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Mental health surveillance in elite Para athletes: early identification and follow-up of athletes at risk of mental health problems

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Accepted 5 June 2024



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To cite: Meidl V, Dallmann P, Steffen K, *et al.* *Br J Sports Med* Epub ahead of print: [please include Day Month Year]. doi:10.1136/bjsports-2023-107995

ABSTRACT

Objective There is a lack of prospective data on mental health of elite Para athletes. The objective was to identify and follow elite Para athletes at risk of mental health problems.

Methods In a 124-week prospective cohort study, mental health of German elite Para athletes was monitored using the Patient Health Questionnaire-4 (PHQ-4). In case of positive screening (PHQ-4 \geq 5) over 2 weeks, a follow-up contact was conducted by a sports psychiatrist, who asked the athletes about their mental condition and sources for their mental distress and offered support.

Results 7543 PHQ-4 scores were obtained from 122 Para athletes with a mean weekly response rate of 84%. The PHQ-4 screening was considered positive for symptoms of depression or anxiety with a prevalence of 6.7%, affecting 48.4% (n=59) of all participants at some point during the study period. In 76.6% (n=49) of all follow-up contacts, athletes (n=34) reported at least one mental health problem, most frequently mental distress (n=31), followed by symptoms of depression (n=19) including acute suicidality (n=1). The most common mental stressors cited were related to education and problems with the team, coaches or federation. At follow-up, almost two-thirds of the athletes were either already in professional psychiatric or psychological care (25%) or were recommended to seek such care (32.8%).

Conclusion Our screening and follow-up system revealed high rates of mental health problems in elite Para athletes. Programmes for early identification with mental health monitoring under the supervision of mental health professionals should be considered by sports federations for Para athletes.

INTRODUCTION

Mental health disorders are frequent among elite athletes across sports and cultures.¹ A meta-analysis identified mental health symptoms in 19%–34% of current top athletes.² Several successful Olympic and Paralympic athletes, such as Michel Phelps and Clara Klug, made their mental health problems public in recent years.^{3,4} Consequently, the importance of this topic has been recognised by international sports organisations and federations calling for attention to athletes' mental health, and claiming research in this field and feasible mental health screening tools.¹

International experts in sports psychiatry suggested different mental disease-specific screening tools to be implemented, including the

WHAT IS ALREADY KNOWN ON THIS TOPIC?

- ⇒ Mental health problems are frequent among elite athletes.
- ⇒ The Patient Health Questionnaire-4 (PHQ-4) has recently been validated for continuous mental health screening among elite Para athletes.

WHAT THIS STUDY ADDS

- ⇒ We collected prospective data on Para athletes' mental health from a continuous mental health surveillance over more than 2 years.
- ⇒ Nearly one-third of all participating athletes were affected by mental health problems and, at follow-up, almost two in three athletes were in need of psychological or psychiatric care.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ This study can serve as a guideline for long-term mental health monitoring among elite Para athletes for early detection and timely treatment of potential mental illnesses.
- ⇒ Prospective mental health data are a prerequisite for the identification of risk factors and the development of preventive strategies.

Baron Depression Screener for Athletes (BDSA), a 10-item self-report instrument to motivate athletes to see a mental health professional if they scored high on depression.⁵ Gouttebargé's *et al* developed a 3-step algorithm (Sport Mental Health Assessment Tool 1 (SMHAT-1)) for the identification of Olympic and Paralympic athletes with mental health problems including the athlete psychological strain questionnaire⁶ for triage, followed by several questionnaires concerning mental health disorders such as the Patient Health Questionnaire-9 and the General Anxiety Disorder Scale 7, as well as clinical interviews.⁷

Recently, we presented the Patient Health Questionnaire-4 (PHQ-4), a globally established, short and easy-to-use screening tool for depression and anxiety,⁸ to be a valid instrument for weekly mental health monitoring in elite Para athletes with the potential of identifying athletes at risk of mental health problems.⁹ The PHQ-4 was also used weekly in a 22-week mental distress monitoring of the Swedish Paralympic Team, showing a prevalence of 9%–19% for depression and 6%–38% for anxiety, respectively, depending on whether the athletes were surveilled before, during or after the Paralympics.¹⁰

Furthermore, the PHQ-4 was part of the health history questionnaire among US Olympic and Paralympic athletes.¹¹

While longitudinal surveillance of injuries and illnesses of athletes has become widespread,^{12–17} results of longitudinal and systematic mental health surveillance are rarely published so far, neither in Olympic nor in Paralympic athletes.²¹⁸ However, there is an urgent need for prospective data to better understand athletes' mental health, and to identify risk factors for mental health problems with the aim of early detection and management of mental health disorders, including prevention programmes.¹²

Therefore, the aim of this study was to

1. implement a long-term mental health surveillance system in a representative population of elite Para athletes and present prospective data on mental health symptoms and disorders from weekly screenings and follow-up contacts.
2. assess the feasibility and needs for a mental health surveillance programme to successfully identify athletes at risk and provide responsible follow-up including individualised mental health support if needed.

