Sleep disturbance, mental health, wellbeing and educational impact in UK university students: a mixed methods study

Rebecca Stores, Skaiste Linceviciute, Karen Pilkington & Damien Ridge

Published online: 15 May 2023.

Submit your article to this journal ⬚

View related articles ⬚

View Crossmark data ⬚

Routledge
Taylor & Francis Group

Sleep disturbance, mental health, wellbeing and educational impact in UK university students: a mixed methods study

Rebecca Stores [a], Skaiste Linceviciute [a,b], Karen Pilkington [a] and Damien Ridge [b]

aSchool of Health and Care Professions, University of Portsmouth, Portsmouth, UK; bCollege of Liberal Arts & Sciences, University of Westminster, London, UK

ABSTRACT

Sleep disturbance has harmful psychological and physical effects and due to a range of biopsychosocial and environmental factors, university students are at an increased risk. Despite the importance of this topic, it is under-researched, especially in the UK. The objectives of this study were (1) to investigate the occurrence and nature of sleep disturbance in a sample of UK undergraduate university students, (2) to compare the incidence of sleep disturbance in first- and third-year students, (3) to explore associations between sleep disturbance, daytime sleepiness, mental health and wellbeing and (4) to obtain details on how participants felt their sleep habits affected both their health and wellbeing and their education and learning. A mixed methods approach was used to collect and analyse both quantitative and qualitative data using an online survey of widely used scales (quantitative) and free text open-ended questions (qualitative). Responses were obtained from 153 undergraduate students. Quantitative findings revealed relatively high levels of disturbed sleep, daytime sleepiness, depression, anxiety and reduced wellbeing in the sample studied. Significant associations were found between all these dimensions. Qualitative findings provided insight into how students felt sleep disruption affected their health and wellbeing and their education and learning, and the serious impact this had in many cases. Insights were also obtained on strategies they used to improve sleep quality. Effective treatments for sleep problems could have beneficial effects on associated mental health and wellbeing problems and educational attainment. Student mental health services and interventions should be aware of this possibility.

Introduction

There is convincing evidence that persistent sleep disturbance has harmful psychological and physical effects for individuals (Kryger, Roth, and Dement 2017). Inadequate or poor quality sleep is associated with disturbed emotional states and behaviours such as anxiety, depression and irritability and impaired cognitive function and performance (Curcio, Ferrara, and De Gennaro 2006).

Due to a range of biopsychosocial and environmental factors, students are at an increased risk of sleep disturbance (Prichard 2020; Gardani et al. 2022). Students new to university experience several significant changes including leaving home; transitional issues; moving from the structured environment of school to the independence of university life; changes in peer groups; new social situations;

and increased academic responsibilities (Cleary, Walter, and Jackson 2011; O'Neill et al. 2018). Any of these challenges can be associated with sleep disturbances resulting in potentially significant mental health and educational impacts.

More than half of all college students in the US report feeling tired or sleepy during the day (American College Health Association 2016) and it has been reported that 70% of US college students obtain fewer than 8-hours sleep per night during the week (Lund et al. 2010). Increased rates of sleep disturbance as well as mental strain have also been found in University students in other non-European countries including Canada (Alapin et al. 2000), China (Cahuas et al. 2020), South Africa (Reid and Baker 2008) as well as European countries like Germany, Netherlands, Luxembourg and Poland (Kiltz et al. 2020; Leenaars et al. 2015; Schlarb et al. 2017; Wróbel-Knybel et al. 2020).

Insufficient and poor-quality sleep can negatively affect learning, attention and academic performance (Curcio, Ferrara, and De Gennaro 2006). This, combined with a range of other factors such as early lecture times, frequent use of technology before bed and excessive alcohol and caffeine intake can all have a detrimental effect on students' sleep, mental health, wellbeing and educational attainment (Gardani et al. 2022).

Despite the importance of this topic, and the importance of context (e.g. whether students tend to live away from or within their family homes can influence sleep) it remains under-researched, especially in the UK.

Akram et al. (2019) conducted an online survey of students at four northern universities in the UK and found that around one-quarter experienced insomnia in the clinical range. Around one-fifth of the students experienced mild to severe levels of depression and two-thirds reported symptoms of anxiety. Symptoms of insomnia and apnoea were significantly related to depression after controlling for co-morbid anxiety. This study focussed on insomnia and depression and did not consider educational impact.

Sheaves et al. (2016) conducted an online survey of sleep and psychiatric symptoms in students at one UK university. Participants were clustered on measures of psychiatric symptoms (hallucinations, paranoia, depression, anxiety and mania) and compared across sleep measures. Insomnia, nightmare frequency and nightmare-related distress increased significantly across the low, medium and high psychiatric symptom groups. The focus of this study was on severe mental illness and participants were from one University only.

One previous UK-based qualitative study (Foulkes, McMillan, and Gregory 2019) in first-year students with self-reported poor quality sleep identified four themes: 'the social context of noise problems', 'the lure of socialising with peers', 'the cost of having an unstructured academic lifestyle' and 'the wide-reaching impact of poor sleep quality on university life'. However, only first-year students who were poor sleepers took part, the majority were female, and associations between sleep disturbance and other factors were not explored.

A better understanding of sleep disturbance, mental health, wellbeing and educational impact and their links in UK university students is required.

With this in mind, the aims of the present study were:

(1) To investigate the occurrence and nature of sleep disturbance in a sample of UK undergraduate university students at different stages of their courses.
(2) To compare the incidence of sleep disturbance in first- and third-year students.
(3) To explore associations between sleep disturbance, daytime sleepiness, mental health and wellbeing in these students.
(4) To obtain details on how participants believe their sleep habits affect both their health and wellbeing and their education and learning.

The study was conducted before the outbreak of the coronavirus pandemic so the findings do not reflect the impacts of this major event on students.

