Journal of Electronic Gaming and Esports, 2023, 1, 1-12
https://doi.org/10.1123/jege.2022-0023

Human Kinetics
ORIGINAL RESEARCH

The Influence of Coaches and Support Staff on the Sleep Habits of Esports Athletes Competing at Professional and Semiprofessional Level

Daniel Bonnar,[1] Matthew Hwu,[2] Sangha Lee,[3] Michael Gradisar,[4] Sooyeon Suh,[5] and Michal Kahn[1]

[1]College of Education, Psychology and Social Work, Flinders University, Adelaide, SA, Australia; [2]1HP LLC, Los Angeles, CA, USA; [3]Department of Psychiatry, Ajou University School of Medicine, Suwon, South Korea; [4]WINK Sleep Pty Ltd., Adelaide, SA, Australia; [5]Department of Psychology, Sungshin Women's University, Seoul, South Korea

The present study investigated the influence and perspective of esports coaches and support staff on the sleep habits of esports athletes competing at professional and semiprofessional levels. Eighty-four esports coaches and support staff from 19 countries completed an online questionnaire. The first section obtained demographic information. The second section evaluated sleep hygiene knowledge using the Sleep Beliefs Scale. The third section assessed sleep monitoring and sleep hygiene practices used by coaches and support staff with esports athletes, barriers to the use of these practices, and conditions that impact the sleep of esports athletes. Overall, sleep hygiene knowledge was inadequate (<75%, based on the study of Miles et al.). Sleep monitoring frequency was low (48.8%), while sleep hygiene practices were implemented more often (66.7%). The most common barrier to sleep monitoring and sleep hygiene practices was players not liking it (50% and 46.3%, respectively). Night competitions (64.6%), congested competition times (51.2%), and night training schedules (47.6%) all rated highly as having an impact on esports athletes' sleep. Sleep education and training for coaches and support staff in the optimal use of sleep monitoring and sleep hygiene practices may increase the frequency and quality of sleep health support provided to esports athletes.

Keywords: monitoring, sleep knowledge, sleep hygiene practices

As research on esports (electronic sports) has expanded, the health status of competitors, known as esports athletes, has begun to take shape. With respect to sleep, two preliminary studies that investigated sleep as a secondary aim observed total sleep time (TST) estimates of 7.8–8.1 hr per night (Rudolf et al., 2020; Thomas et al, 2019). However, these studies used single-item retrospective questions (e.g., "On average, how many hours of sleep do you get each night?") that are considered low-grade sleep measures prone to recall bias (Mallinson et al., 2019). In comparison, several subsequent studies (Bonnar et al., 2022; Gomes et al., 2021; Lee et al., 2020, 2021) which used more robust sleep measures have found contrasting findings. That is, esports athletes from South Korea, the United States, Australia, and Brazil typically experienced delayed sleep timing (i.e., late sleep onset and offset) and obtained a TST of 6.5–7.4 hr per night (Bonnar et al., 2022; Gomes et al., 2021). Established guidelines recommend a TST of 7–9 hr per night for adults and 8–10 hr per night for adolescents (Hirshkowitz et al., 2015). Hence, although further research is required to develop a more nuanced understanding of esports athletes' sleep behavior (e.g., investigating sleep parameters in professional vs. semiprofessionals), it would appear that some esports athletes are training and competing while sleep restricted (i.e., moderately reduced TST over one or more nights). This finding reflects evidence from the sports science literature, which shows that sleep restriction is also prevalent among traditional athletes (Walsh et al., 2021).

Compared with the more well-developed sports science literature, there is currently a lack of empirical evidence about sleep restriction studies in esports. This absence of work is likely due to the fact esports research is still emerging, the cost and time associated with sleep restriction study designs, and difficulty recruiting esports athletes. However, drawing on the wider sleep literature, we can infer some important implications for esports athletes who obtain suboptimal TST. From a performance perspective, sleep restriction is known to have a detrimental impact on cognitive functioning, and esports is proposed to have a strong cognitive basis (Pedraza-Ramirez et al., 2020). For example, a recent systematic review by Smithies et al. (2021) evaluated the impact of sleep restriction on elite cognitive performers. They found that performance on rudimentary cognitive tasks (e.g., psychomotor vigilance task) was reliably impaired by sleep restriction, while more complex tasks (e.g., multitask tests) were also affected, but only if cognitive flexibility (i.e., adaptation to changing task requirements) was required. These findings are pertinent given that esports is often fast-paced and involves complex decision making within unpredictable match circumstances (Bonnar, Castine, et al., 2019). From a mental health perspective, sleep restriction is also known to contribute to disturbed mood states such as depression (Short et al., 2020), which is relevant given evidence of high depression scores in some esports athletes (Lee et al., 2020).

Consequently, researchers have begun to investigate ways of improving the sleep of esports athletes. In the first sleep intervention trial in an esports sample, Bonnar et al. (2022) implemented a brief (2 weeks) low-intensity sleep intervention with 56 esports athletes from South Korea, the United States, and Australia. The sleep intervention included a group sleep education class, daily

Bonnar https://orcid.org/0000-0001-7528-3023
Lee https://orcid.org/0000-0002-7042-2052
Gradisar https://orcid.org/0000-0002-5146-2657
Kahn https://orcid.org/0000-0002-8682-2974
Suh (alysuh@sungshin.ac.kr) is corresponding author, https://orcid.org/0000-0003-0644-8634

biofeedback from a wrist activity monitor, and an individual session with a clinical psychologist which covered the four rules of brief behavioral therapy for insomnia, a relaxation task, and motivational interviewing questions to enhance treatment compliance. Overall, there were modest changes for subjective and objective sleep onset time, as well as for subjective sleep onset latency and sleep efficiency. However, sleep did not improve enough to affect change in mood (i.e., depression and anxiety) or performance (i.e., psychomotor vigilance task). These results are consistent with those from similarly structured sleep interventions implemented in traditional athlete samples (e.g., Van Ryswyk et al., 2017). Unsurprisingly, Bonnar et al. (2022) concluded that further research is required to develop more effective sleep interventions for esports athletes. Accordingly, they made several suggestions including the development of a stepped-care model, involving coaches and support staff, better understanding the risk factors for poor sleep in esports, and using contextual learning. Thus, the broad purpose of the present study was to start exploring some of these suggestions (i.e., involving coaches and support staff, understanding risk factors for poor sleep) to determine their utility.

One suggestion by Bonnar et al. (2022) that warrants attention from researchers is that coaches and support staff could help support sleep health in esports. This idea was premised on the fact that in traditional sports, coaches and support staff can play a central role in promoting and implementing performance and health-related strategies to athletes (Miles et al., 2019; Van Hoye et al., 2016). From a sleep perspective, the optimal use of sleep monitoring and sleep hygiene practices is recommended for traditional athletes and is within the capacity of coaches and support staff to provide (Walsh et al., 2021). Miles et al. (2019) found in their study that, overall, participants (coaches and support staff) had adequate sleep hygiene (i.e., good sleep habits) knowledge, while sleep monitoring and implementation of sleep hygiene practices were low (56% and 43% respectively). Key barriers to the use of sleep monitoring and sleep hygiene practices were lack of resources and knowledge. Based on these findings, the authors were able to suggest some pragmatic strategies to improve how coaches and support staff approach sleep health support for athletes. In esports, presumably some coaches and support staff are also attempting to support the sleep health of esports athletes using sleep monitoring and sleep hygiene practices. However, their current sleep hygiene knowledge, the frequency and methods of practices used, and barriers to these practices, remains to be established. This information will give insight as to what additional sleep training and resources are required to provide maximum benefit for esports athletes.