To meet the call of the International Olympic Committee (IOC) consensus statement about mental health in elite athletes in 2019,¹ we provide considerations and implications for using the PHQ-4 for a feasible mental health surveillance in elite Paralympic or Olympic athletes.

METHODS

Study design and participants

The study was designed as an expansion of a previous injury and illness surveillance programme in German elite Para athletes conducted in 2016. Based on the athletes' feedback, an additional set of questions was added for mental health surveillance and tested in a 10-week pilot phase.^{12 19 20} With the support of the National Paralympic Committee, all candidate athletes preparing for the Tokyo Paralympic Summer Games and the Beijing Paralympic Winter Games were invited to participate in November 2018. Starting in May 2019, a cohort of German elite Para athletes with a minimum age of 16 years completed a weekly mental health survey provided by AthleteMonitoring (FitStats Technologies, Moncton, Canada), an online athlete health monitoring system available as web platform or mobile app.^{9 20 21} Due to the longitudinal study design, participants could drop out or start participation during the study period.

The study was carried out according to the Strengthening the Reporting of Observational studies in Epidemiology guidelines.

Mental health assessments

To screen for mental health symptoms, we used the PHQ-4 weekly in accordance with the previous injury and illness monitoring.^{12 19 20} The PHQ-4 is a self-reporting questionnaire, which on a 4-point scale evaluates the presence of mental health symptoms over the past 2 weeks, ranging from 0 (not at all) to 3 (nearly every day).²² It has recently been validated for continuous mental health monitoring in elite Para athletes.⁹ The PHQ-4 includes the PHQ-2, and the GAD-2 screening for depressive and anxiety symptoms, respectively.²² Clinical practice guidelines recommend the use of the PHQ-4 total score as a general screening tool, considering scores greater than 5 as a yellow flag for depression or anxiety.⁸ We interpreted PHQ-4 scores as 'no/minimal symptoms' (0–2), 'mild symptoms' (3–5), 'moderate symptoms' (6–8) and 'severe symptoms' (9–12).²² Regarding the subscales, PHQ-2 and GAD-2, we considered scores as 'no symptoms' (0–1), 'mild symptoms' (2) and 'clear symptoms' (>3).^{10 22} Given the preventive strategy of the programme, we

set the threshold for a positive screening of mental health symptoms at scores of 5 or greater.⁹

Further, subjective stress levels and mood were obtained, as initially collected to validate the PHQ-4 in elite Para athletes.⁹ However, these were not included in further analysis or the screening process in the present study.

Finally, athletes could explicitly ask for professional help to address a need for acute mental health support.

Screening process and follow-up

As the athletes could complete the questionnaire at any time during the current week, the study team's clinically experienced sports psychiatrist reviewed athletes' mental health data twice weekly. She initiated a follow-up contact via AthleteMonitoring no later than 3 days after athletes completed the questionnaire when presenting PHQ-4 scores of 5 or greater over 2 consecutive weeks and/or when support was explicitly requested.²³ This follow-up included questions on the athletes' psychopathology, potential mental health stressors, already diagnosed mental illness and existing psychiatric care, psychotherapy, or support from a sports psychologist. She further offered mental health support, as telephone consultations and referrals or even direct mediation to any psychiatrist or psychotherapist, preferably an expert in the field of sport. Figure 1 illustrates the screening process.

Data analyses and statistics

All collected data were integrated into an Excel database (Microsoft Excel 2021, Windows) and we conducted statistical analyses with SPSS (SPSS Statistics V.28). The demographic data of the athletes were analysed descriptively, and subgroups were formed according to age, gender, type of sports and type of impairment in accordance with the IOC Para sport translation.²⁴ The cohort size was calculated each week as well as overall and weekly response rates based on the number of completed questionnaires divided by the current number of participants. Means and SD were presented for the PHQ-4 and its subscales among all participants and for each individual athlete. To compare PHQ-4 scores of athletes across gender (male/female) and type of sports (team/individual), we performed the Mann-Whitney U test and the Wilcoxon-W test (significance level at $\alpha=0.05$). To present the frequency of mental health symptoms, we calculated the prevalence of all PHQ-4, PHQ-2 and GAD-2 sum scores over the entire study period as well as weekly prevalence of positive screening (PHQ-4 ≥ 5) and moderate/severe symptoms (PHQ-4 ≥ 6). To analyse the changes in prevalence over time, we divided the study period into 2 and 6 time intervals, respectively. The prevalence in the first and second half of the study period was compared using a t-test. The prevalence in the six time intervals was analysed using analysis of variance. We coded qualitative data drawn from follow-up contacts and formed subgroups of follow-ups based on PHQ-4 scores and follow-ups based on support requests. The percentages of reported mental health symptoms were calculated in relation to the number of follow-ups carried out. As the athletes could also be contacted several times, we further analysed the data for the total number of different athletes who were followed up and reported mental health symptoms, respectively. Furthermore, we included two brief case reports of follow-up contacts and the subsequent referrals and interventions.