Method

Sample

Participants were first and third (final) year undergraduate students from two large UK universities, one located in central London and the other on the South Coast. Involving students from these two universities increased the diversity of participants as well as the scope and generalisability of the findings. Three psychology-related BSc courses from the London based university and one accountancy and one health care-related courses from the South Coast university were selected for participation. The total number of first- and third-year students on these courses at the time the study was carried out was 1,283.

Procedure

A mixed methods approach was used to combine quantitative and qualitative data to obtain breadth and depth of understanding about student sleep (Johnson, Onwuegbuzie, and Turner 2007; O'Cathain, Murphy, and Nicholl 2008). By combining these two types of data, it is possible to benefit from both the generalisable externally valid insights of quantitative data and the detailed contextual insights of qualitative data on students' lived experiences. This is sometimes called 'triangulation' in the sense that a phenomenon is studied, in this case sleep disturbance, to gain a more complete understanding of the issues involved (O'Cathain, Murphy, and Nicholl 2010). Triangulation happens interpretatively, once both sets of data have been analysed separately.

Both the quantitative and qualitative data were collected using a cross-sectional online survey. The survey was compiled using the 'Online Surveys' platform and consisted of widely used scales (quantitative) and free text open-ended questions (qualitative) (see *Measures*).

Course Leaders were asked to forward an email to students describing the study and inviting participation, and a link to the survey was provided within the email. A study information sheet was included at the start of the survey. It was made clear to participants that by completing the survey, they were indicating their consent to participate.

Following the initial invitation, two reminder emails were sent, the first three weeks after the initial one, and the second, a month after that. The survey was live between the middle of October and the end of December 2019.

At the end of the survey, participants were provided with contact details of their university's wellbeing and counselling services and signposted to additional sources of support, including advice on contacting their GP, should they have become upset due to the areas covered by the survey.

Ethical approval was obtained from ethics committees at both universities (SFEC 2019–072A and ETH 1920–0066). Issues identified included limiting the number of email reminders to students to complete the survey to three (to ensure a high response rate without overburdening students with emails) and ensuring that debriefing information included resources recommended for the support of participants' sleep and mental health at both University sites (as described above).

Measures

The survey was organised into separate sections on sleep, daytime sleepiness, mental health, wellbeing and demographic information.

Demographic data included age category, gender, year of study, name of course, living arrangements (i.e. student halls, private accommodation), and employment status. A range of scales were included in the survey. Each of these were chosen as they are widely used, allowing easy comparison with previous research, are well validated and measure the specific aspects of sleep disturbance, mental health and wellbeing relevant to the aims of the study.

Quantitative

Pittsburgh Sleep Quality Index (PSQI). The Pittsburgh Sleep Quality Index (PSQI) was used to assess self-reported sleep (Buysse et al. 1989). The scale is one of the most widely used and well-validated tools for assessing sleep quality in adults. Participants self-report on subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction over the last month. A total score is computed by summing across all seven domains, producing a possible range of scores from 0 to 21, with higher scores representing worse subjective sleep quality. A score of >5 indicates poor sleep quality.

Epworth Sleepiness Scale (ESS). The widely used Epworth Sleepiness Scale (ESS) (Johns 1991), a measure of the propensity to fall asleep in eight situations, was used to assess daytime sleepiness. The eight situations are: sitting and reading; watching television; sitting inactive in a public place e.g. theatre, meeting; as a passenger in a car for an hour without a break; lying down to rest in the afternoon; sitting and talking to someone; sitting quietly after lunch (when they have had no alcohol); and in a car, while stopped in traffic. Respondents are asked to indicate the chance of dozing from: 'would never doze', 'slight chance of dozing', 'medium chance of dozing' or 'high chance of dozing' and a total score obtained. Total scores can range from 0 to 24 and a score of >10 indicates different levels of excessive daytime sleepiness (mild, moderate or severe).

Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS). The WEMWBS (Tennant et al. 2007) is the most widely used wellbeing scale and was originally designed and tested in UK University students. It is a measure of mental wellbeing and consists of 14 statements related to wellbeing which respondents are asked to indicate their level of agreements to from 'None of the time', 'Rarely', 'Some of the time', 'Often' or 'All of the time' over the last 2 weeks. The possible total score ranges from a minimum of 14 to a maximum of 70 with a higher score indicating a higher level of wellbeing. A total score of 14 to 40 indicates 'low mental health'.

Patient Health Questionnaire Anxiety-Depression Scale (PHQ-ADS). The PHQ-ADS is a composite measure of depression and anxiety and combines the widely used and validated scales of the Patient Health Questionnaire 9-item depression scale (PHQ-9) (Kroenke, Spitzer, and Williams 2001) and the 7-item Generalised Anxiety Disorder Scale (GAD-7) (Spitzer et al. 2006). Both instruments ask respondents to base their answers over the last 2 weeks. The total possible score for depression severity ranges from 0 to 27 across five categories: none (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), severe (20–27). The total possible score for anxiety severity ranges from 0 to 21 across four categories: none (0–5), mild (6–10), moderate (11–15), severe (16–21).

Qualitative open-ended questions

Participants were asked the following open-ended questions at the end of the survey:

> Do you think your current sleep habits affect your health and wellbeing? If yes, please give details.

> Do you think your current sleep habits affect your education or learning? If yes, please give details.

> If there is anything about your sleep that you think is important that we have not already mentioned, please give details below

Yes/No responses and open-ended text boxes were provided for participants to provide as much or as little information as they wanted. The format of these questions was shown to be acceptable to respondents in a pilot stage of the research.

Statistical analysis

Quantitative data were exported from the Online Surveys platform into SPSS Version 25 IBM. Percentages, means and standard deviations were used to describe the data, Chi squared statistics and T-tests were used to test for significant group differences and Pearson correlation coefficients were used to test for significant associations. Details of tests are provided in the relevant Results sections.

