructure in place, it is important to determine which screening tool(s) and

555 **cut-off score is utilized to identify athletes for a follow-up (Trojian, 2016). Considering**
556 **that screening tools are designed to overestimate "true" clinical cases to minimize**
557 **potential false-negative cases - rather than merely "red -flagging" athletes with clinically**
558 **significant depressive symptom scores - exploring the specific symptomology could**
559 **potentially improve the specificity of the screening results. For example, analysing scores**
560 **specifically for symptoms such as depressed mood and/or lack of interest, insomnia or**
561 **suicidal thoughts may be important when considering further follow-up (Joffres et al.,**
562 **2013). Furthermore, it is important to determine how initial screening results are**
563 **communicated to athletes, and that athletes are included in the process when determining**
564 **potential mental health referrals (Donohue et al., 2018; Joffres et al., 2013; Trojian,**
565 **2016). Considering our findings, discussing specific symptoms and related issues that are**
566 **especially relevant for athletes could potentially improve this decision-making process.**
567 **As shown in a study by Kroshus (2016) there were on average one full-time**
568 **physician for each NCAA division I sports medicine department, and 376.4 student-**
569 **athletes per physician. Applying the 23.7% prevalence rate reported in college athletes by**
570 **Wolanin et al. (2016) and the average number of students per physician reported by**
571 **Kroshus (2016), at any given time there would be approximately 89 NCAA division I**
572 **collegiate athletes per physician screened with clinically significant depressive symptoms.**
573 **This underlines the importance of conducting an evidence-based assessment of the target**
574 **population, and the resources required to assure that appropriate follow-up assessment**
575 **and mental health support can be provided to athletes following the screening process. It**
576 **must however be noted that our aim with this discussion is not to recommend for or**
577 **against screening in athletes, but to highlight the potential utility of exploring individual**
578 **depressive symptoms in settings where screening protocols are being planned or already**
579 **in place.**
580 **In our sample, 17% (n=138) of athletes with non-clinically significant depressive**
581 **symptom sum-scores, reported experiencing 1-2 depressive symptoms most of the days in**

582 **the past two weeks. It is therefore important for practitioners working with athletes to be**
583 **mindful of the possibility that although an athlete does not present with clinically**
584 **significant depressive symptom sum-scores, they may nevertheless experience significant**
585 **distress and impairment in specific areas of functioning (e.g. issues with sleep/appetite,**
586 **feelings of guilt). Therefore, independent of the sum-scores, it may be beneficial to discuss**
587 **with the athlete about the individual symptoms on which they may exhibit elevated**
588 **scores. This could also open new doors to identifying other potential mental health issues**
589 **(Mummery, 2005; Trojian, 2016). For example, there is considerable overlap between**
590 **symptoms of depression and other conditions highly relevant in the athlete population,**
591 **such as overtraining syndrome (OTS) (Kreher, 2016), burnout (Nixdorf et al., 2020), and**
592 **eating disorders (Kristjánsdóttir et al., 2019) and hence, a detailed analysis of the specific**
593 **symptomology may provide the practitioner with additional road signs when**
594 **conceptualizing potential issues that may need further assessment.**

595 **One of the interesting and perhaps surprising, findings in our study was that there**
596 **were significant differences in the mean sum-scores and the prevalence of specific**
597 **symptoms between the three team sports included in our study. This suggests that even**
598 **across sports that could be considered similar in terms of the nature of the competition**
599 **(e.g. team-based with competition outcome evaluated objectively, i.e. scoring point/goals)**
600 **– there may be important contextual differences influencing athletes' mental health (Rice**
601 **et al., 2016). Therefore, practitioners working in team-based settings could benefit from**
602 **exploring specific symptoms to gain clues to the potential contextual factors that could**
603 **undermine athletes' well-being and performance. For example, if issues with sleep seem**
604 **to be highly prevalent in the team or within the organization, the practitioner could map**
605 **potential risk factors (e.g. training times, logistic issues in relation to traveling etc.), and**
606 **consequently plan targeted interventions to address these issues.**

607

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Limitations and Future Directions

Some limitations to the current study should be noted. Firstly, the mean difference analyses did not consider potential differences emanating from unmeasured third variables and therefore, these unadjusted mean differences should be interpreted with this limitation in mind. This study was also cross-sectional and can only be considered descriptive of prevalence at one point in time. There is now evidence suggesting that prevalence rates may vary over a competitive season (Du Preez et al., 2017; McGuire et al., 2017) and hence, the reported rates should not be considered static. Furthermore, although we had large sample sizes across the included sports – almost 40% of football players and 30 % of handball players did not respond to the depression symptom items, and where therefore excluded from the current study. Consequently, the representativeness of our findings should be interpreted with this limitation in mind. In terms of our logistic regression analyses, the overall rates for some symptoms (e.g. psychomotor) were low, which may have biased the odds ratio estimates. Furthermore, it should be noted that several of the PHQ-9 items do not make a distinction between the direction of symptom presentation (e.g. eating too little or over-eating, sleeping too much/too little). Hence, we were not able to identify the exact nature of the issue relating to this symptom.