Patient and public involvement

The participants of an injury and illness surveillance system among German Para athletes conducted in 2016 suggested in

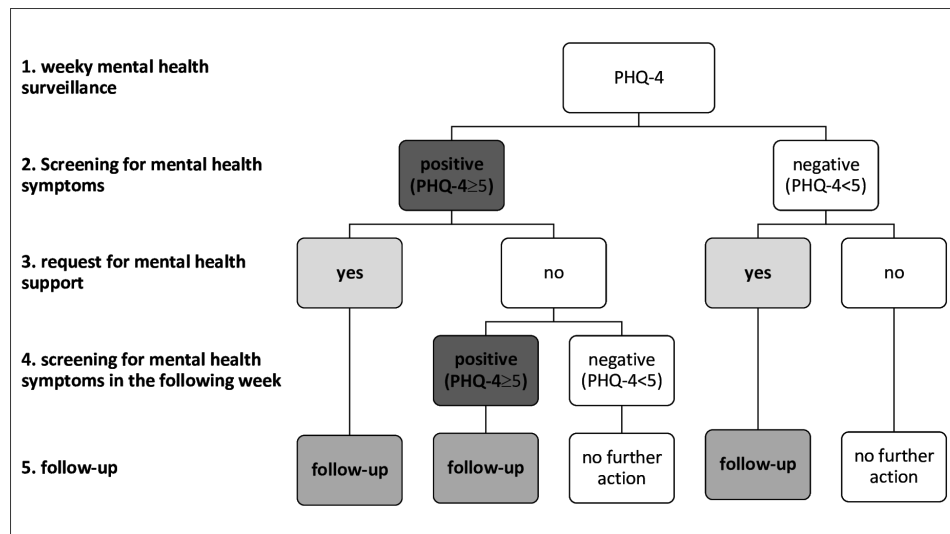


Figure 1 Flow chart of the Patient Health Questionnaire-4 (PHQ-4) mental health surveillance and screening process.

an evaluation to also include psychological aspects.¹² This led to the addition of a mental health questionnaire, including the PHQ-4, which was later tested in a pilot phase²⁰ and successfully validated in the population of elite Para athletes.⁹

Equity, diversity and inclusion

The author group consists of researchers from various disciplines (first and last author both women) and includes three junior scholars. The study population included individuals of different genders, demographics, ages and all impairment groups within the National Paralympic elite track. As authors and population were limited to high-income countries and elite Para athletes, findings may not be generalisable to settings with fewer resources and amateur athletes.

RESULTS

Sample characteristics

Out of 252 invited athletes, a total number of 124 (49.2%) agreed to participate with 2 athletes withdrawing their agreement during the study period, meaning that overall 122 athletes could be included in the statistical analyses. The weekly cohort size varied between 49 and 96 participating athletes. Female athletes comprised almost half of the cohort ($n=57$; 46.7%). The overall mean age was 28.4 years (SD 10.6), ranging from 16 to 61 years. In total, 20 different Paralympic sports were represented. A detailed overview of the demographic information of the study population can be found in [table 1](#).

PHQ-4 and positive screening

Over 124 weeks, a total of 7543 valid PHQ-4 measurements were obtained. The mean response rate throughout the study period was 84% (6.2 SD). The overall mean PHQ-4 score was 1.3 (2.1 SD). When looking at the weekly mean PHQ-4 scores over time, fluctuations were noted. Mean PHQ-4 scores of individual athletes showed a wide range from 0 (0 SD) to 10.5 (1.2 SD). Fluctuations of weekly individual PHQ-4 scores over time allowed the identification of changes in the mental health symptoms of individual athletes. PHQ-4 scores were significantly higher among female athletes ($M_{\text{PHQ-4}/\text{female}}=1.9$) compared with male athletes ($M_{\text{PHQ-4}/\text{male}}=0.8$) ($Z=-23.8$, $p < 0.001$). Also, athletes in team sports ($M_{\text{PHQ-4}/\text{team}}=1.4$) had significantly higher PHQ-4 scores than athletes in individual sports ($M_{\text{PHQ-4}/\text{individual}}=1.2$) ($Z=-7.7$, $p < 0.001$).