Bonnar et al. (2022) also suggested that identifying and better understanding the risk factors associated with poor sleep in esports athletes will help improve the precision of sleep interventions, thereby making them more effective. In an early paper, a number of potential risk factors for suboptimal sleep in esports were initially proposed by Bonnar, Castine, et al. (2019), including caffeine use, air travel, elevated arousal on precompetition and competition nights, evening technology use combined with late training time, sleep disorders, and performance-enhancing substances. In a subsequent review, game genre and gaming culture were also proposed (Bonnar, Lee, et al., 2019). Over time, evidence has emerged in support of some of these (e.g., late training time), or been found lacking (e.g., caffeine use), while others are yet to be investigated (e.g., game genre). Overall, current evidence on the risk factors for poor sleep in esports is limited,, but slowly expanding, highlighting the need for further research in this area. Notably, research to date has focused on the experience of esports athletes directly. However, there may be value in also obtaining additional information from individuals who regularly interact with esports athletes, as has been done with traditional athletes (Miles et al., 2019). For example, coaches and support staff are likely able to provide a unique, and, as of yet, untapped perspective, on the sleep-related challenges experienced by esports athletes. Given the comprehensive understanding they have of training and competition conditions, their view on these areas may be particularly valuable.

The present study aimed to evaluate the sleep hygiene knowledge of esports coaches and support staff, the sleep monitoring and sleep hygiene practices they use with esports athletes, barriers to the use of these practices, and conditions that impact the sleep of esports athletes. As a secondary aim we also sought to determine whether these outcomes differed based on the level of esports athlete worked with (i.e., professional vs. semiprofessional). Addressing these aims will help guide how coaches and support staff can be better equipped with knowledge and skills to support the sleep health of esports athletes at all professional levels, which in turn, may begin to inform how coaches and support staff could fit into future models of care. Currently, research on coaches and support staff in esports is extremely limited, and to the best of our knowledge, this is the first study to involve coaches and support staff in a sleep and esports study.

Method

Participants

Participants were 48 coaches and 36 support staff from 19 countries (see Table 1 for sample characteristics based on job role and the professional level of esports athletes worked with). Countries included the United States ($N = 36$), Australia ($N = 17$), Korea ($N = 5$), Canada ($N = 5$), Belgium ($N = 3$), Malaysia ($N = 2$), New Zealand ($N = 2$), Germany ($N = 2$), United Kingdom ($N = 2$), Croatia ($N = 1$), Hong Kong ($N = 1$), Singapore ($N = 2$), Lebanon ($N = 1$), France ($N = 1$), Austria ($N = 1$), Czech Republic ($N = 1$), Argentina ($N = 1$), India ($N = 1$), and South America country not specified ($N = 1$). Overall, most participants were male, with a significant difference between coaches and support staff (i.e., all coaches were male; $\chi^2 = 11.79$, $p = .001$). The mean age of the sample was 29.0 years ($SD = 7.8$; range = 19–65 years), with support staff being significantly older than coaches, $t(82) = -2.9$, $p = .006$, but no difference based on professional level. The average length of time in a role was relatively short (i.e., ~2 years), with no difference found based on job role or professional level. The most common game genre within which participants worked was shooter, followed by massive online battle arena, sports, and fighting genres. There was no difference between game genre worked in based on job role, but more participants worked with professional shooter esports athletes than semiprofessionals ($\chi^2 = 6.13$, $p = .01$). Most participants worked with male esports athletes, with no difference found based on job role or professional level. Overall education levels were high, with approximately half of participants reporting undergraduate degrees and one third reporting postgraduate degrees. Support staff were more likely to have higher levels of education compared to coaches ($\chi^2 = 1,357$, $p = .001$), while there was no difference in education based on professional level. Only a very small number of participants had a coaching qualification, with no difference based on job role or professional level. Furthermore, no coaching

Table 1 Sample Characteristics by Job Role and Professional Level

		Job role			Professional level		
	Overall *N* = 84	Coach *N* = 48	Support staff *N* = 36	t/χ^2/Fisher's/*U* (*p*)	Pro *N* = 55	Semipro *N* = 29	t/χ^2/Fisher's/*U* (*p*)
Male sex (%)	76 (90.5%)	48 (100%)	28 (77.8%)	11.79 (.001)*	52 (94.5%)	24 (82.8%)	3.06 (.08)
Age (years)	29.0 (7.8)	26.7 (3.8)	31.9 (10.3)	−2.90 (.006)*	30.3 (8.3)	26.6 (6.2)	2.11 (.04)
Years in role	2.3 (2.1)	2.5 (2.2)	1.9 (2.1)	1.08 (.28)	2.3 (2.3)	2.2 (1.8)	0.15 (.88)
Game genre worked with							
Sports	16 (20.3%)	10 (21.3%)	6 (18.8%)	0.08 (0.78)	11 (20.8%)	5 (19.2%)	0.03 (.87)
Shooter	43 (54.4%)	21 (44.7%)	22 (68.8%)	4.45 (.03)	34 (64.2%)	9 (34.6%)	6.13 (.01)*
MOBA	34 (43.0%)	19 (40.4%)	15 (46.9%)	0.32 (.57)	19 (35.8%)	15 (57.7%)	3.39 (.06)
Fighting games	5 (6.3%)	1 (2.1%)	4 (12.5%)	Fisher's exact test (.15)	4 (7.5%)	1 (3.8%)	Fisher's exact test (1.0)
Sex of players worked with (% male only)	61 (72.6%)	38 (79.2%)	23 (63.9%)	9.97 (.04)	43 (78.2%)	18 (62.1%)	11.28 (.02)
Employment status				1.75 (.04)			19.01 (<.001)*
Full time	42 (50%)	27 (56.3%)	15 (41.7%)		37 (67.3%)	5 (17.2%)	
Part time	42 (50%)	21 (43.8%)	21 (58.3%)		18 (32.7%)	24 (82.8%)	
Education				1,357 (<.001)*			830 (.74)
High school	16 (19.0%)	14 (29.2%)	2 (5.6%)		10 (18.2%)	6 (20.7%)	
Undergraduate	43 (51.2%)	30 (62.5%)	13 (36.1%)		30 (54.5%)	13 (44.8%)	
Postgraduate	25 (29.8%)	4 (8.3%)	21 (58.3%)		15 (27.3%)	10 (34.5%)	
Coaching qualification (% acquired)	6 (7.1%)	4 (8.3%)	2 (5.6%)	Fisher's exact test (.70)	6 (10.9%)	0.0 (0.0%)	Fisher's exact test (.09)

Note. Data are provided as *M* (*SD*) for continuous outcomes (i.e., age and years in role) and *n* (%) for all remaining categorical outcomes. MOBA = multiplayer online battle arena.
*Significant *p* value ($p \leq .01$).

qualification was esports specific. In terms of employment status, there was no difference based on job role. However, there was a significant difference for professional level ($\chi^2 = 19.01$, $p = .001$), where participants working in professional settings were more likely to be employed full time, and participants working in semiprofessional settings were more likely to be part time. Ethics approval was obtained from the Flinders University Social and Behavioral Research Ethics Committee (project number: 8408).

Eligibility Criteria

Participants were eligible for inclusion in the study if they coached or played a role in supporting the health and performance of esports athletes (i.e., team manager or owner, psychologist/mental health worker, physical therapist, dietician, chiropractor, health/performance advisor) at a professional or semiprofessional level. Participants had to be actively engaged with an esports organization, although the team did not have to be competing in season at the time of data collection. There were no exclusion criteria.

Measures

A questionnaire developed by Miles et al. (2019) for coaches and support staff in traditional sports was adapted (i.e., the term "athletes" was replaced with "esports athletes") for the present study. The questionnaire had three sections. The first section of the questionnaire collected demographic information about participants. This included country of origin; age; sex; occupation within esports; employment status; length of time in their role; characteristics of esports athletes with whom they worked (sex, game genre, and professional level); highest coaching level; and highest level of academic education.