Qualitative analysis

The responses from all three text-based open-ended questions were exported and combined into a single Excel spreadsheet and analysed using a qualitative thematic approach (Braun and Clarke 2006). Thematic analysis – using the basic building blocks of qualitative analysis – is a pragmatic approach which is especially useful for examining views, experiences and attitudes, while ensuring rigour. The data set was read and re-read several times and notes about potential patterns were made. A coding scheme was developed and all data were collated into meaningful codes, sub-themes and themes. The data set was then re-examined by two of the authors and codes, sub-themes and themes were refined to ensure they formed agreed and coherent patterns. Typical quotes were used to illustrate each of the sub-themes.

Results

Demographic characteristics

A total of 153 individuals completed the survey. Response rates on individual courses ranged from 9% to 32%. Just over half (77) were from the London-based university (all psychology-related courses) and 76 from the South Coast-based university [41 (54%) on the accountancy course and 35 (46%) on the healthcare-related course]. Table 1 provides the demographic characteristics of the total sample and the London-based and South Coast-based cohorts separately. The majority of respondents were female (84%) (reflecting the proportion of students enrolled on the courses), aged 18–24 years old (82%), first years (73%) and either not working or working less than 20 hours per week (74%). The majority were living with parents although there was a significant difference between the London-based and South Coast-based students with 68% of London students living with their parents compared with 22% of South Coast-based students ($\chi2 = 51.75$, df = 5, $p < 0.001$).

Pittsburgh Sleep Quality Index (PSQI)

PSQI scores for the total sample and the London-based and South Coast-based cohorts are shown in Table 2. One hundred (75%) of the total sample's scores fell in to the 'bad sleepers' category. When asked 'During the past month, how would you rate your sleep quality overall?', 64 (42%) indicated 'Fairly bad' and 7 (5%) indicated 'Very bad'. Thirty-six per cent of respondents usually took longer than 30 minutes to fall asleep, 62% had less than 7 hours sleep a night and 46% had a sleep efficiency less than 85%. No significant differences were found between the London and South Coast-based cohorts for the global PSQI scores.

Epworth Sleepiness Scale (ESS)

ESS scores are shown in Table 2. Forty-one (28%) of individuals fell into categories of clinically significant excessive daytime sleepiness using the categories defined by Johns (1991), 14% as mild, 8% as moderate and 6% as severe. No significant differences were found between the London and South Coast-based cohorts for the total ESS scores.

Table 1. Demographic characteristics of total sample and London and South Coast-based cohorts separately.

Demographic characteristic	Total (n = 153)	London based cohort (n = 77)	South Coast based cohort (n = 76)
Gender			
Female	128 (84%)	75 (97%)	53 (70%)
Male	24 (16%	1 (1%)	23 (30%)
Other	–	–	–
Prefer not to say	1	1 (1%)	–
Age group (years)			
18–24	125 (82%)	68 (88%)	57 (75%)
25–34	20 (13%)	7 (9%)	13 (17%)
35–44	6 (4%)	1 (1%)	5 (7%)
45–54	1 (1%)	–	1 (1%)
≥55	1 (1%)	1 (1%)	–
Year of study			
1st Year	111 (73%)	64 (84%)	47 (62%)
3rd Year	41 (27%)	12 (16%)	29 (38%)
Living Circumstances*			
Student halls (shared bedroom)	1 (1%)	1 (1%)	–
Student halls (private bedroom)	29 (19%)	3 (4%)	26 (34%)
Private rented (shared)	10 (7%)	8 (10%)	2 (3%)
Private rented (private)	35 (23%)	12 (16%	23 (30%)
Living with parents/relatives	68 (44%)	52 (68%)	16 (21%)
Living on own	10 (7%)	1 (1%)	9 (12%)
Employment status			
Not working	63 (41%)	19 (46%)	34 (45%)
Working PT (<20 hours)	50 (33%)	10 (24%)	17 (22%)
Working PT (>20 hours)	12 (8%)	3 (7%)	4 (5%)
Working on Uni breaks only	23 (15%)	8 (20%)	19 (25%)
Other	4 (3%)	1 (2%)	2 (3%)

Where frequencies do not equal n, there is missing data.
***$p < 0.001$ (2-tailed) between London based and South Coast based cohorts.

Patient Health Questionnaire 9-item depression scale (PHQ-9)

PHQ-9 scores are shown in Table 3. Eighty-one (54%) of the total sample fell into the clinically significant categories with 42 (28%) classified as moderate, 24 (16%) as moderately severe and 15 (10%) into the severe categories. The London-based students had significantly higher PHQ-9 scores than the South Coast students (mean 11.9 vs 9.7) (t = 2.08, df = 149, p = 0.04, 2 tailed, d = 0.34)

Generalised Anxiety Disorder Scale (GAD-7)

GAD-7 scores are shown in Table 3. Fifty-six (37%) of the total sample fell into clinically significant categories with 31 (20%) categorised as moderate and 25 (16%) categorised as severe. The London-based students had significantly higher GAD-7 scores than the South Coast students (mean 10.4 vs 7.7) (t = 3.09, df = 151, p = 0.002, 2-tailed, d = 0.25).

Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS)

WEMWBS scores are shown in Table 3. Seventy (47%) of the total sample fell into the 'Low mental health' category. No significant differences were found between the London and South Coast-based cohorts for the WEMWBS scores.

Comparison of first and third year students

There were no significant differences between the first- and third-year students on the PSQI, ESS, PHQ-9, GAD-7 or WEBWMS.

Table 2. Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scores (ESS) scores for the total sample and London and South Coast-based cohorts separately.