In accordance with our threshold (PHQ-4 ≥ 5), the prevalence of positive screenings on mental health symptoms was 6.7%, 95% CI (6.1% to 7.3%). Overall, 48.4% of all participants ($n=59$) showed at least one positive screen. The prevalence of moderate or severe symptoms of depression/anxiety, according to Kroenke, was 4.7% (4.2% to 5.2%) (PHQ-4 ≥ 6). Regarding PHQ-2 and GAD-2, the prevalence for clear symptoms of depression and anxiety was 5.4% (4.9% to 5.9%) and 6.3% (5.8% to 6.8%), respectively (PHQ-2/GAD-2 > 3). Overall, PHQ-4 scores show strong floor effects and are not normally distributed. A detailed list of prevalences can be found in [table 2](#).

Longitudinally, the weekly prevalence of positive screenings ranged from 0% to 13.9%. Prevalences of positive screenings were significantly higher in the second part of the study ($t=-6.86$, $df=122$, $p < 0.001$). When broken down into shorter periods, we saw a significant increase in prevalence in the fourth sixth of the study period ($F=8.027$, $df_1=5$, $df_2=118$, $\eta^2=0.254$, Tukey-B). [Figure 2](#) illustrates the prevalence of positive screenings and moderate/severe symptoms over time.

Follow-up contacts

A total of 86 cases met the criteria for a follow-up by our sports psychiatrist. After initiating a follow-up contact with those 86 cases, we received 74 responses (86%), of which 10 cases were excluded due to athletes erroneously requesting support. This left us with 64 follow-up contacts with 40 athletes (some of them were contacted multiple times) to be analysed in further detail.

78.1% of these follow-up contacts ($n=50$) were initiated due to elevated PHQ-4 scores in 2 consecutive weeks. In 9 of these 50 cases, athletes concomitantly requested explicit mental health support. The option of explicitly asking for professional mental health support—without elevated PHQ-4 scores—was used 14 times (21.9%).

In 76.6% ($n=49$) of all follow-up contacts, athletes reported mental health problems including diagnosed mental illness, manifest mental health symptoms and/or mental distress due to exposure to a stressful life-event. Overall, athletes reported mental distress most frequently ($n=31$). Symptoms of depression were reported 19 times and symptoms of eating disorders 3 times. Post-traumatic stress disorder (PTSD) and anxiety were each reported once. In four cases, athletes reported symptoms

Table 1 Characterisation of participating Para athletes with age, gender, type of sport and impairment

Total number of athletes	122
Age, mean±SD	28.4 ± 10.6
Gender	
Male	65 (53.3%)
Female	57 (46.7%)
Type of sport	
Wheelchair basketball	32 (26.2%)
Paracycling	18 (14.8%)
Athletics	13 (10.7%)
Table tennis	9 (7.4%)
Swimming	8 (6.6%)
Wheelchair rugby	7 (5.7%)
Goalball	6 (4.9%)
Nordic skiing	6 (4.9%)
Equestrian	5 (4.1%)
Rowing	3 (2.5%)
Shooting	3 (2.5%)
Judo	2 (1.6%)
Alpine skiing	2 (1.6%)
Wheelchair tennis	2 (1.6%)
Wheelchair fencing	1 (0.8%)
Sitting volleyball	1 (0.8%)
Wheelchair curling	1 (0.8%)
Triathlon	1 (0.8%)
Canoe	1 (0.8%)
Boccia	1 (0.8%)
Team sport	47 (38.5%)
Individual sport	75 (61.5%)
Ambulatory	62 (50.8%)
Wheelchair	60 (49.1%)
Impairment ²⁴	
Spinal cord related disorders	42 (34.4%)
Other musculoskeletal impairments*	23 (18.9%)
Limb deficiency	17 (13.9%)
Other neurological impairments†	16 (13.1%)
Visual impairment	15 (12.3%)
Cerebral palsy	6 (4.9%)
Intellectual impairment	2 (1.6%)
Other	1 (0.8%)

*For example, leg length difference.
†For example, brain disorders.