The second section of the questionnaire evaluated sleep hygiene knowledge using the Sleep Beliefs Scale (SBS; Adan et al., 2006). The SBS is a 20-item scale that evaluates knowledge on sleep hygiene practices and their effect on sleep in general. Participants responded to items (e.g., "Drinking alcohol in the evening") by indicating whether they had a "positive effect," "negative effect," or "neither effect." Items 5, 9, 15, and 19 corresponded to a positive effect with remaining items having a negative effect. Correct responses were scored 1 and incorrect responses scored 0. Individual item scores were summed to generate a total score (range from 0 to 20). Higher total scores indicated greater sleep hygiene knowledge. In addition, separate factor scores relating to discrete areas of sleep knowledge were also generated. Factors included sleep incompatible behaviors (range from 0 to 8), sleep–wake cycle behaviors (range from 0 to 7), and thoughts, and attitudes toward sleep (range from 0 to 5). Consistent with Miles et al. (2019), SBS total and factor scores ≥75% were defined as adequate, while scores <75% were considered inadequate.

The third section of the questionnaire collected information on the sleep monitoring and sleep hygiene practices used by coaches and support staff with esports athletes, barriers to the use of these practices, and conditions that impact the sleep of esports athletes. Regarding sleep monitoring practices, participants were asked to respond "yes" or "no" as to whether they monitored the sleep of their esports athletes. If a participant responded "yes," they were instructed to complete a closed answer response format consisting of multiple-choice answers. Options included "self-reported sleep diaries," "wrist activity monitors (actigraphy)," "sleep questionnaires," "testing for morning larks or night owls," and/or "other." If participants selected "other" they were required to specify the method used. Participants could select multiple options. These options reflect the most common sleep monitoring practices in the sports science literature due to their affordability, accessibility, and ease of use (Walsh et al., 2021), while the "other" option allowed participants to describe alternative methods.

With respect to sleep hygiene practices, participants were again asked to respond "yes" or "no" as to whether they implemented sleep hygiene practices with their esports athletes. If a participant responded "yes," they were instructed to complete a closed answer response format consisting of multiple-choice answers. Options included "establishing a regular sleep/wake routine," "short naps (<2 hr) during the day if required," "no hard exercise within 1 hr before bedtime," "no alcohol or caffeinated beverages within 4 hr of bedtime," "not using the bed for things other than sleeping or sex," "creating a cool, dark, and quiet bedroom," "reducing thinking, planning or worrying in bed," and "other." If participants selected "other" they were required to specify the sleep hygiene practice used. Participants could select multiple options. These options represent established sleep hygiene practices that are based on the sleep hygiene index (Mastin et al., 2006), while the "other" option allowed participants to describe alternative methods.

The two questions relating to sleep monitoring and sleep hygiene barriers were answered with a closed answer response format, in which participants could select multiple options. Options for both questions were the same and included "too busy," "lack of resources (e.g., financial, equipment)," "lack of knowledge," "players do not like it," "do not think it is important," "no barriers," and "other." These response options reflect those from Miles et al. (2019).

The question relating to conditions that impact the sleep of esports athletes was also answered with a closed answer response format, in which participants could select multiple options. Options included "morning training schedules"; "night training schedules"; "night competitions"; "congested competition times"; "these situations are commonly experienced, but I do not think they affect sleep"; "none of these situations are commonly experienced and therefore do not affect sleep"; and "other." These options were selected as they tap into the potential impact of training and competitions conditions on esports athletes, which has received minimal research attention to date. It should be noted that because data collection occurred pre and during COVID, the closed answer response relating to domestic travel was removed.

Procedure

Data were collected between July 2019 and October 2021. As Twitter is a popular social platform for members of the esports industry, a twitter post was created and shared with an attached link to the online questionnaire administered via Qualtrics. Coaches and support staff working with esports athletes were asked to respond. As the post was shared and retweeted, it is impossible to know how many coaches and support staff received information about the study relative to how many responded. Eight participants who took part in another sleep and esports study by our research group also completed the questionnaire.

Data Analysis

SPSS (version 26.0) was used for all data analyses. Descriptive statistics, including frequencies, means, and *SD*s, were used to summarize sample characteristics. For job role (coach vs. support staff) and professional level (professional vs. semiprofessional)

comparisons, *t* tests were computed for continuous outcomes (i.e., age, years in role) and chi-square tests were computed for categorical variables (i.e., sex, game genre, sex of esports athletes, employment status). Fisher exact test was used when cell counts were ≤5 (i.e., coaching qualification, fighting game genre) and the Mann–Whitney test was performed for ordinal outcomes (i.e., education). In terms of primary outcome variables, analyses of variance (adjusting for education level) were used for the SBS with means and *SD*s reported. Furthermore, frequencies were reported for all other outcome variables (i.e., sleep monitoring and sleep hygiene practices, barriers to the use of these practices, and conditions that impact the sleep of esports athletes) with chi-square and Fisher exact test (used when cell counts were ≤5) used. A significance level of 0.01 was used for all analyses. Please note, qualitative responses related to the closed answer response "other" were not formally analyzed or reported as a large portion of the responses were either missing or uninterpretable. Hence, only the frequency of "other" being selected is reported.

Results

Sleep Hygiene Knowledge

No significant differences were found for sleep hygiene knowledge as assessed by the SBS based on job role, $F(1, 81) = 0.00$, $p = .99$ or professional level, $F(1, 81) = 0.00$, $p = .99$ (see Table 2). Based on the cutoff of 75% (Miles et al., 2019), overall participant sleep hygiene knowledge was inadequate. However, support staff had adequate sleep hygiene knowledge while coaches did not. More specifically, coaches had inadequate sleep hygiene knowledge on all SBS factors (i.e., sleep incompatible behaviors, sleep–wake cycle behaviors, and thoughts and attitudes toward sleep), while support staff had inadequate sleep hygiene knowledge on SBS factor thoughts and attitudes toward sleep.

Sleep Monitoring Practices

No significant differences were found for sleep monitoring frequency based on job role ($\chi^2 = 2.29$, $p = .13$) or professional level ($\chi^2 = 0.15$, $p = .70$). The primary sleep monitoring method used by participants (see Table 3) were self-reported sleep diaries, followed by "other," testing for morning larks or night owls, sleep questionnaires, and wrist activity monitors (ActiGraphy). No differences were found between the types of sleep monitoring method used by participants based on job role or professional level.

Sleep Hygiene Practices

No significant differences were found for sleep hygiene implementation frequency based on job role ($\chi^2 = 5.47$, $p = .02$) or professional

Table 2 Sleep Hygiene Knowledge as Assessed by the Sleep Beliefs Scale

		Job role			Professional level		
	Overall *M* (*SD*)	Coach *M* (*SD*)	Support staff *M* (*SD*)	*F* (*p*)	Pro *M* (*SD*)	Semipro *M* (*SD*)	*F* (*p*)
Total score	14.6 (3.3)	13.9 (3.7)	15.5 (2.4)	0.03 (.86)	14.5 (3.0)	14.7 (3.9)	0.00 (.99)
Sleep-incompatible behaviors	6.1 (1.6)	5.7 (1.8)	6.5 (1.1)	1.62 (.21)	6.0 (1.5)	6.1 (1.8)	0.001 (.97)
Sleep–wake cycle behaviors	5.1 (1.6)	4.9 (1.8)	5.4 (1.3)	0.65 (.42)	5.2 (1.6)	5.1 (1.6)	0.14 (.71)
Thoughts and attitudes about sleep	3.4 (1.2)	3.2 (1.2)	3.6 (1.1)	0.04 (.84)	3.3 (1.2)	3.5 (1.2)	0.29 (.59)

Note. The Sleep Beliefs Scale generates a total score (range from 0 to 20) and scores for individual factors including sleep incompatible behaviors (range from 0 to 8); sleep–wake cycle behaviors (range from 0 to 7); and thoughts and attitudes to sleep (range from 0 to 5). Consistent with Miles et al. (2019), Sleep Beliefs Scale total and factor scores ≥75% were defined as adequate, while scores <75% were considered inadequate.