Despite the limitations our study offers an important addition to previous depression-related research in athletes. We utilized a large representative sample of team sport athletes from three popular team sports in Iceland. We also had sufficiently large sub-samples across the different sport and non-sport specific determinants, allowing us to conduct more specific (adjusted) analyses across these determinants. Our approach to exploring the prevalence of specific depressive symptoms was also novel in the athlete literature. Future research could take our analyses further and explore how different symptoms may relate to athlete functioning, in and out of sport, **and explore these relations within prospective research designs**. For example, in non-athletes, sad mood and concentration difficulties was shown to have the most severe influence on overall psychosocial functioning, whereas insomnia had a

strong influence on work life, self-blame on close relationships and loss of interest on social activities (Fried & Nesse, 2014).

Conclusions

While research in athletes often note that depression questionnaires are limited in their ability to provide a depression diagnosis, few have explored the opportunities that questionnaires can offer, over and beyond the more commonly utilized sum-scores. As our study shows, there is a wealth of information to be gleaned by analysing the specific symptoms of depression. The initial findings suggest that female athletes report more symptoms than male athletes. Younger female athletes (18-20 years) in comparison to older (24+) may be especially prone to exhibit cognitive symptoms of depression, while younger male athletes (18-20) in comparison to older males (27+) may be especially prone to experiencing issues with sleep and appetite. Our study also shows that when utilizing PHQ-9 cut-off 10 to identify clinically significant depressive symptoms, almost 40% of the identified cases did not exhibit depressed mood or lack of interest. Hence, referring to athletes with clinically significant depressive symptoms as "depressed" athletes, could have been misleading in the current study. It is, however, important to underline that 90% of athletes with clinically significant symptoms reported having experienced at least 3 different depressive symptoms most of the days in the past two weeks. Hence, although some athletes in this group did not experience the core symptoms of depression, they may have nevertheless experienced significant distress. With these considerations in mind, future studies are encouraged to further explore individual symptoms in addition to sum-scores, and to explore symptoms in relation to athletes' overall psychosocial functioning.

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Table 1
Sex Specific Sum-score Means and Prevalence Rates across Age, Competition Level, and Type of Sport

	Sum-scores (male athletes)							Sum-scores (female athletes)						
				Severity (cut-off)							Severity (cut-off)			
				10-27 (≥10)		15-27 (≥15)					10-27 (≥10)		15-27 (≥15)	
Factor	***N***	***M***	**SD**	***n***	**%**	***n***	**%**	***N***	***M***	**SD**	***n***	**%**	***n***	**%**
Total sample score	*565*	***3.05***	3.70	*33*	***5.8***	*13*	2.30	*320*	***5.11***	4.38	*39*	**12.2**	*11*	3.4
Age														
18-20	143	3.03	3.79	10	7.0	2	1.4	142	**6.02**	4.63	27	**19.0**	6	4.2
21-23	146	3.47	4.02	10	6.8	5	3.4	84	4.68	4.14	7	**8.3**	3	3.6
24-26	117	2.91	3.83	7	6.0	4	3.4	48	4.81	4.56	3	**6.3**	2	4.2
27-29	76	2.61	3.20	2	2.6	1	1.3	26	3.81	2.82	1	**3.8**	0	.0
30-42	83	2.94	3.13	4	4.8	1	1.2	20	**2.80**	3.29	1	5.0	0	.0
Competition level														
Top level	179	2.97	3.67	8	4.5	3	1.7	142	4.73	4.36	16	11.3	4	2.8
1st division	117	3.51	4.13	10	6.8	4	3.4	178	5.41	4.38	23	12.9	7	3.9
2nd division	86	2.70	3.08	5	5.8	0	.0	-	-	-	-	-	-	-
3rd division	72	2.74	4.00	3	4.2	0	.0	-	-	-	-	-	-	-
4th division	111	3.16	4.04	7	6.3	6	5.4	-	-	-	-	-	-	-
Type of sport														
Handball	109	**3.93**	3.82	9	8.3	3	2.8	103	5.42	3.65	13	12.6	1	1.0
Basketball	149	2.99	4.18	11	7.4	4	2.7	89	5.52	5.54	14	15.7	7	7.9
Football (soccer)	307	**2.77**	3.35	13	4.2	6	2.0	128	4.57	3.97	12	9.4	3	2.3

Note. Sum-scores 10-27 = Moderate-severe, 15-27 = Moderately severe-severe. N = total number of athletes within factor level, *n*=number of athletes within severity. Scores ≥ 10 considered clinically significant according to Kroenke & Spitzer (2002). Levels 2nd -4th division includes only male athletes. Third division includes only male basketball and football players and 4th division includes only male football players. Bold numbers significant $p < .05$.