Table 2 Prevalence of PHQ-4, PHQ-2 and GAD-2 scores over the whole study period interpreted as non/minimal, mild, moderate or severe symptoms of depression and anxiety (n=7543)^{10,22}

	PHQ-4 prevalence for symptoms of depression/anxiety	
Non/minimal (0–2)	79.8%	
Mild (3–5)	15.4%	
Moderate (6–8)	3.1%	
Severe (9–12)	1.7%	
	PHQ-2 prevalence for symptoms of depression	GAD-2 prevalence for symptoms of anxiety
No (1–0)	80.8%	83.1%
Mild (2)	13.8%	10.6%
Clear (≥3)	5.4%	6.3%

GAD-7, General Anxiety Disorder Scale 7; PHQ-4, Patient Health Questionnaire-4.

of multiple mental health problems at the same time. If athletes were able to name their current mental health stressors, these included, in descending order of frequency, problems regarding their education, problems with the team, coaches, or federation, sport-specific issues, such as pressure to perform, or problems connected to their physical health condition.

In relation to the entire study sample, 27.9% of the participating athletes reported any mental health problem throughout the entire study period (n=34, representing 15 sports). The majority of these athletes were female (70.6%, n=24), and 58.8% were athletes in individual sports (n=20).

In 25% of the follow-up contacts, athletes indicated being already in professional psychiatric or psychological care. In a further 32.8% of the follow-up contacts, athletes were recommended to seek such care or were even referred directly. In relation to the entire study sample, this concerned 14.8% of the athletes (n=18).

Detailed results of reported mental health problems and further recommendations are listed in table 3.

Case report 1

An athlete who was contacted by the study team's psychiatrist due to high PHQ-4 scores in weeks 93 and 94 reported to suffer from sadness, decreased ability to feel pleasure, feeling of emptiness, reduced appetite, weight loss and disordered sleeping. Several stressors were reported, such as interpersonal problems, serious illness of a family member, unsatisfactory training conditions and reduced social contact. The self-reported symptoms indicated the presence of a depressive episode and the study team's psychiatrist suggested the consultation of a psychiatrist and psychotherapist. As the athlete was wheelchair dependent, an accessible facility was needed. With the support of the study team's psychiatrist, one of the three sports psychotherapists contacted was able to provide an appointment under appropriate conditions.

Figure 3 shows the athlete's PHQ-4 scores over the entire study period with a clear peak of PHQ-4 scores of 12 and 10 at weeks 93 and 94 matching the time of the follow-up contact.

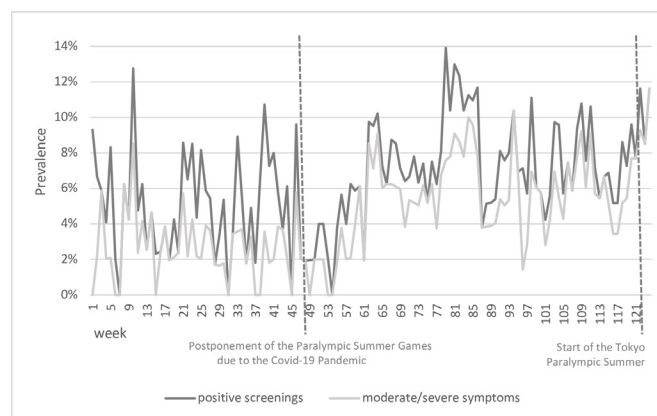
**Figure 2** Weekly prevalence of positive Patient Health Questionnaire-4 (PHQ-4) screenings (PHQ-4 >4) and moderate/severe symptoms (PHQ-4 >5) over time starting in May 2019 (week 1) including the moment of the postponement of the Paralympic Summer Games due to the Corona Pandemic (week 48) and the Tokyo Paralympic Summer Games (week 122–124) (marked by vertical dashed lines).

Table 3 Detailed information obtained from follow-up contacts including mental health problems and further recommendation

	Total	Reason for follow-up	
		2× PHQ-4 ≥5	Support request without 2× PHQ-4 ≥5
N (follow-up contacts)	64	50	14
		41 Without support request	9 With support request
Mental health problems (mental distress, depression, eating disorder, anxiety, PTSD)	49 (76.6%)	35 (70.0%)	14 (100%)
Already under professional mental healthcare	16 (25.0%)	15 (30%)	1 (7.1%)
Recommendation of seeking professional mental health support	21 (32.8%)	11 (22.0%)	10 (71.4%)

Case report 2

An athlete showed persistent high PHQ-4 scores and asked explicitly for mental health support. Several follow-up contacts were conducted. The psychiatric history revealed various inpatient and outpatient treatments due to a complex post-traumatic disorder. During one of the contacts, suicidal thoughts were reported. Several phone calls were held to ensure the absence of acute self-endangerment. At one point, the athlete was assessed as acutely suicidal, not being able to give commitment regarding avoiding self-harm behaviour. The study team's psychiatrist informed the police, finding the athlete intoxicated and taking him/her to a psychiatric hospital, where he/she got an inpatient treatment and survived the incident. Figure 4 illustrates the athlete's weekly PHQ-4 scores over time before and during the period in which acute suicidality was present with frequent positive screenings for mental health symptoms including a maximum PHQ-4 score of 12.