Table 3 Sleep Monitoring Frequency and Practices by Job Role and Professional Level

		Job role			Professional level		
	Overall	Coach	Support staff	χ^2/Fisher's (*p*)	Pro	Semipro	χ^2/Fisher's (*p*)
Do you monitor the sleep of the esports athletes you support? (% yes)	41 (48.8%)	20 (41.7%)	21 (58.3%)	2.29 (.13)	26 (47.3%)	15 (51.7%)	0.15 (.70)
Self-reported sleep diaries	21 (52.5%)	9 (45.0%)	12 (60.0%)	0.90 (.34)	13 (52.0%)	8 (53.3%)	0.01 (.94)
Activity wrist monitors (ActiGraphy)	4 (10.0%)	2 (10.0%)	2 (10.0%)	Fisher's exact test (1.00)	2 (8.0%)	2 (13.3%)	Fisher's exact test (.62)
Sleep questionnaire	7 (17.5%)	2 (10.0%)	5 (25.0%)	Fisher's exact test (.41)	4 (16.0%)	3 (20.0%)	Fisher's exact test (1.00)
Testing for "morning larks" or "night owls"	9 (22.5%)	5 (25.0%)	4 (20.0%)	Fisher's exact test (1.00)	5 (20.0%)	4 (26.7%)	Fisher's exact test (.71)
Other	14 (35.0%)	8 (40.0%)	6 (30.0%)	0.44 (.51)	11 (44.0%)	3 (20.0%)	Fisher's exact test (.18)

Significant *p* value ($p \leq .01$).

level ($\chi^2 = 0.66$, $p = .42$). The primary sleep hygiene practices used by participants were establishing a regular sleep/wake routine, followed by creating a cool, dark, and quiet bedroom, reducing thinking, planning, or worrying in bed, no alcohol or caffeinated beverages within 4 hr of bedtime, not using the bed for things other than sleep or sex, no hard exercise within 1 hr of bedtime, short naps (<2 hr) during the day if required, and "other" (see Table 4). As for differences between groups, significantly more support staff than coaches suggested no hard exercise within 1 hr before bedtime ($\chi^2 = 7.00$, $p = .008$); not using the bed for things other than sleep and sex ($\chi^2 = 6.32$, $p = .01$); and creating a cool, dark, and quiet bedroom to facilitate sleep ($\chi^2 = 7.25$, $p = .007$). No other differences were found between coaches and support staff, or as a function of professional level.

Barriers to Sleep Monitoring Practices

Overall, the highest rated response for barriers to sleep monitoring was players not liking it, followed by lack of resources, lack of knowledge, too busy, do not think it is important, "other," and no barriers (see Table 5). Significantly more participants working with semiprofessional esports athletes than those working with professional esports athletes rated do not think it is important ($\chi^2 = 7.56$, $p = .006$). No other differences were found based on job role or professional level.

Barriers to Sleep Hygiene Practices

Overall, the highest rated response for barriers to sleep hygiene practices was players not liking it, followed by lack of knowledge, lack of resources, "other," too busy, do not think it is important, and no barriers (see Table 5). Significantly more support staff than coaches rated players not liking it ($\chi^2 = 6.90$, $p = .009$). No other differences were found based on job role or professional level.

Conditions Impacting Sleep

The highest rated condition by participants that impacts the sleep of esports athletes was night competitions, followed by congested competition times, night training schedules, morning training schedules, and "other" (see Table 6). Only a small number of participants reported that these conditions were commonly experienced but do not affect sleep, while fewer still indicated that none of these conditions were commonly experienced and, therefore, do not affect sleep. In terms of differences between groups, significantly more support staff than coaches rated night competitions ($\chi^2 = 6.31$, $p = .01$), congested competition times ($\chi^2 = 7.36$, $p = .007$), and night training schedules ($\chi^2 = 10.81$, $p = .001$) as having an impact. No other differences were found based on job role or professional level.

Discussion

Coaches and support staff are critical to the functioning of an esports team, including the provision of performance and health-related advice. In the present study, we evaluated the sleep hygiene knowledge of esports coaches and support staff, the sleep monitoring and sleep hygiene practices they use with esports athletes, barriers to the use of these practices, and conditions that impact the sleep of esports athletes. As a secondary aim, we also sought to determine whether these outcomes differed based on the level of esports athlete worked with (i.e., professional vs. semiprofessional). Results indicated that overall sleep hygiene knowledge was inadequate (i.e., <75%; Miles et al., 2019), with support staff being the exception. Approximately half of participants monitored the sleep of their esports athletes, with key barriers being players not liking it and lack of resources. Two thirds of participants implemented sleep hygiene practices with their esports athletes, with key barriers being players not liking it and lack of knowledge.

Table 4 Sleep Hygiene Administration Frequency and Practices by Job Role and Professional Level

		Job role			Professional level		
	Overall	Coach	Support staff	χ^2/Fisher's (p)	Pro	Semipro	χ^2/Fisher's (p)
Do you implement sleep hygiene practices with your esports athletes? (% yes)	56 (66.7%)	27 (56.3%)	29 (80.6%)	5.47 (.02)	35 (63.6%)	21 (72.4%)	0.66 (.42)
Establishing a regular sleep/wake routine	53 (93.0%)	24 (88.9%)	29 (96.7%)	1.32 (.25)	34 (94.4%)	19 (90.5%)	0.32 (.57)
Short naps (<2 hr) during the day if required	16 (28.1%)	6 (22.2%)	10 (33.3%)	0.87 (.35)	12 (33.3%)	4 (19.0%)	Fisher's exact test (.36)
No hard exercise within 1 hr before bedtime	23 (40.4%)	6 (22.2%)	17 (56.7%)	7.00 (.008)*	13 (36.1%)	10 (47.6%)	0.73 (.39)
No alcohol or caffeinated beverages within 4 hr of bedtime	35 (61.4%)	14 (51.9%)	21 (70.0%)	1.97 (.16)	20 (55.6%)	15 (71.4%)	1.41 (.23)
Not using the bed for things other than sleeping or sex	29 (50.9%)	9 (33.3%)	20 (66.7%)	6.32 (.01)*	19 (52.8%)	10 (47.6%)	0.14 (.71)
Creating a cool, dark and quiet bedroom	43 (75.4%)	16 (59.3%)	27 (90.0%)	7.25 (.007)*	28 (77.8%)	15 (71.4%)	0.29 (.59)
Reducing thinking, planning or worrying in bed	38 (66.7%)	15 (55.6%)	23 (76.7%)	2.85 (.09)	24 (66.7%)	14 (66.7%)	0.0 (1.00)
Other	7 (12.3%)	4 (14.8%)	3 (10.0%)	Fisher's exact test (.69)	4 (11.1%)	3 (14.3%)	Fisher's exact test (.70)

*Significant p value ($p \leq .01$).