Table 2

Prevalence of Individual Depressive Symptoms for the Sample and for Athletes with and without Clinically Significant Sum-scores

	Total sample		Symptom sum-score	
			≤ 9 (N=813)	≥10 (N=72)
Factor	**N/n**	**%**	**%**	**%**
Type of symptom				
lack of interest	894/61	6.8	2.3	55.6
Depressed mood	892/53	5.9	1.6	51.4
Sleep problems	894/71	7.9	3.9	51.4
Fatigue	894/109	12.2	6.9	66.7
Problems with appetite	894/62	6.9	2.0	59.7
Worthlessness/ Guilt	894/76	8.5	3.4	63.9
Concentration problems	894/58	6.5	2.5	50.0
Psychomotor problems	892/26	2.9	1.0	23.6
Suicidal thoughts	888/14	1.6	.0	19.4
Number of Symptoms				
None	885/670	75.7	82.4	.0
1-2	885/144	16.3	16.9	9.7
3-4	885/43	4.9	.7	51.4
≥ 5	885/28	3.2	.0	38.9

Note. N/n=total number of athletes/athletes exhibiting symptom. All symptoms scored 0-3. Symptoms considered present if scored ≥ 2 (“more than half the days” or “nearly every day”).

Table 3
Prevalence of the Core Symptoms of Depression across Sum-score Severity

	Severity sum-score (male)						Severity sum-score (female)					
	0-9 (N=532)		10-14 (N=20)		15-27 (N=13)		0-9 (N=281)		10-14 (N=28)		15-27 (N=11)	
Factor	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Presence of defining symptoms												
Neither	519	97.6	9	45.0	3	23.1	269	95.7	15	53.6	0	.0
Only decreased interest	8	1.5	4	20.0	0	.0	4	1.4	4	14.3	0	.0
Only **depressed** mood	2	.4	2	10.0	0	.0	4	1.4	2	7.1	1	9.1
Both symptoms	3	.6	5	25.0	10	76.9	4	1.4	7	25.0	10	90.9

Note. Sum scores 0-9=Minimal-mild, 10-14=Moderate, 15-27=Moderately severe-severe. N/n=Total number of athletes within severity category/number of athletes within factor. Scores ≥2 (“more than half the days” or “nearly every day”) indicating the presence of the core symptom. Highlighted cases represent athletes with clinically significant symptoms (PHQ-9 ≥ 10), without exhibiting the symptoms depressed mood and lack of interest.

Table 4
Number of Additional Symptoms across Athletes without and with the Core Symptoms of Depression

	Number of additional symptoms (excluding decreased interest and depressed mood)									
	0		**1**		**2**		***3***		**≥ 4**	
Factor	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Presence of defining symptoms										
Neither (N=815)	670	82.4	96	11.8	28	3.4	14	1.7	7	.9
Only decreased interest (N=20)	7	35.0	5	25.0	3	15.0	4	20.0	1	5.0
Only depressed mood (N=11)	1	9.1	4	36.4	4	36.4	1	9.1	1	9.1
Both symptoms (N=39)	3	7.7	4	10.3	8	20.5	6	15.4	18	46.2

Note. N/n=Total number of athletes within factor/frequency of athletes exhibiting number of symptoms. Scores ≥2 (“more than half the days” or “nearly every day”) indicating the presence of a symptom (for suicidal ideation scores ≥ 1 “several days” or higher indicated presence). Highlighted cases identified as clinically significant based on the algorithm method (Manea et al., 2015).