Scale	Total (n = 153) n (%)	London based cohort (n = 77) n (%)	South Coast based cohort (n = 76) n (%)
Pittsburgh Sleep Quality Index (PSQI)			
Mean (SD)	7.9 (3.2)	8.1 (3.0)	7.7 (3.5)
Range (0–21)	1–19	3–14	1–19
Global Score			
Good sleepers (0–5)	33 (25%)	16 (23%)	17 (27%)
Bad sleepers (6–21)	100 (75%)	54 (77%)	46 (73%)
Subjective sleep quality			
Very good	12 (8%)	3 (4%)	9 (12%)
Fairly good	70 (46%)	39 (51%)	31 (41%)
Fairly bad	64 (42%)	34 (44%)	30 (40%)
Very bad	7 (5%)	1 (1%)	6 (8%)
Sleep latency			
≤15 min	45 (29%)	18 (23%)	27 (36%)
16–30 min	53 (35%)	28 (26%)	25 (33%)
31–60 min	29 (19%)	16 (21%)	13 (17%)
>60 min	26 (17%)	15 (20%)	11 (15%)
Sleep duration			
<5 h	6 (4%)	2 (3%)	4 (6%)
5–5 h 59 min	19 (13%)	8 (11%)	11 (15%)
6–6 h 59 min	66 (45%)	34 (47%)	32 (44%)
≥7 h	55 (38%)	29 (40%)	26 (36%)
Sleep efficiency			
>85%	74 (54%)	39 (55%0	35 (54%)
75–84%	31 (23%)	17 (24%)	14 (22%)
65–74%	16 (12%	9 (13%)	7 (11%)
<65%	15 (11%)	6 (9%)	9 (14%)
Use of medication			
Not at all	139 (91%)	70 (91%)	69 (91%)
< once per week	7 (5%)	2 (3%)	5 (7%)
1 or 2 times per week	3 (2%)	2 (3%)	1 (1%)
3 or more times per week	4 (3%)	3 (4%)	1 (1%)
Epworth Sleepiness Scale (ESS) scores			
Mean (SD)	8.1 (4.5)	8.4 (4.5)	7.8 (4.5)
Range (0–24)	0–21	0–20	0–21
Level of daytime sleepiness			
0–5 (Lower normal)	48 (33%)	21 (29%)	27 (37%)
6–10 (Higher normal)	57 (39%)	28 (38%)	29 (40%)
11–12 (Mild excessive daytime sleepiness)	21 (14%)	13 (18%)	8 (11%)
13–15 (Moderate excessive daytime sleepiness)	11 (8%)	6 (8%)	5 (7%)
16–24 (Severe excessive daytime sleepiness)	9 (6%)	5 (7%)	4 (6%)

Where frequencies do not equal n, there is missing data as not all scale items were responded to.

Associations between sleep quality, daytime sleepiness, depression, anxiety and wellbeing

Pearson correlation coefficients between the PSQI, ESS, PHQ-9, GAD-7 and WEMWBS scores are shown in Table 4.

Each of these variables were highly significantly correlated with all other variables showing strong associations between sleep quality, daytime sleepiness, depression, anxiety and lower levels of wellbeing.

Qualitative findings

A total of 48 participants responded to the question '*Do you think your current sleep habits affect your health and wellbeing? If yes, please give details*'; 44 responded to '*Do you think your current sleep habits*

Table 3. PHQ-9 depression, GAD-7 anxiety and WEBWBS scores.

Scale	Total (n = 153) n (%)	London based cohort (n = 77) n (%)	South Coast based cohort (n = 76) n (%)
Depression PHQ-9			
Mean (SD)	10.8 (6.4)	11.9 (6.5)*	9.7 (6.2)*
Range (0–27)	0–27	1–27	0–26
Severity of depression			
None (0–4)	29 (19%)	12 (16%)	17 (23%)
Mild (5–9)	41 (27%)	19 (25%)	22 (29%)
Moderate (10–14)	42 (28%)	21 (28%)	21 (28%)
Moderately Severe (15–19)	24 (16%)	16 (21%)	8 (11%)
Severe (20–27)	15 (10%)	8 (10%)	7 (9%)
GAD-7 Anxiety			
Mean (SD)	9.0 (5.6)	10.4 (5.4)**	7.7 (5.5)**
Range (0–21)	0–21	0–21	0–21
Severity of anxiety			
None (0–5)	49 (32%)	19 (25%)	30 (40%)
Mild (6–10)	48 (31%)	21 (27%)	27 (36%)
Moderate (11–15)	31 (20%)	22 (29%)	9 (12%)
Severe (16–21)	25 (16%)	15 (20%)	10 (13%)
Warwick-Edinburgh Mental Wellbeing Scales (WEMWBS)			
Mean (SD)	41.1 (10.0)	40.8 (9.9)	41.4 (11.8)
Range (14–70)	14–70	15–61	14–70
Level of mental wellbeing			
Low mental health (14–40)	70 (47%)	34 (44%)	36 (49%)
Normal mental health (41–58)	73 (49%)	41 (53%)	32 (43%)
High mental health (59–70)	7 (5%)	1 (1.3%)	6 (8%)

Where frequencies do not equal n, there is missing data as not all scale items were responded to.
*$p < 0.05$ (2-tailed)
**$p < 0.01$ (2-tailed)

Table 4. Pearson correlation coefficients between PSQI, ESS, PHQ-9, GAD-7 and WEMWBS scores.

	1 PSQI	2 ESS	3 PHQI	4 GAD-7
1 PSQI				
2 ESS	0.437***			
3 PHQ-9	0.451***	0.531***		
4 GAD-7	0.369***	0.447***	0.738***	
5 WEMWBS	−0.285**	−0.335***	−0.622***	−0.502***

***$p < 0.001$ (2-tailed)
**$p < 0.01$ (2-tailed)

affect your education or learning? If yes please give details' and 16 responded to 'If there is anything about your sleep that you think is important that we have not already mentioned, please give details below'.