Table 5 Barriers to Sleep Monitoring and Sleep Hygiene Practices

		Job role			Professional level		
	Overall	Coach	Support staff	χ^2/Fisher's (p)	Pro	Semipro	χ^2/Fisher's (p)
Sleep monitoring practices							
Too busy	20 (25.0%)	11 (24.4%)	9 (25.7%)	0.02 (.90)	14 (27.5%)	6 (20.7%)	0.45 (.50)
Lack of resources (e.g., financial, equipment)	34 (42.5%)	18 (40.0%)	16 (45.7%)	0.26 (.61)	23 (45.1%)	11 (37.9%)	0.39 (.53)
Lack of knowledge	27 (33.8%)	18 (40.0%)	9 (25.7%)	1.80 (.18)	18 (35.3%)	9 (31.0%)	0.15 (.70)
Players do not like it	40 (50.0%)	21 (46.7%)	19 (54.3%)	0.46 (.50)	24 (47.1%)	16 (55.2%)	0.49 (.48)
Do not think it is important	17 (21.3%)	9 (20.0%)	8 (22.9%)	0.10 (.76)	6 (11.8%)	11 (37.9%)	7.56 (.006)*
No barriers	9 (11.3%)	4 (8.9%)	5 (14.3%)	Fisher's exact test (.49)	5 (9.8%)	4 (13.8%)	Fisher's exact test (.72)
Other	14 (17.5%)	7 (15.6%)	7 (20.0%)	0.27 (.60)	10 (19.6%)	4 (13.8%)	Fisher's exact test (.76)
Sleep hygiene practices							
Too busy	15 (18.8%)	9 (20.0%)	6 (17.1%)	0.11 (.75)	10 (19.6%)	5 (17.2%)	Fisher's exact test (1.00)
Lack of resources (e.g., financial, equipment)	25 (31.3%)	12 (26.7%)	13 (37.1%)	1.01 (.32)	14 (27.5%)	11 (37.9%)	0.94 (.33)
Lack of knowledge	32 (40.0%)	19 (42.2%)	13 (37.1%)	0.21 (.64)	22 (43.1%)	10 (34.5%)	0.58 (.45)
Players do not like it	37 (46.3%)	15 (33.3%)	22 (62.9%)	6.90 (.009)*	21 (41.2%)	16 (55.2%)	1.46 (.23)
Do not think it is important	14 (17.5%)	9 (20.0%)	5 (14.3%)	Fisher's exact test (.57)	5 (9.8%)	9 (31.0%)	Fisher's exact test (.03)
No barriers	13 (16.3%)	8 (17.8%)	5 (14.3%)	Fisher's exact test (.77)	9 (17.6%)	4 (13.8%)	Fisher's exact test (.76)
Other	16 (20.0%)	9 (20.0%)	7 (20.0%)	0.00 (1.00)	11 (21.6%)	5 (17.2%)	Fisher's exact test (.77)

*Significant p value ($p \leq .01$).

Table 6 Conditions That Impact the Sleep of Esports Athletes

		Job role			Professional level		
	Overall	Coach	Support staff	χ^2/Fisher's (p)	Pro	Semipro	χ^2/Fisher's (p)
Morning training schedules	21 (25.6%)	10 (21.3%)	11 (31.4%)	1.08 (.30)	14 (26.4%)	7 (24.1%)	0.05 (.82)
Night training schedules	39 (47.6%)	15 (31.9%)	24 (68.6%)	10.81 (.001)*	21 (39.6%)	18 (62.1%)	3.79 (.06)
Night competitions	53 (64.6%)	25 (53.2%)	28 (80.0%)	6.31 (.01)*	30 (56.6%)	23 (79.3%)	4.23 (.04)
Congested competition times	42 (51.2%)	18 (38.3%)	24 (68.6%)	7.36 (.007)*	25 (47.2%)	17 (58.6%)	0.98 (.32)
These situations are commonly experienced, but I do not think they affect sleep	7 (8.5%)	7 (14.9%)	0 (0.0%)	Fisher's exact test (.02)	6 (11.3%)	1 (3.4%)	Fisher's exact test (.41)
None of these situations are commonly experienced and therefore do not affect sleep	4 (4.9%)	4 (8.5%)	0 (0.0%)	Fisher's exact test (.13)	4 (7.5%)	0 (0.0%)	Fisher's exact test (.29)
Other	11 (13.4%)	6 (12.8%)	5 (14.3%)	Fisher's exact test (1.00)	8 (15.1%)	3 (10.3%)	Fisher's exact test (.74)

*Significant p value ($p \leq .01$).

Notable conditions that impact the sleep of esports athletes were night competitions, congested competition times, and night training schedules. Overall, there were few differences between coaches and support staff working with professional and semiprofessional esports athletes. We now discuss emerging findings from our study and examine how coaches and support staff working across different professional levels can optimally support the sleep needs of esports athletes, and how they might fit into future models of care.

Sleep Hygiene Knowledge

Overall participant sleep hygiene knowledge was inadequate (i.e., <75%; Miles et al., 2019). However, although there was no significant difference between coaches and support staff, support staff had adequate sleep hygiene knowledge (i.e., >75%), while coaches did not. More specifically, coaches had inadequate sleep hygiene knowledge on all SBS factors (i.e., sleep incompatible behaviors, sleep–wake cycle behaviors, and thoughts and attitudes toward sleep), while support staff had inadequate sleep hygiene knowledge on SBS factor thoughts and attitudes toward sleep. These findings are similar to those reported by Miles et al. (2019) in a sample of traditional sport coaches and support staff. They found overall adequate sleep hygiene knowledge, but as found in our study, support staff had adequate sleep hygiene knowledge and coaches did not. One possible explanation for the finding of adequate sleep hygiene knowledge among support staff versus coaches in our study is the higher education levels among support staff and low qualification level among coaches (see Table 1). That is, support staff may have greater preexisting sleep knowledge attained through their education and training. In addition, support staff may be more effective consumers of health-related information due to the academic literacy developed through their formal education. Interestingly, the sleep hygiene knowledge of those working with professional esports athletes was no different to those working with semiprofessionals, with both having inadequate sleep hygiene knowledge. Thus, in summary, sleep hygiene education (and presumably sleep health education more broadly) may be required for coaches, and to a lesser degree support staff, across all professional levels. As coaches and support staff are the main conduit of health information to esports athletes, enhancing their knowledge may in turn improve the accuracy and quality of information provided to esports athletes.

Sleep Monitoring Practices and Barriers

Sleep monitoring is essential to understand and support sleep health (Halson, 2019). Overall, approximately half (48.8%) of participants monitored the sleep of their esports athletes, with no significant difference found between coaches and support staff or the professional level of esports athlete worked with. This rate of sleep monitoring is low and indicates that many esports athletes are operating within team environments, including at a professional level, with no available information available regarding their sleep health. Without this information, coaches and support staff would be unaware that sleep may be a crucial factor explaining when an esports athlete is underperforming, experiencing mental health issues, or when there is a need to refer to specialist services (e.g., a clinical psychologist for insomnia treatment). Furthermore, the sleep monitoring frequency (48.8%) in our study is approximately 8% lower than that reported by Miles et al. (2019), suggesting that sleep monitoring may occur more often in traditional sports settings than esports.

Regarding the types of sleep monitoring practices used, there were no significant differences between coaches and support staff, or professional level worked with. Self-reported sleep diaries were the most popular sleep measure used, which is most likely due to them being accessible, simple, and cost effective (Walsh et al., 2021). The second highest rated response was "other." Although we are unable to determine what "other" entails, this finding indicates that some participants are using alternative sleep monitoring methods to those specified in our study. Surprisingly, only a small proportion of participants reported using wrist activity monitors despite their relative affordability and widespread use among the public (Walsh et al., 2021). The use of sleep questionnaires and chronotype testing was also low, which limits additional information (e.g., subjective sleepiness and fatigue levels) that can help clarify overall sleep health. Taken together, these findings suggest that the specificity and scope of sleep information gathered could be improved.

The two main barriers to the more frequent use of sleep monitoring practices were esports athletes not liking it and lack of resources, while significantly more participants working in semiprofessional settings considered sleep monitoring unimportant. Although we cannot specifically determine why esports athletes do not like sleep monitoring, one explanation may be the strong reliance on sleep diaries, which have a moderate subject burden (Walsh et al., 2021). Hence, validated wearables (e.g., wrist activity monitors) may be more accepted by esports athletes given their lower subject burden (Walsh et al., 2021). In addition, nearables (i.e., noncontact sleep trackers) are another alternative, which have an even lower subject burden than wearables. Nearables were not included as an option in this study as at the time they lacked sufficient validation. However, evidence has recently emerged in support of some nearable devices (Chinoy et al., 2021). With respect to lack of resources, our results indicate that coaches and support staff may be unaware of or unable to locate existing sleep monitoring resources (e.g., questionnaires). Hence, education to enhance awareness, use, and accessibility of sleep monitoring resources, may improve both the frequency and effectiveness of sleep monitoring in esports.