DISCUSSION

We implemented a longitudinal mental health monitoring among elite Para athletes to obtain prospective data and gain a better understanding of mental health in this population. With continuous monitoring over more than 2 years in a representative sample of German Para athletes, this is, to our knowledge, the largest prospective mental health surveillance study among Paralympic and Olympic athletes to date. Since weekly response rates of 84% confirm good acceptance and feasibility among Para athletes, the monitoring can be assumed to be applicable among Olympic athletes in the same manner as demonstrated in this study.

PHQ-4 in elite Para athletes

In the current study, athletes showed moderate-to-severe symptoms of depression/anxiety (PHQ-4 ≥6) with a prevalence of 4.7%, according to Kroenke's categorisation.²² Looking at

depression (PHQ-2 ≥3) and anxiety (GAD-2 ≥3) separately, athletes reported clear symptoms with prevalence of 5.4% and 6.3%, respectively.¹⁰ In a longitudinal mental distress assessment using the same scales among Swedish Para athletes during the preparation for the 2022 Beijing Paralympic Games, the prevalence of clear symptoms of depression and anxiety was 9% and 6.2%, respectively.^{10,22} The higher prevalence of depression among Swedish athletes might be the result of a shorter data collection period close to the Paralympic Games, which in itself is supposed to be a stressful event for athletes.²⁵ In contrast, our observation period covered a total of 124 weeks and should illustrate a more representative picture of athletes' mental health across in and off seasons. In a cross-sectional study among U.S. Para athletes, using the PHQ-2 and GAD-2 as part of their health history questionnaire, 4.7% and 7.4% had positive screenings for depression and anxiety, which is comparable to the values of the present study.¹¹ Interestingly, the same health history questionnaire also was used among U.S. Olympic athletes, who were 2.5 times less likely to test positive for depression and anxiety.¹¹ However, other studies suggest prevalence of mental distress among Para athletes and Olympic athletes to be similar.^{10,26} Considering a meta-analysis estimating the prevalence of anxiety/depression in current top athletes to be 34%, all prevalence mentioned above may seem rather low.² Nonetheless, as this meta-analysis represents mostly cross-sectional data collected with different tools to measure mental health symptoms, accurate comparisons are impossible.² This shows the importance of conducting more prospective studies such as the current one to improve the evidence and reduce bias.

Data from a general population sample in the age group of 25–34 years, to which most German Para athletes belonged, demonstrated moderate symptoms of depression and anxiety with a prevalence of 4.7%, the same as in the current study. Regarding the subscales PHQ-2 and GAD-2 separately, the prevalence of clear symptoms was higher in the general population

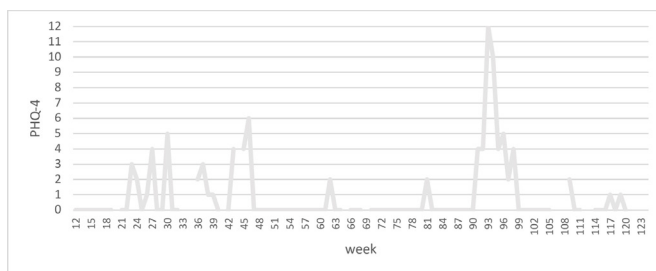


Figure 3 Patient Health Questionnaire-4 (PHQ-4) scores of an athlete over the entire study period with a clear peak of PHQ-4 scores of 12 and 10 at weeks 93 and 94 matching the time of a follow-up contact.

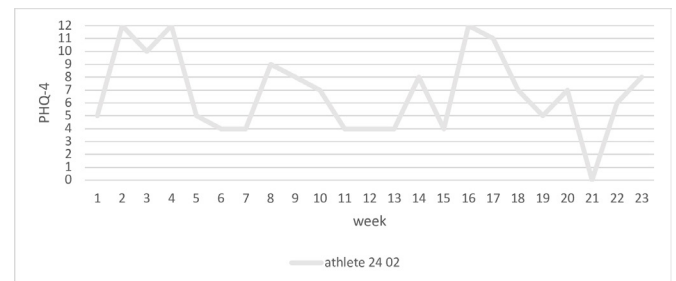


Figure 4 Patient Health Questionnaire-4 (PHQ-4) scores over time of an athlete with frequent positive screenings (PHQ-4 ≥5) including a maximum PHQ-4 score of 12 during a period with acute suicidality.