Three themes and eight sub-themes emerged from the qualitative thematic analysis of the responses to the open-ended questions as outlined in Table 5.

In order to provide a wider representation of the qualitative findings, the number of participants commenting on each of the sub-themes is indicated in brackets in Table 5.

The majority of students commented on the disruption that sleep posed to their academic life. Students' sleep problems impaired motivation and enthusiasm to complete university-related work and routines like studying after classes and they were considered to have limited overall performance the following day (1.1). Instead of feeling productive, students reportedly turned to procrastination, avoidance and delay. Others persevered in their attempts at learning, but their capacity to concentrate was considered to be impaired (1.2). Those reporting sleep disruption believed they were less able to focus on learning, remember new information or keep track of their thoughts. Their attention was inconsistent and 'foggy'. A few students reported skipping classes and, instead, choosing to catch up on their sleep (1.3).

Table 5. Qualitative findings from the open-ended questions.

Theme	Sub-theme	Example quote
(1) Sleep disruption is a direct strain on students learning capacity and academic performance	1.1 Students productivity levels are at risk (n = 33)	'When I don't get a good night's rest, I wake up feeling less energetic. It's harder to feel motivated to get out of bed and do the things I have to do during the day, like go to university or work'.
	1.2 Students attention is at risk (n = 63)	'I'm unable to concentrate on my work or in lectures which means I miss vital information which I would have to catch up on later'.
	1.3 Students attendance is at risk (n = 6)	'Because I have been getting to sleep really late. I don't want to get up for my lectures or seminars'
(2) Sleep disruption is a direct strain on student's mental wellbeing and physical health	2.1 Experiencing complex psychosocial responses (n = 61)	'If I get a bad night's sleep it will always affect my mood the next day'.
	2.2 Experiencing physical symptoms of exhaustion (n = 81)	'I went through a period when I was getting less than 7 hours sleep every night for a few months and my health had never been so bad as it was during that time, I was constantly feeling like I wanted to collapse because I was so tired, I didn't want to eat, I felt sick and I felt very anxious constantly'.
	2.3 Experiencing irregular sleep management (n = 53)	'I constantly need sleep. I often feel dizzy or disoriented and need multiple naps during the day just to get basic work done'.
	2.4 The importance of regular sleep and good sleep habits (n = 28)	'The more sleep the better not just mentally but also physically and spiritually. Sleep relaxes your body and allows the brain to focus on other functions and process all the new info[rmation] learnt that day and keep the body healthy and ready for the next day to absorb more information'.
(3) Sleep preventing factors versus sleep aiding strategies	3.1 Controllable and uncontrollable factors that prevent sleep (n = 20)	'Most of the time it is a noise that prevents me from falling asleep or wakes me up during the night'.
	3.2 Successful factors that improve sleep (n = 26)	'This year, I have tried my best to go to sleep at regular times and wake up fairly early even on weekends. My mental health is so much better this year'.

Beyond the educational disruption, poor sleep was reported to be detrimental to students' overall health and wellbeing. Many experienced unpleasant and/or difficult emotional states that challenged their mood and outlook on daily life (2.1). In addition to recounting anxiety, stress and depression, students reporting poor sleep were less inclined to socialise, were generally frustrated, or used sleep as a way to escape reality. Some respondents expressed that, without appropriate sleep quality and quantity, they experienced fatigue that was prolonged and disruptive (2.2). Participants found they were tired, lacked energy and were sleepy during and after their classes, with headaches, migraines and/or irregular eating habits described. Irregular sleep management was a regular feature of student life for some (2.3). By morning, some students were oversleeping and ignoring wake up calls, thus missing out on daily plans, or catching up on their sleep with naps during the day. However, those students who had achieved regular sleep reported improved mental and physical health (2.4), where sleep was restful having achieved a sufficient number of hours. These students gave accounts of more energy, better physical condition and good levels of motivation.

Some students commented on lifestyle choices, accommodation and sleeping arrangements, wellbeing concerns and daily roles and responsibilities like university and employment as complicating factors in students sleep practices (3.1). Although the qualitative data were less complete around the potential reasons for poor student sleep, responses suggested contexts were important. Some, however, had implemented potential solutions to interrupted sleep (3.2). While some students were relying on sleep inducing medication, technology such as YouTube videos in the background, or a dark and quiet room to help them fall sleep were used by others. Some tried to maintain a consistent sleep-wake schedule that proved helpful.

Discussion

The study investigated the occurrence and nature of sleep disturbance in a sample of UK undergraduate university students including implications for mental health and wellbeing. Details were also sought on how participants believed their sleep habits affected both their health and wellbeing and their education and learning using open-ended questions.

The quantitative findings revealed relatively high levels of disturbed sleep, daytime sleepiness, depression and anxiety and reduced wellbeing in the sample studied. To-re-cap, 75% of respondents were categorised as poor sleepers and 28% had clinically significant scores for daytime sleepiness. Concerning mental health, 54% scored clinically significant scores for depression and 37% for anxiety. Forty-seven per cent fell into the 'low mental health category' for mental wellbeing. Significant associations were found between all these dimensions. The majority of respondents reported their sleep habits affected their health and wellbeing (59%) and their education and learning (62%).

The rate of sleep disturbance found in the present study was markedly higher than that found in the general population. Using the same PSQI cut-off of >5 used in the present study, Hinz et al. (2017) found 36% of individuals fell into the 'poor sleepers' category in their general population community sample involving 9284 people, a significantly lower proportion than the 75% found in the present study. In addition, the sample in the present study showed poorer sleep quality in terms of sleep latency, sleep duration and sleep efficiency compared to Hinz et al.'s (2017) general population sample.