Sleep Hygiene Practices and Barriers

Sleep hygiene practices are a relatively easy method for coaches and support staff to assist esports athletes in optimizing sleep outcomes, for nonclinical sleep problems, at all professional levels. Overall, two thirds (66.7%) of coaches and support staff implemented sleep hygiene practices with esports athletes, which is approximately 20% more than that reported by Miles et al. (2019). There was no significant difference found between coaches and support staff or professional level worked with. It is promising that so many participants indicated trying to help esports athletes improve their sleep via sleep hygiene practices. However, the low sleep monitoring rates relative to sleep hygiene implementation suggests that recommendations made to esports athletes may often be generic rather than targeted and data-informed, potentially limiting their effectiveness (Driller et al., 2019).

With respect to the types of sleep hygiene practices used, the most common overall strategy promoted by participants was establishing a regular sleep/wake routine. Attempts at regularizing sleep schedules are pertinent as previous evidence from our group shows some esports athletes have irregular sleep scheduling (i.e., sleep onset/offset times), leading to reduced sleep duration (Lee et al., 2021). Other popular practices endorsed by most

participants were creating a cool, dark, and quiet bedroom; reducing thinking, planning, or worrying in bed; and having no caffeine or alcohol within 4 hr of bedtime. In contrast, not using the bed for things other than sleep or sex, short naps (<2 hr) if required, and "other" were rated much lower. It should be noted that the frequency of sleep hygiene implementation, which was not assessed in the current study, may be important, given findings showing single dose sleep hygiene sessions have limited benefits (Miles et al., 2019).

The two main barriers to more frequent implementation of sleep hygiene practices were esports athletes not liking it and lack of knowledge, with significantly more support staff than coaches rating esports athletes not liking it. The fact esports athletes do not like to work on improving their sleep is unsurprising. Esports athletes are typically young (mean = 20 years; Bonnar et al., 2022), and the broader sleep literature shows that young people can be apathetic to sleep behavior change (Micic et al., 2019). Borrowing from other group-based sleep intervention research involving young people, designing sleep interventions to be interactive and motivating can aid engagement (Bonnar et al., 2015). Furthermore, esports athletes may be more inclined to comply with proposed sleep hygiene practices if they appear relevant and personalized. Regarding lack of knowledge, education and improved sleep hygiene knowledge should increase coaches and support staff confidence in the use of sleep hygiene practices.

Conditions Impacting the Sleep of Esports Athletes

A large proportion of esports coaches and support staff working in both semiprofessional and professional settings indicated that night competitions, congested competition times, and night training schedules, negatively impact the sleep of esports athletes. The impact of night training schedules has been documented previously by our group (Lee et al., 2021). We found that night training schedules can delay esports athletes sleep patterns, resulting in reduced sleep duration if daytime commitments necessitate an earlier than desired wake-up time (Lee et al., 2021). In addition, it has previously been proposed that evening light exposure could impact the sleep of esports athletes (Bonnar, Castine, et al., 2019), which was based on concerns in the general sleep literature that late-night exposure to light emitted by screens can delay sleep onset via the suppression of melatonin (Wong & Bahmani, 2022). However, with many contrary findings reported over time, the current body of evidence is equivocal, and whether device use translates to disturbed sleep is contentious (Wong & Bahmani, 2022). For example, in the sports science literature meta-analytic evidence indicates no impact of electronic device use on the sleep of traditional athletes, and no sleep benefits when devices are removed from the bedroom (Roberts et al., 2019). In saying that, it remains to be tested whether light exposure has an impact on sleep outcomes in more extreme tech users like esports athletes.

The influence of night competitions is even less well understood than night training schedules but was rated higher by participants, indicating a different type of impact even though both occur at night. Looking at the sports science literature, meta-analytic evidence suggests that traditional athletes often have short TST on the night of competition compared to precompetition nights, which is primarily due to a delay in bedtime and subsequent reduced sleep opportunity (Roberts et al., 2019). A delay in bedtime has been attributed to a range of postcompetition factors including muscle soreness, increased circulating cortisol, sympathetic hyperactivity, and lingering high caffeine levels (Roberts et al., 2019). Whether these same factors apply to esports is yet to be examined, although some may be less relevant (e.g., muscle soreness) to esports than others. For example, considering findings of high stress levels among esports athletes (Leis & Lautenbach, 2020), it is plausible that like traditional athletes, sympathetic hyperactivity could induce increased arousal levels postmatch (e.g., excitement, anxiety, alertness) and interfere with sleep.

This is the first study to highlight the impact of congested competition times on the sleep of esports athletes. Further research is therefore required to investigate the exact cause of this impact. Similar to night competitions, evidence from the sports science literature indicates that congested competition times can lead to short TST via reduced sleep opportunity, which is due to factors such as sustained competition anticipation, travel, and simply being busy (Fullagar et al., 2015; Saidi et al., 2022). Once again, some of these factors would likely apply to esports. However, other factors may be unique to esports. For example, unlike traditional sports which have training constraints due to the need for physical recovery, esports athletes often "grind" (i.e., train for long hours) after matches (Abbott et al., 2022). Based on anecdotal evidence, one explanation for an impact of congested competition times on sleep is that during multiday tournaments esports athletes may feel pressure to restrict their sleep opportunity and grind to prepare for their following matches (e.g., scrim, learn strategies, and counter strategies, etc.).

It is worth noting that support staff rated night competitions, congested competition times, and night training schedules significantly higher than coaches. These differences suggest that support staff, more so than coaches, perceive a greater impact of these conditions on esports athletes' sleep behavior. Hence, support staff be more attuned to the sleep health and needs of esports athletes.

Professional Versus Semiprofessional

Overall, findings from the present study suggest few differences between coaches and support staff working in professional and semiprofessional settings. Rather than being inconsequential, we believe this lack of difference is a noteworthy finding in and of itself. Research is yet to investigate whether sleep habits differ between professional and semiprofessional esports athletes. However, it is plausible that professional and semiprofessional esports athletes operate under different conditions (e.g., training/lifestyle, access to resources) which result in nuanced sleep needs and associated implications for sleep health support. Comparatively, research on this topic in traditional sports is limited, but preliminary evidence suggests differences in TST based on professional level exist in some sports (i.e., Rugby; Teece et al., 2022). In esports, the answer to this question will become clearer as more research is published, with findings from the present study acting as a starting point on which future studies can build.

Clinical Implications

Evidence from the present study suggests that some esports coaches and support staff in both professional and semiprofessional settings are already taking an active role in managing the sleep health of esports athletes. With additional training and guidance, it is likely that coaches and support staff could aid esports athletes in addressing their sleep needs even more effectively. Specifically, coaches, and to a lesser extent support staff, need to be better

educated about sleep hygiene. However, there may also be benefit in including broader sleep health education (e.g., the importance of sleep for physical and mental health and performance). Given indications that some coaches and support staff working in semi-professional settings are more likely to believe sleep monitoring is unimportant, sleep education might also help modify these types of unhelpful beliefs. Sleep monitoring frequency needs to be increased, wrist activity monitors and nearables used where available to improve tolerability, and resources (e.g., questionnaires) made accessible so that a more comprehensive understanding of esports athletes' sleep health can be obtained. With the information collected via sleep monitoring, a needs-based assessment could be completed (which could include referring to specialist services). This assessment would enable coaches and support staff to provide more personalized sleep hygiene recommendations, which increases the likelihood of optimal outcomes, especially if reinforced over time and delivered in an engaging and interactive manner. Moreover, particular consideration may be required to mitigate the impact of night competitions, congested competition times, and night training schedules. In addition, the specific role that coaches and support staff play in supporting the sleep health of esports athletes (e.g., support staff taking the lead with coaches providing ancillary support) is another factor that warrants consideration.