than among Para athletes in the current study (18.2% and 9.4%, respectively).⁸ The same applies to the overall mean PHQ-4 score (1.6 vs 1.3). Lower PHQ-4 scores in Para athletes than in a general population sample have been reported and discussed previously.^{9, 21} Higher resilience among athletes with varying impairments and a possible preventive effect of participating in a longitudinal mental health monitoring programme with a safety net including mental health support might be reasons why our Para athletes coped better with depression and anxiety than other cohorts.²¹

Regarding the longitudinal data, we noticed significantly higher prevalences of positive screenings in the second half of the study. One could assume that this could be due to the COVID-19 pandemic including social restrictions and lockdown. However, the significant increase did not occur directly after the announcement of the lockdown (week 45) but only in the fourth sixth of the study period as it has also been shown recently by Busch *et al.*²¹ Other conceivable reasons for the increase are the postponement of the Paralympic Games as the culmination of a 4-year preparation phase and the associated fluctuation in the cohort. For a better understanding of athletes' mental health over time, the statistical approach could be an individual time series analysis, which was difficult in the current study due to frequent interruptions in the time series of measurement points. In addition, individual progressions should be further analysed qualitatively. It is conceivable that future mental health monitoring programmes could implement these considerations by incorporating artificial intelligence.

Mental health symptoms and disorders in follow-ups

One-third of all participating athletes have been contacted by the sports psychiatrist for follow-up at least once. In follow-ups, more than three out of four athletes reported mental health problems, with mental distress due to exposure to a stressful life event and symptoms of depression being mentioned most frequently, followed by symptoms of eating disorders, PTSD and anxiety. As expected due to existing comorbidity, some athletes also presented symptoms of multiple mental health problems at the same time.²⁷

Mental health stressors indicated by athletes included problems related to education, team, coaches and staff, sport-specific issues such as pressure to perform, and their physical health condition. Previously, Para athletes were thought to suffer especially from impairment-specific stressors affecting their mental health, such as discomfort regarding their impairment, lack of adequate accessible sports facilities or challenges in reaching competition venues.^{1, 28} However, stressors of this kind were rarely cited in the current study.

In more than one-third of all follow-up contacts, athletes were recommended to seek professional psychological or psychiatric help. This is considered high, given the fact, that almost another third reported already being in professional psychiatric or psychological care. As some athletes were contacted several times during the study period, they also received recommendations several times. However, in relation to the entire study population, 14.8% of the athletes received a recommendation to seek professional psychological and psychiatric help at least once.

We noted that the proportion of reported mental health problems was higher among athletes with an explicit request for mental health support (100%) compared with those who were contacted due to high PHQ-4 scores (70.0%). Likewise, we provided more recommendations for further professional

psychiatric or psychological care for those who merely requested for support (71.4% vs 22%). It seems that athletes in the current study have a good sense of when they need professional help. Reasons why many athletes with high PHQ-4 scores neglected to ask for mental health support may be due to perceived barriers to ask for professional mental health support,¹ lack of awareness or being already enrolled in psychiatric or psychological care. About 22% of all follow-ups were conducted based on explicit support requests without positive PHQ-4 screenings in two consecutive weeks. In all these cases, athletes reported mental health symptoms. Therefore, they could be interpreted as false-negative screenings. Conceivable reasons for this might be athletes who might have been in need of mental health support for other reasons than depression or anxiety, or have had problems in completing the questionnaire. However, considering the preventive approach of the programme, reported mental health problems in 70% of all follow-ups conducted due to PHQ-4 scores are satisfactory in terms of the cut-off score we set (PHQ-4 ≥ 5) and criterion for follow-up and the option of explicit support request seems to compensate the possibility of false-negative screenings.

Clinical and research implications

Thanks to the large amount of data collected, we were able to make detailed methodological considerations and draw conclusions for future mental health surveillance programmes.

The observed low prevalence of depression and anxiety in the current study population might be due to the thresholds chosen. Following Kroenke's cut-off score of 3, the PHQ-2 has a sensitivity of only 62.3% for any depressive disorder and 82.9% for major depressive disorder, respectively.²⁹ Including mild symptoms (PHQ-4=3–5) in the analysis of the current study would increase the prevalence to 20.1%.

When seeking explicit mental health support, more athletes concurrently had a positive PHQ-4 screen in a single week than in two consecutive weeks. Therefore, following up all athletes with single positive screens might better picture the real burden of mental health support needs. However, this would have led to much higher efforts needed, as the number of follow-up contacts would have increased 10 times. Conversely, regarding human resources, one could debate whether it might be sufficient to solely follow-up on explicit requests for support rather than positive PHQ-4 screens, especially considering the higher proportion of mental health problems among athletes with support requests. However, we experienced that the total number of follow-up contacts, based on high PHQ-4 scores, was significantly higher than contacts made on explicit request, leading us to conclude that the combination of both is an appropriate way of identifying athletes at risk of mental health problems in need of support.