We found that students on different courses may be more or less prone to sleep disturbance. Akram et al. (2019) used a similar recruitment method to the present study but did not target specific courses and no details are given as to which courses respondents in their study were on. In the present study, the London-based university courses were all Psychology-related undergraduate courses. One of the South Coast university courses was accountancy related and the other healthcare related. It is possible that students on Psychology-related courses have more interest, experience and insight into the topic under investigation which could have potentially influenced the findings and this possibility is worthy of future investigation.

The present study also found relatively high rates of depression and anxiety. As with sleep disturbance, levels were higher than the general population (Spitzer et al. 2006) and higher than in the Akram et al. (2019) study of UK university students for depression where one-fifth experienced mild to severe levels of depressive symptoms compared to 54% in the current study. However, lower levels of anxiety were found compared to the Akram et al. (2019) study which found two-thirds of their sample had anxiety symptoms compared to 37% in the present study. These differences could be explained by the different measures used, the different courses the students were enrolled on, and/or actual differences in mental health.

The London-based cohort was found to have significantly higher levels of self-reported depression and anxiety than the South Coast-based students. This is an interesting finding and deserves further attention. A significantly greater proportion of the London-based students lived with their parents which one might have expected to have a protective influence given the stresses of independent living. However, the opposite was found. Perhaps living with parents can also have less positive associations and additionally, these students are likely to have had longer commutes to and from the university which could lead to reduced opportunities to sleep. The finding could also be explained by other demographic differences between the groups which were not explored in the current study but warrant further investigation.

The finding that sleep quality, daytime sleepiness, depression, anxiety and lower levels of wellbeing were all significantly correlated with each other in this sample is consistent with previous research in UK university students (Akram et al. 2019; Sheaves et al. 2016). The relationship between disturbed sleep and mental health problems is a complex one. It is possible that disturbed sleep may negatively affect mental health and wellbeing by impairing an individual's ability to cope with the

academic and social demands of University life. But equally there could be a causal relationship in the opposite direction where depressive and anxiety-related thought processes lead to increased worry and ruminating at night and consequently impaired sleep quality (Harvey 2002). Future longitudinal research may be able to unravel any direction of causation by establishing which problems arise first.

Qualitatively, respondents were mostly concerned with damaging effects on their mental and physical wellbeing as well as unpleasant emotional states and severe tiredness. Unsurprisingly, respondents believed sleep disturbance disrupted their learning and academic performance and were concerned with the impact on their attention and productivity. Responses also indicated that students suffered with irregular sleep practices.

Contextual issues may play a significant role. The study by Foulkes, McMillan, and Gregory (2019) pointed out that for first-year undergraduates, in addition to unstructured academic lifestyle, social context, particularly socialising with peers and associative disruptive noise were central to students' poor sleep quality. Several factors may contribute such as commuting, employment, and university commitments. A large number of students in this study were in employment. A study by Barone (2017) with undergraduate students in one US university found that students normalised lack of sleep and tiredness in exchange for work and for attending university. While this may offer a partial explanation, the link between employment and poor sleep practices requires an in-depth exploration between working and non-working students in the UK.

Insights were also obtained on strategies used by students to improve sleep quality. Some examples suggested that students were taking a proactive role to create a sleep routine and adapt different behaviours to help them fall asleep more easily and sleep better. This observation warrants further investigation, particularly regarding students' decision-making about their willingness to change sleep practices.

Future research should consider additional factors such as the influence of physical activity, caffeine intake and smoking which have been shown to be associated with sleep quality (Atoui et al. 2021) as well as screen time, stress and shift work (Holmen et al. 2021).

There are a number of limitations to the present study which should be considered when interpreting the findings. There are limitations to questionnaire studies in general, mainly concerning the subjectivity of the data obtained and the possibility of bias on the part of the informant. However, there is no particular reason to believe participants would have been motivated to provide misleading information in the present study.

The students were recruited from only two universities and five individual undergraduate courses. In addition, the sample consisted mainly of female students although this reflected the proportion of students enrolled on the majority of these courses. This will have some effect on the generalisability of the findings as there is evidence to suggest that females are more prone to insomnia (Zhang and Wing 2006) and depression (Nolen-Hoeksema 2001).

There is also a possibility of a biased sample having been recruited. However, it was made clear that information was required from both individuals with and without sleep problems. Nevertheless, it is possible that individuals with disturbed sleep or mental health issues were more likely to respond leading to an overestimation of such problems. Future research should aim to achieve a more systematic approach to recruitment and improved response rates.

Future research could include the use of objective methods to measure sleep quality and quantity such as actigraphy. This approach is relatively low cost, well tolerated and concords well with polysomnography (Van De Water, Holmes, and Hurley 2011).

The qualitative component of this study has limitations that further research could consider. Firstly, qualitative data were collected via open-fielded text boxes, and while a large number of students have reported their experiences, not everyone has taken up this opportunity, thus additional responses may have offered more insights, particularly for less discussed areas. Another observation relates to the richness of the data. The level of detail in respondents' answers varied widely and responses were not followed-up by additional methods such as using focus groups. However, qualitative findings, particularly

those related to students' sleep disturbance and the effect on their mental wellbeing and physical health strongly corroborate with the quantitative data. Further, more extensive qualitative research could build on these findings and provide deeper insights into the relationships between these factors.

Both the short- and long-term effect of the pandemic on students' sleep and wellbeing is another area ripe for further research. A recent UK-based survey (Evans et al. 2021) and a global one (Ellakany et al. 2022) have found significant impact of Covid 19 on students in this respect.