Future Models of Care

In light of findings from the present study, let us consider how coaches and support staff might fit into future models of care. As noted in the introduction, Bonnar et al. (2022) proposed a stepped-care model, which have gained traction in the sleep health field over recent years (Cheung et al., 2019), might be appropriate for esports. In a seminal paper, Espie (2009) posited that stepped-care models must (a) provide benefit at the entry level, (b) efficiently use resources at each level, and (c) be acceptable to the consumer. Coaches and support staff have a "boots on the ground" presence, essentially making them an existing resource that could be leveraged and utilized. This point is accentuated by our results which show that some coaches and support staff are already actively engaged in supporting the sleep health of esports athletes, and with additional training, may be able to enhance their support further and provide greater sleep benefits. Furthermore, most sleep monitoring and hygiene practices are resource efficient and minimally invasive. Taken together, coaches and support staff could potentially provide suitable entry level sleep health support to esports athletes within a stepped-care model, at both a professional and semiprofessional level. However, although this idea may have merit, future research is required to investigate whether (and to what degree) sleep training for coaches and support staff translates into effective and meaningful sleep behavior change for esports athletes. This will ultimately determine if coaches and support staff can deliver entry level sleep health support to esports athletes.

Sleep Training Implementation

A notable industry-related challenge is the implementation of the sleep training itself (i.e., knowledge and practices) for coaches and support staff. In the short-term, professional development is likely the most feasible option for existing coaches and support staff. However, it could be argued this type of approach is a "band-aid" solution and would only provide patch-work coverage across the industry. Contrastingly, as previously proposed by Pedraza-Ramirez et al. (2020), a potential long-term solution is the development of more systemic learning and educational pathways (which could incorporate sleep training) for coaches and support staff that possibly lead into qualifications. The same approach has been applied to some traditional sports in a bid to try and improve coaching knowledge and skills that ultimately benefits athletes (Smith et al., 2023). In esports, the implementation of such a system would take time and likely require collaboration between researchers and key stakeholders such as game developers, leagues, and esports organizations. Yet, the potential payoff for esports athletes in terms of health provision quality could be significant. It is worth highlighting that in our study (see Table 1) very few participants had any type of coaching qualification, and no participants had an esports coaching qualification. This finding corroborates those of Watson et al. (2022) who found that coach learning and education in esports is primarily informal and experiential. The reason for this is that there are currently no official esports coaching qualifications, although unofficial programs like that developed by the Esports Health and Performance Institute have recently become available (ehpi.org). In summary, the development of formal learning and educational pathways leading into qualifications may represent the best opportunity to systemically implement sleep training for coaches and support staff.

Limitations

There are some limitations worth noting. Participants largely worked with esports athletes from shooter and massive online battle arena genres, and to a lesser degree sports genre games (see Table 1). Moreover, only a small proportion worked with esports athletes from fighting genre games. Hence, findings from the present study are most representative of coaches and support staff who work within the shooter and massive online battle arena genre specifically. Similarly, participants mostly worked with male esports athletes (see Table 1), which is consistent with the general discrepancy between male and female esports athlete participation levels. As such, like game genre, findings are most reflective of coaches and support staff who work with male esports athletes. Furthermore, although our sample was approximately equivalent to Miles et al. (2019), it was still relatively small, and a priori power analysis was not conducted due to there being no prior studies involving coaches and support staff at the time. Lastly, the third section of the questionnaire included the response option "other" and allowed qualitative answers. Unfortunately, this response option produced missing and largely uninterpretable data. Future research should use more robust qualitative study designs (i.e., formal interviews) to elicit better quality and more informative data.

Conclusion

This is the first study to evaluate the influence and perspective of coaches and support staff on the sleep behavior of esports athletes competing at professional and semiprofessional levels. Positively, it appears that some coaches and support staff are already trying to support the sleep health of esports athletes. Emerging findings from our results suggest that this support could be enhanced if coaches and support staff underwent sleep health education, used more frequent and comprehensive sleep monitoring practices, while also providing more targeted sleep hygiene practices. Importantly, coaches and support staff need to be equipped with adequate knowledge and resources, while efforts to improve the experience of esports athletes engaging in sleep health-related practices

appears critical to overcoming noncompliance. Overall, there is potential for coaches and support staff to provide entry level support within a broader stepped-care model, although further research is required to investigate this idea. Notably, there were few differences found between coaches and support staff working in professional versus semiprofessional settings. Finally, according to coaches and support staff, night competitions, congested competition times, and night training schedules appear to have an impact on the sleep of esports athletes.

Research Contribution: Key Points

- The overall sleep hygiene knowledge of coaches and support staff was inadequate, sleep monitoring was low, but implementation of sleep hygiene practices was reasonable. There were minimal differences between those working in professional and semiprofessional settings.
- Sleep training is required to enhance the ability of coaches and support staff to optimally support the sleep health of esports athletes. Importantly, sleep resources need to be made available and there should be a focus on making sleep health an engaging experience for esports athletes.
- Further research is required to determine the effectiveness of sleep health support led by coaches and support staff. In the future, there may be potential for coaches and support staff to feature more formally within a stepped-care model, providing entry level sleep health support.
- Night competitions, night training schedules, and congested competition schedules were all rated highly by coaches and support staff as having an impact on the sleep of esports athletes. Further research is required to identify the mechanistic relationship between sleep and these risk factors.

References

Abbott, C., Watson, M., & Birch, P. (2022). Perceptions of effective training practices in League of Legends: A qualitative exploration. *Journal of Electronic Gaming and Esports, 1*(1), Article 11. https://doi.org/10.1123/jege.2022-0011

Adan, A.N., Fabbri, M., Natale, V., & Prat, G. (2006). Sleep Beliefs Scale (SBS) and circadian typology. *Journal of Sleep Research, 15*(2), 125–132. https://doi.org/10.1111/j.1365-2869.2006.00509.x

Bonnar, D., Castine, B., Kakoschke, N., & Sharp, G. (2019). Sleep and performance in eathletes: For the win! *Sleep Health, 5*(6), 647–650. https://doi.org/10.1016/j.sleh.2019.06.007

Bonnar, D., Gradisar, M., Moseley, L., Coughlin, A.M., Cain, N., & Short, M.A. (2015). Evaluation of novel school-based interventions for adolescent sleep problems: Does parental involvement and bright light improve outcomes? *Sleep Health, 1*(1), 66–74. https://doi.org/10.1016/j.sleh.2014.11.002

Bonnar, D., Lee, S., Gradisar, M., & Suh, S. (2019). Risk factors and sleep intervention considerations in esports: A review and practical guide. *Sleep Medicine Research, 10*(2), 59–66. https://doi.org/10.17241/smr.2019.00479

Bonnar, D., Lee, S., Roane, B.M., Blum, D.J., Kahn, M., Jang, E., Dunican, I.C., Gradisar, M., & Suh, S. (2022). Evaluation of a brief sleep intervention designed to improve the sleep, mood, and cognitive performance of esports athletes. *International Journal of Environmental Research and Public Health, 19*(7), Article 4146. https://doi.org/10.3390/ijerph19074146

Cheung, J.M., Jarrin, D.C., Ballot, O., Bharwani, A.A., & Morin, C.M. (2019). A systematic review of cognitive behavioral therapy for insomnia implemented in primary care and community settings. *Sleep Medicine Reviews, 44,* 23–36. https://doi.org/10.1016/j.smrv.2018.11.001

Chinoy, E.D., Cuellar, J.A., Huwa, K.E., Jameson, J.T., Watson, C.H., Bessman, S.C., Hirsch, D.A., Cooper, A.D., Drummond, S.P.A., & Markwald, R.R. (2021). Performance of seven consumer sleep-tracking devices compared with polysomnography. *Sleep, 44*(5), Article zsaa291. https://doi.org/10.1093/sleep/zsaa291

Driller, M.W., Lastella, M., & Sharp, A.P. (2019). Individualized sleep education improves subjective and objective sleep indices in elite cricket athletes: A pilot study. *Journal of Sports Science, 37*(17), 2021–2025. https://doi.org/10.1080/02640414.2019.1616900

Espie, C.A. (2009). "Stepped care": A health technology solution for delivering cognitive behavioral therapy as a first line insomnia treatment. *Sleep, 32*(12), 1549–1558. https://doi.org/10.1093/sleep/32.12.1549

Fullagar, H.H., Duffield, R., Skorski, S., Coutts, A.J., Julian, R., & Meyer, T. (2015). Sleep and recovery in team sport: Current sleep-related issues facing professional team-sport athletes. *International Journal of Sports Physiology and Performance, 10*(8), 950–957. https://doi.org/10.1123/ijspp.2014-0565