Table 5

Binary Logistic Regression Models with Odds Ratios and 95% Confidence Intervals of Different Symptoms across Selected Determinants

		Interest	Depressed mood	Sleep	Fatigue	Appetite	Worthlessness/ Guilt	Concentration	Psychomotor	Suicidal thoughts
Sex (reference male)										
Female	OR (*n*)	1.44 (894)	**2.08 (892)**	**1.92 (894)**	**3.88 (894)**	**2.08 (894)**	**1.78 (894)**	**1.85 (894)**	.63 (892)	1.23 (888)
	CI	.80-2.60	**1.91-3.97**	**1.07-3.46**	**2.37-6.37**	**1.15-3.74**	**1.04-3.04**	**1.01-3.41**	.24-1.63	.69-2.20
Type of sport (reference football)										
Handball	OR (*n*)	1.15 (656)	**2.43 (654)**	**3.34 (656)**	1.53 (656)	**3.69**	1.33 (656)	1.76 (656)	1.69 (654)	1.05 (650)
	CI	.57-2.34	**1.08-5.46**	**1.57-7.12**	.88-2.67	**1.57-8.76**	.68-2.62	.83-3.73	.56-5.11	.51-2.13
Basketball	OR (*n*)	.98 (679)	2.11 (677)	**2.19 (679)**	1.47 (679)	**4.31 (679)**	1.67 (679)	1.54 (679)	.81 (678)	.90 (675)
	CI	.48-1.99	.96-4.67	**1.07-4.50**	.84-2.58	**2.03-9.18**	.88-3.14	.74-3.20	.25-2.61	.45-1.79
Sex-specific analyses										
Age (male) (reference ≥ 27 years)										
24-26 years	OR (*n*)	1.92 (277)	1.61 (277)	1.90 (277)	2.70 (277)	3.27 (277)	2.17 (277)	1.55 (277)	3.41 (277)	1.54 (276)
	CI	.58-6.31	.39-6.73	.65-5.54	.95-7.67	.57-18.75	.77-6.15	.52-4.62	.81-14.28	.54-4.44
21-23 years	OR (*n*)	2.16 (306)	**3.52 (306)**	**2.93 (305)**	2.37 (306)	**4.90 (306)**	2.40 (306)	.96 (305)	2.33 (306)	1.98 (305)
	CI	.67-6.95	**1.02-12.14**	**1.11-7.73**	.84-6.71	**1.01-23.90**	.91-6.32	.31-2.95	.56-9.63	.74-5.26
18-20 years	OR (*n*)	**3.03 (303)**	2.07 (303)	1.70 (302)	1.99 (303)	**7.06 (303)**	1.59 (303)	1.26 (302)	1.53 (303)	1.66 (302)
	CI	**1.01-9.07**	.58-7.43	.58-5.00	.69-5.74	**1.52-32.79**	.56-4.55	.44-3.62	.32-7.27	.60-4.56
Age (female) (reference ≥ 24 years)										
21-23 years	OR (*n*)	2.00 (179)	2.35 (179)	.61 (179)	1.62 (179)	1.83 (179)	2.76 (179)	1.48 (179)	0.00 (178)	1.11 (179)
	CI	.55-7.23	.56-9.85	.43-4.19	.75-3.50	.62-5.42	.91-8.35	.38-5.73	0.00 -	.31-4.01
18-20 years	OR (*n*)	**3.16 (241)**	**4.78 (239)**	2.22 (241)	1.92 (241)	2.37 (241)	**3.09 (241)**	**3.67 (241)**	4.14 (240)	2.30 (238)
	CI	**1.04-9.67**	**1.37-16.65**	.85-5.78	.97-3.82	.92-6.15	**1.12-8.47**	**1.22-11.09**	.49-35.04	.81-6.50
Level (male) (reference top level)										
1st division	OR (*n*)	1.24 (297)	2.29 (297)	2.11 (297)	1.42 (297)	2.79 (297)	**2.50 (297)**	.77 (297)	**4.50 (297)**	1.95 (296)
	CI	.47-3.28	.75-6.98	.80-5.57	.58-3.48	.98-8.00	**1.02-6.15**	.26-2.34	**1.16-17.43**	.78-4.88
2nd – 4th division	OR (*n*)	.95 (450)	.85 (450)	2.50 (450)	.89 (450)	1.52 (450)	1.17 (450)	.90 (450)	1.89 (450)	.81 (448)
	CI	.33-2.72	.24-2.99	.85-7.31	.34-2.37	.40-5.70	.41-3.36	.31-2.61	.35-10.12	.30-2.19
Level (female) (reference top level)										
1st division	OR (*n*)	.76 (326)	.87 (324)	1.83 (326)	1.49 (326)	1.07 (326)	1.07 (326)	1.26 (326)	.50 (324)	1.68 (323)
	CI	.35-1.68	.40-1.91	.84-3.98	.86-2.59	.53-2.22	.53-2.17	.58-2.77	.11-2.37	.72-3.92

Note. Each symptom measured on a scale 0-3 with scores ≥ 2 indicating presence of the symptom. For suicidal thoughts scores ≥1 indicated the presence of the symptom. Bold numbers significant p< .05.