Conclusion

The present study found high rates of sleep disturbance, daytime sleepiness, depression, anxiety and reduced wellbeing amongst a sample of university students in the UK compared to the general population. Significant associations between each of these factors were also observed. Future research should further explore associations between sleep problems and mental health, wellbeing and educational impact taking a longitudinal approach to attempt to ascertain direction of any causation and involve both quantitative and qualitative methods. As the relationships become clearer, effective treatments for sleep problems could be valuable in having a beneficial effect on associated mental health and wellbeing problems and reduced educational attainment. Student mental health services and interventions should explore the possibility of treating sleep disturbance to have a beneficial effect on associated mental health problems and educational impact. It may also be helpful for students to receive sleep promoting education routinely, aimed at preventing the likelihood of sleep problems developing.

Disclosure statement

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

ORCID

Rebecca Stores http://orcid.org/0000-0003-0546-6734
Skaiste Linceviciute http://orcid.org/0000-0002-2618-4747
Karen Pilkington http://orcid.org/0000-0002-6914-3347
Damien Ridge http://orcid.org/0000-0001-9245-5958

Data availability statement

The data that support the findings of this study are available from the corresponding author [RS], upon reasonable request.

References

Akram, U., A. Akram, M. Gardani, A. Ypsilanti, K. McCarty, S. Allen, and A. Lazuras. 2019. "The Relationship between Depression and Insomnia Symptoms Amongst a Sample of UK University Students." *Sleep Medicine Research* 10 (1): 49–53. doi:10.17241/smr.2019.00332.

Alapin, I., C.S. Fichten, E. Libman, L. Creti, S. Bailes, and J. Wright. 2000. "How Is Good and Poor Sleep in Older Adults and College Students Related to Daytime Sleepiness, Fatigue, and Ability to Concentrate?" *Journal of Psychosomatic Research* 49 (5): 381–390. doi:10.1016/s0022-3999(00).

American College Health Association. 2016. *American College Health Association – National College Health Assessment II: Reference Group Executive Summary Spring 2016*. Hanover, MD: American College Health Association.

Atoui, S., G. Chevance, A.J. Romain, C. Kingsbury, J.P. Lachance, and P. Bernard. 2021. "Daily Associations between Sleep and Physical Activity: A Systematic Review and Meta-Analysis." *Sleep Medicine Reviews* 57: 101426. doi:10.1016/j.smrv.2021.101426.

Barone, T.L. 2017. ""Sleep Is on the Back Burner": Working Students and Sleep." *The Social Science Journal* 54 (2): 159–167. doi:10.1016/j.soscij.2016.12.001.

Braun, V., and V. Clarke. 2006. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3 (2): 77–101. doi:10.1191/1478088706qp063oa.

Buysse, D.J., C.F. Reynolds, T.H. Monk, S.R. Berman, and D.J. Kupfer. 1989. "The Pittsburgh Sleep Quality Index: A New Instrument for Psychiatric Practice and Research." *Psychiatry Research* 28 (2): 193–213. doi:10.1016/0165-1781(89).

Cahuas, A., Z. He, Z. Zhang, and W. Chen. 2020. "Relationship of Physical Activity and Sleep with Depression in College Students." *Journal of American College Health* 68 (5): 557–564. doi:10.1080/07448481.2019.1583653.

Cleary, M., G. Walter, and D. Jackson. 2011. ""Not Always Smooth Sailing": Mental Health Issues Associated with the Transition from High School to College." *Issues in Mental Health Nursing* 32: 250–254. doi:10.3109/01612840.2010.548906.

Curcio, G., M. Ferrara, and L. De Gennaro. 2006. "Sleep Loss Learning Capacity and Academic Performance." *Sleep Medicine Reviews* 10 (5): 323–337. doi:10.1016/j.smrv.2005.11.001.

Ellakany, P., R. Zuñiga, M. El Tantawi, B. Brown, N.M. Aly, O. Ezechi, B. Uzochukwu, et al. 2022. "Impact of the COVID-19 Pandemic on Student' Sleep Patterns, Sexual Activity, Screen Use, and Food Intake: A Global Survey." *PloS one* 17 (1): e0262617. doi:10.1371/journal.pone.0262617.

Evans, S., E. Alkan, J.K. Bhangoo, H. Tenenbaum, and T. Ng-Knight. 2021. "Effects of the COVID-19 Lockdown on Mental Health, Wellbeing, Sleep, and Alcohol Use in a UK Student Sample." *Psychiatry Research* 298: 113819. doi:10.1016/j.psychres.2021.113819.

Foulkes, L., D. McMillan, and A.M. Gregory. 2019. "A Bad Night's Sleep on Campus: An Interview Study of first-year University Students with Poor Sleep Quality." *Sleep Health* 5 (3): 280–287. doi:10.1016/j.sleh.2019.01.003.

Gardani, M., D.R.R. Bradford, K. Russell, S. Allan, L. Beattie, J.G. Ellis, and U. Akram. 2022. "A Systematic Review and Meta-Analysis of Poor Sleep, Insomnia Symptoms and Stress in Undergraduate Students." *Sleep Medicine Reviews* 61: 101565. doi:10.1016/j.smrv.2021.101565.

Harvey, A.G. 2002. "A Cognitive Model of Insomnia." *Behaviour Research Therapy* 40: 869–893. doi:10.1016/s0005-7967(01)00061-4.

Hinz, A., H. Glaesmer, E. Brahler, M. Loffler, C. Engel, C. Enzenbach, U. Hegerl, and C. Sander. 2017. "Sleep Quality in the General Population: Psychometric Properties of the Pittsburgh Sleep Quality Index, Derived from a German Community Sample of 9284 People." *Sleep Medicine* 30: 57–63. doi:10.1016/j.sleep.2016.03.008.

Holmen, H., K. Riiser, B. Løyland, I.H. Sandbekken, K. Almendingen, R. Andenæs, A.K. Bjørnnes, et al. 2021. "Students' Top 10 Priorities of Research Uncertainties on Students' Sleep: A Pragmatic James Lind Alliance Approach." *BMJ Open* 11: Article e043697. doi:10.1136/bmjopen-2020-043697.