Gomes, M.A., Narciso, F.V., de Mello, M.T., & Esteves, A.M. (2021). Identifying electronic-sport athletes' sleep-wake cycle characteristics. *Chronobiology International, 38*(7), 1002–1009. https://doi.org/10.1080/07420528.2021.1903480

Halson, S.L. (2019). Sleep monitoring in athletes: Motivation, methods, miscalculations and why it matters. *Sports Medicine, 49*(10), 1487–1497. https://doi.org/10.1007/s40279019-01119-4

Hirshkowitz, M., Whiton, K., Albert, S.M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Hillard, P.J.A., Katz, E.S., Kheirandish-Gozal, L., Neubauer, D.N., O'Donnell, A.E., Ohayon, M., Peever, J., Rawding, R., Sachdeva, R.C., Setters, B., Vitiello, M.V., & Ware, J.C. (2015). National Sleep Foundation's updated sleep duration recommendations. *Sleep Health, 1*(4), 233–243. https://doi.org/10.1016/j.sleh.2015.10.004

Lee, S., Bonnar, D., Kim, Y., Lee, Y., Lee, S., Gradisar, M., & Suh, S. (2020). Sleep characteristics and risk factors of Korean esports athletes: An exploratory study. *Sleep Medicine Research, 11*(2), 77–87. https://doi.org/10.17241/smr.2020.00773

Lee, S., Bonnar, D., Roane, B., Gradisar, M., Dunican, I.C., Lastella, M., Maisey, G., & Suh, S. (2021). Sleep characteristics and mood of professional esports athletes: A multi-national study. *International Journal of Environmental Research and Public Health, 18*(2), Article 664. https://doi.org/10.3390/ijerph18020664

Leis, O., & Lautenbach, F. (2020). Psychological and physiological stress in non-competitive and competitive esports settings: A systematic review. *Psychology of Sport and Exercise, 51,* Article 101738. https://doi.org/10.1016/j.psychsport.2020.101738

Mallinson, D.C., Kamenetsky, M.E., Hagen, E.W., & Peppard, P.E. (2019). Subjective sleep measurement: Comparing sleep diary to questionnaire. *Nature and Science of Sleep, 11,* 197–206. https://doi.org/10.2147/NSS.S217867

Mastin, D.F., Bryson, J., & Corwyn, R. (2006). Assessment of sleep hygiene using the sleep hygiene index. *Journal of Behavioral Medicine, 29*(3), 223–227. https://doi.org/10.1007/s10865-006-9047-6

Micic, G., Richardson, C., Cain, N., Reynolds, C., Bartel, K., Maddock, B., & Gradisar, M. (2019). Readiness to change and commitment as predictors of therapy compliance in adolescents with delayed sleep-wake phase disorder. *Sleep Medicine, 55,* 48–55. https://doi.org/10.1016/j.sleep.2018.12.002

Miles, K.H., Clark, B., Fowler, P.M., Miller, J., & Pumpa, K.L. (2019). Sleep practices implemented by team sport coaches and sports science support staff: A potential avenue to improve athlete sleep? *Journal of Science and Medicine in Sport, 2*(7), 748–752. https://doi:10.1016/j.jsams.2019.01.008

Pedraza-Ramirez, I., Musculus, L., Raab, M., & Laborde, S. (2020). Setting the scientific stage for esports psychology: A systematic review. *International Review of Sport and Exercise Psychology, 13*(1), 319–352. https://doi.org/10.1080/1750984X.2020.1723122

Roberts, S.S.H., Teo, W.P., & Warmington, S.A. (2019). Effects of training and competition on the sleep of elite athletes: A systematic review and meta-analysis. *British Journal of Sports Medicine, 53*(8), 513–522. https://doi.org/10.1136/bjsports-2018-099322

Rudolf, K., Bickmann, P., Froböse, I., Tholl, C., Wechsler, K., & Grieben, C. (2020). Demographics and health behavior of video game and eSports players in Germany: The eSports study 2019. *International Journal of Environmental Research and Public Health, 17*(6), Article 1870. https://doi.org/10.3390/ijerph17061870

Saidi, O., Pereira, B., Peyrel, P., Maso, F., Doré, E., Rochette, E., Ratel, S., Walrand, S., & Duché, P. (2022). Sleep pattern and staging in elite adolescent rugby players during the in-season competitive phase compared to an age matched non-athlete population. *European Journal of Sport Science, 22*(4), 499–510. https://doi.org/10.1080/17461391.2021.1887368

Short, M.A., Booth, S.A., Omar, O., Ostlundh, L., & Arora, T. (2020). The relationship between sleep duration and mood in adolescents: A systematic review and meta-analysis. *Sleep Medicine Reviews, 52,* Article 101311. https://doi.org/10.1016/j.smrv.2020.101311

Smith, K., Burns, C., O'Neill, C., Duggan, J.D., Winkelman, N., Wilkie, M., & Coughlan, E.K. (2023). How to coach: A review of theoretical approaches for the development of a novel coach education framework. *International Journal of Sports Science & Coaching, 18*(2, 594–608. https://doi.org/10.1177/17479541221136222

Smithies, T.D., Toth, A.J., Dunican, I.C., Caldwell, J.A., Kowal, M., & Campbell, M.J. (2021). The effect of sleep restriction on cognitive performance in elite cognitive performers: A systematic review. *Sleep, 44*(7), Article zsab008. https://doi.org/10.1093/sleep/zsab008

Teece, A.R., Beaven, M., Argus, C.K., Gill, N., & Driller, M.W. (2022). Characterization of differences in sleep behaviors between academy, semi-professional and professional levels of competition in rugby union athletes. *International Journal of Sports Science & Coaching*. Advance online publication. https://doi.org/10.1177/17479541221127516

Thomas, C.J., Rothschild, J., Earnest, C.P., & Blaisdell, A. (2019). The effects of energy drink consumption on cognitive and physical performance in elite league of legends players. *Sports, 7*(9), Article 196. https://doi.org/10.3390/sports7090196

Van Hoye, A., Heuzé, J.P., Van den Broucke, S., & Sarrazin, P. (2016). Are coaches' health promotion activities beneficial for sport participants? A multilevel analysis. *Journal of Science and Medicine in Sport, 19*(12), 1028–1032. https://doi.org/10.1016/j.jsams.2016.03.002

Van Ryswyk, E., Weeks, R., Bandick, L., O'Keefe, M., Vakulin, A., Catcheside, P., Barger, L., Potter, A., Poulos, N., Wallace, J., & Antic, N.A. (2017). A novel sleep optimisation programme to improve athletes' well-being and performance. *European Journal of Sport Science, 17*(2), 144–151. https://doi.org/10.1080/17461391.2016.1221470

Walsh, N.P., Halson, S.L., Sargent, C., Roach, G.D., Nédélec, M., Gupta, L., Leeder, J., Fullagar, H.H., Coutts, A.J., Edwards, B.J., Pullinger, S.A., Robertson, C.M., Burniston, J.G., Lastella, M., Meur, Y.L., Hausswirth, C., Bender, A.M., Grandner, M.A., & Samuels, C.H. (2021). Sleep and the athlete: Narrative review and 2021 expert consensus recommendations. *British Journal of Sports Medicine, 55*(7), 356–368. https://doi.org/10.1136/bjsports2020-102025

Watson, M., Smith, D., Fenton, J., Pedraza-Ramirez, I., Laborde, S., & Cronin, C. (2022). Introducing esports coaching to sport coaching (not as sport coaching). *Sports Coaching Review*. Advance online publication. https://doi.org/10.1080/21640629.2022.2123960

Wong, N.A., & Bahmani, H. (2022). A review of the current state of research on artificial blue light safety as it applies to digital devices. *Heliyon, 8*(8), Article 10282. https://doi.org/10.1016/j.heliyon.2022.e10282