We want to stress the need for a professional safety net to be in place when performing a mental health surveillance. During the screening process, the expertise of a clinically experienced sports psychiatrist was an absolute requirement to ensure responsible follow-up. The network of our sports psychiatrist facilitated the organisation of further psychological or psychiatric support. Regarding mental health emergencies, as the second case report demonstrates, there is an imperative need for a mental health monitoring system to be accompanied by a mental health professional.

For better addressing highly acute needs, it might be useful to include an emergency option for seeking mental health support at any time, independent of whether the questionnaire has already been completed or not. It would also be conceivable, as

with Goutteborge's SMHAT-1, to add a question about suicidality and self-injury that, if answered in the affirmative, would lead to immediate intervention.⁷

In the current study, one of the most frequent mental health stressors cited by athletes was related to teams, coaches or federation. The IOC consensus statement on mental health in elite athletes states that coaches play an important role in creating an environment that encourages athletes to seek mental health support.¹ Furthermore, coaches' attitudes towards mental health monitoring programmes may influence their athletes whether to take part or not.⁹ With their 'Sport Mental Health Recognition Tool 1' Goutteborge *et al* specifically include coaches in the screening process for the early detection of athletes with mental health problems.⁷ Nonetheless, if coaches are involved, it is questionable whether athletes want to share intimate mental health information with them and whether this is consistent with privacy and medical confidentiality.

Strength and limitations

Due to the large and diverse study population, length of study period and high response rate among participating athletes, this is a robust study to meet our research aim. The use of the PHQ-4, a globally established mental health screening instrument, with well-established thresholds for positive screenings,⁸ ensures high-quality data and good comparability with other studies. However, it should be noted that due to the preventive strategy of the project, a rather low PHQ-4 score was chosen as the threshold for a positive screening and therefore the number of positive screenings might be overestimated. As the study period of 124 weeks includes all phases of a sporting season, a possible bias of a selected measurement period is limited. However, our study sample was limited to elite Para athletes from high-income countries; findings may not be generalisable to settings with fewer resources and amateur athletes. Further, a final conclusion about clinically verified diagnoses and prevalence of mental health disorders among Para athletes is limited since symptoms were self-reported and follow-up contacts were not conducted in athletes with single positive screening. Further, follow-up contacts did not include standardised diagnostics. Due to a lack of feedback in follow-up contacts, only 76.2% of all contacts were included in the analysis and therefore a selection bias is possible. Although the combination of physical and mental health monitoring may have contributed to the good compliance of the athletes, the high response rate in the PHQ-4 monitoring of 84% indicates good acceptance and feasibility of the surveillance system,⁹ which is clearly one of the major strengths of this project and also invites to consider transferability of the methodology to Olympic athletes.

CONCLUSION

Weekly mental health surveillance using the PHQ-4 allowed us the early identification of athletes at risk of mental health problems. Seven out of ten athletes reported manifest symptoms of mental health problems when followed up for positive PHQ-4 screens. The need for professional mental health support was high as almost two-thirds of all athletes followed up were either already in psychological/psychiatric care or had been advised to seek such care. Supervision by mental health professionals should be mandatory in future monitoring programmes.

Acknowledgements We thank the involved athletes. Further we thank the team physicians and physiotherapists, trainers and the National Federation (NPC Germany) for their support in recruiting the athletes and collecting the data. We are also grateful to our international Collaborators at the Oslo Sports Trauma

research Center for their advice throughout the planning phase of the study as well as data processing and statistical analyses. Partial results have been presented at the Sports Medicine & Health Summit 2023 in Hamburg, Germany by Petra Dallmann.

Contributors AH, EJK, RL and PD designed the study and applied for ethics approval. VM, PD, BB and AB collected and preprocessed the data. RL, AH and VM analysed the data. VM, PD, KS, AB and AH drafted and revised the manuscript. All authors provided input and approved the final version of the manuscript. AH as guarantor.

Funding The study was funded by the German Institute for Sports Science (Bundesinstitut für Sportwissenschaft (BiSP)) (project no: ZMV14-070404). EJK is funded by the Berta-Ottenstein-Program for Advanced Clinician Scientists, Faculty of Medicine, University of Freiburg.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by Freiburg University's Ethics Committee (approval 254/18) and the Heidelberg University's Ethics Committee (approval S-365/2019) according to the Declaration of Helsinki. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Requests to access the data will be considered by the authors, within the constraints of privacy and consent.

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