Johns, M.W. 1991. "A New Method for Measuring Daytime Sleepiness: The Epworth Sleepiness Scale." *Sleep* 14 (6): 540–545. doi:10.1093/sleep/14.6.540.

Johnson, R.B., A.J. Onwuegbuzie, and L.A. Turner. 2007. "Toward a Definition of Mixed Methods Research." *Journal of Mixed Methods Research* 2: 112–133. doi:10.1177/1558689806298224.

Kiltz, L., R. Rinas, M. Daumiller, M. Fokkens-Bruinsma, and E. Jansen. 2020. "'When They Struggle, I Cannot Sleep Well Either': Perceptions and Interactions Surrounding University Student and Teacher Well-Being." *Frontiers in Psychology* 11: 578378. doi:10.3389/fpsyg.2020.578378.

Kroenke, K., R.L. Spitzer, and J.B. Williams. 2001. "The PHQ-9: Validity of a Brief Depression Severity Measure." *Journal of General Internal Medicine* 16 (9): 606–613. doi:10.1046/j.1525-1497.2001.016009606.x.

Kryger, M.H., T. Roth, and W.C. Dement. 2017. *Principles and Practice of Sleep Medicine*. 6th ed. Philadelphia, PA: Elsevier.

Leenaars, C.H., I.P. Klinkenberg, A. Aussems, N. Borger, V. Faatz, A. Hak, E. Houben, J. Ramackers, D. Snackers, and A. Kalsbeek. 2015. "Sleep and Food Choice in a Dutch Student Population." *Journal of Circadian Rhythms* 13: 6. doi:10.5334/jcr.ag.

Lund, H.G., B.D. Reider, A.B. Whiting, and J.R. Pritchard. 2010. "Sleep Patterns and Predictors of Disturbed Sleep in a Large Population of College Students." *Journal of Adolescence Health* 46 (2): 124–132. doi:10.1016/j.jadohealth.2009.06.016.

Nolen-Hoeksema, S. 2001. "Gender Differences in Depression." *Current Directions in Psychological Science* 10: 173–176. doi:10.1111/1467-8721.00142.

O'Cathain, A., E. Murphy, and J. Nicholl. 2008. "The Quality of Mixed Methods Studies in Health Services Research." *Journal of Health Services Research & Policy* 13: 92–98. doi:10.1258/jhsrp.2007.007074.

O'Cathain, A., E. Murphy, and J. Nicholl. 2010. "Three Techniques for Integrating Data in Mixed Methods Studies." *British Medical Journal* 341: C4587. doi:10.1136/bmj.c4587.

O'Neill, S., M. McLafferty, E. Ennis, C. Lapsley, T. Bjourson, C. Armour, S. Murphy, B. Bunting, and E. Murray. 2018. "Socio-demographic, Mental Health and Childhood Adversity Risk Factors for self-harm and Suicidal Behaviour in College Students in Northern Ireland." *Journal of Affective Disorders* 239: 58–65. doi:10.1016/j.jad.2018.06.006.

Prichard, J.R. 2020. "Sleep Predicts Collegiate Academic Performance: Implications for Equity in Student Retention and Success." *Sleep Medicine Clinics* 15 (1): 59–69. doi:10.1016/j.jsmc.2019.10.003.

Reid, A., and F.C. Baker. 2008. "Perceived Sleep Quality and Sleepiness in South African University Students." *South African Journal of Psychology* 38 (2): 287–303. doi:10.1177/008124630803800203.

Schlarb, A.A., M. Classen, J. Grunwald, and C. Vogele. 2017. "Sleep Disturbances and Mental Strain in University Students: Results from an Online Survey in Luxembourg and Germany." *International Journal of Mental Health Systems* 11: 24. doi:10.1186/s13033-017-0131-9.

Sheaves, B., K. Porcheret, A. Tsanas, C.A. Espie, R.G. Foster, D. Freeman, P.J. Harrison, K. Wulff, and G.M. Goodwin. 2016. "Insomnia, Nightmares and Chronotype as Markers of Risk for Severe Mental Illness: Results from a Student Population." *Sleep* 39 (1): 173–181. doi:10.5665/sleep.5342.

Spitzer, R.L., K. Kroenke, J.B. Williams, and B. Lowe. 2006. "A Brief Measure for Assessing Generalized Anxiety Disorder: The GAD-7." *Archives of Internal Medicine* 166 (10): 1092–1097. doi:10.1001/archinte.166.10.1092.

Tennant, R., L. Hiller, R. Fishwick, S. Platt, S. Joseph, S. Weich, J. Parkinson, J. Secker, and S. Stewart-Brown. 2007. "The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): Development and UK Validation." *Health and Quality of Life Outcomes* 5: 63. doi:10.1186/1477-7525-5-63.

Van De Water, A.T.M., A. Holmes, and D.A. Hurley. 2011. "Objective Measurements of Sleep for non-laboratory Settings as Alternatives to Polysomnography - A Systematic Review: A Systematic Review of Objective Sleep Measures." *Journal of Sleep Research* 20 (1pt2): 183–200. doi:10.1111/j.1365-2869.2009.00814.x.

Wróbel-Knybel, P., H. Karakuła-Juchnowicz, M. Flis, J. Rog, D.E. Hinton, P. Boguta, and B. Jalal. 2020. "Prevalence and Clinical Picture of Sleep Paralysis in a Polish Student Sample." *International Journal of Environmental Research and Public Health* 17 (10): 3529. doi:10.3390/ijerph17103529.

Zhang, B., and Y.K. Wing. 2006. "Sex Differences in Insomnia: A meta-analysis." *Sleep* 29: 85–93. doi:10.1093/sleep/29.1.85.