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Time to think: Subjective sleep quality, trait anxiety and university start time.

Ray Norbury[a,*], Simon Evans[b]

[a] Department of Psychology, University of Roehampton, London, UK, SW15 4JD
[b] School of Psychology, Faculty of Health and Medical Sciences, University of Surrey, Guildford, Surrey, UK, GU2 7XH

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ABSTRACT

Poor quality sleep is related to mental health and there is increasing interest in student wellbeing and mental health. The aim of the current study was to evaluate sleep quality, daytime dozing, anxiety proneness, chronotype and preferred start time in a sample of university students. A total of 546 university students (age range, 18–55) from two university located in South East England were included and completed an online survey. Participants' self-reported age, gender, year and field of study. Sleep quality, anxiety, daytime dozing, coffee/caffeine/tobacco use (coded as binary variables), preferred start time and chronotype were also recorded. Data were analysed using independent samples *t*-tests, chi-square, simple mediation-analyses and Analysis of Variance. Across the entire sample 46% percent of participants rated their sleep as fairly bad or very bad. Poor quality sleep was associated with significantly higher levels of anxiety which was not mediated by chronotype. Poor quality sleep is more prevalent in the first year of university and our sample endorsed a start time for university activities approximately 2 h later than currently timetabled. The current findings demonstrate that a large proportion of students are chronically sleep deprived, obtaining, on average, less than 7 h sleep per night on week days and this was more marked in first year students. In addition, we show that poor sleep is associated with increased anxiety. Based on the current evidence the authors suggest a review of current university timetabling and examination scheduling merits immediate consideration by policy makers and educators.

1. Introduction

In mammals sleep is critical to survival and optimal health. Sleep plays a key role in brain function and systemic physiological processes including metabolism, cardiovascular and immune system function. Given the importance of sleep in central and systemic function it is perhaps not surprising that poor sleep is associated with a number of negative physical health outcomes. For example, poor sleep has been associated with reduced cardiometabolic health generally, as well as with specific conditions such as Type-2 diabetes (Cappuccio et al., 2010), cardiovascular disease (Cappuccio et al., 2011), stroke (Li et al., 2016) and obesity (Cappuccio et al., 2008).

Poor quality sleep is also related to mental health and there is increasing interest in student wellbeing and mental health. Prevalence estimates of mental health conditions in university students rose nearly five-fold in the period 2006–2015. The number of student suicides rose by 79% during the same period. In 2014/15, a record number of students (1180) who experienced mental health problems dropped-out of university, an increase of 210% compared to 2009/10 (Not by degrees, 2017). Recent UK Government initiatives are designed to target mental health in childhood and young adults (Children and young adults, 2017) and universities are investing heavily in counselling and support services (Not by degrees, 2017). There has been a substantial increase in the numbers of students reporting mental health problems, although the underlying reasons for this increase are unclear and may simply reflect an increased willingness to disclose such information. Nevertheless students, relative to other young adults, may be at increased risk of poorer mental health and wellbeing due to academic workload, financial and social pressures (Kwan et al., 2016).

For a large proportion of students, entering university is a major life-transition and is associated with many significant life adjustments across numerous domains. This period of emerging adulthood, which typically leaves individuals with increased autonomy and reduced adult supervision, is associated with increased hazardous behaviours (e.g. drug taking, binge drinking) and reduced protective, health-promoting behaviours (e.g. physical activity and healthy eating) (Kwan et al., 2012). These changes in environment and routine may leave university students at increased risk for developing sleep problems such as

* Corresponding author.
E-mail address: ray.norbury@roehampton.ac.uk (R. Norbury).

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difficulties falling asleep, frequent night awakenings and nightmares (Schlarb, 2015). For example, Forquer et al. (2008) reported significantly later bed and rise times on weekends as compared to week days (differing by more than 2 h). More recently, Becker et al. (2018) reported that 27% of university students rate their sleep quality as poor, over a third obtain fewer than seven hours of sleep per night and over 40% of students reported taking longer than 30 m to fall asleep one or more nights per week (Becker et al., 2018).

Emerging evidence, albeit largely limited to school-age children, suggests a positive impact of later start time on sleep quality, behaviour, academic and health outcomes. In a recent systematic review Minges and Redeker (2016) reported that delayed start time (in the studies included for review these ranged between ~25 and 60 m) was associated with reduced daytime sleepiness and caffeine use and improved mood (Minges and Redeker, 2016). In a mixed within- and between-cohort design Chan and colleagues (Chan et al., 2018) reported that a delay in start time of one hour (from 7:30am to 8:30am) was associated with increased total sleep time, higher life satisfaction and reduced depressive symptoms as measured by the Depression and Anxiety Stress Scale (DASS). Taking advantage of the Uruguayan school shift system, whereby pupils are randomly assigned to attend school either early in the morning or afternoon, Estevan et al. (2018) reported no between-group (early vs. late start) differences in Grade Point Average (GPA). However, chronotype was a significant predictor of GPA in the morning group only - thereby demonstrating an impact of circadian preference on school performance only when the student is exposed to temporal misalignment (i.e. early morning starts). In a large sample (>35,000) cross-sectional study of Canadian adolescents Patte and colleagues reported that later school start time was associated with longer sleep duration and that students attending schools with later start times were more likely to report adequate sleep (Patte et al., 2017). Unfortunately, Patte and colleagues did not report any association between start time and academic achievement or mental health and only a limited number of schools had a start time of 9 am or later. Nevertheless, current evidence suggests a positive impact of delayed start time in adolescents and policies regarding school start times merit consideration. Indeed, the American Medical Association (AMA) recently released a policy document encouraging schools to take note of the above evidence and delay school start-times to no earlier than 8:30am.

Evidence assessing the impact of start time on tertiary level students is limited. Although a typical university schedule is less rigid when compared to a primary or secondary school timetable, the teaching day generally starts at similar fixed time, which, especially considering that many students may commute to university, has little regard to optimal functioning for students. A recent survey of university students demonstrated a marked preference for a later start time with the majority of students endorsing a start time of between 11am and 1pm (Evans et al., 2017). As Evans et al. note, adolescence and early adulthood is associated with a marked shift in preferred sleep times of 2–3 h later in the day peaking in females at 19.5 years and 20.9 in males. The preference for a later start time, therefore, likely reflects a drive to minimise the temporal misalignment between internal biological time and external societal demands.

Following previous work, the aims of the current study were to evaluate sleep quality, daytime dozing, anxiety proneness, chronotype and preferred start time in a sample of university students. We hypothesised that poor sleep quality would be associated with increased anxiety and daytime dozing. We also make the guarded prediction that the association between sleep quality and anxiety proneness would be mediated by chronotype.

Table 1
Participant characteristics.

Characteristic	Study sample (*n* = 546)
Male:Female (*n* (%)):	85 (16): 461 (84)
Age (mean/SD,/range)	20.4/4.31/18–55
Sleep quality (*n* (%)):	
Very good	34 (6)
Fairly good	259 (47)
Fairly bad	193 (35)
Very bad	60 (11)
Chronotype (*n* (%)):	
Early	36 (6.6)
Intermediate	266 (48.7)
Late	244 (44.7)
Trait anxiety (mean/SD,/range)	47.37/10.9/20–78
Discipline (*n* (%)):	
Psychology	486 (89)
Life sciences	17 (3)
Social sciences	15 (3)
Other	30 (5)
Year of study (*n* (%)):	
1st	291 (53)
2nd	225 (41)
3rd	30 (6)

2. Methods

2.1. Participants

A total of 546 students, enrolled in two universities located in South East England. Participants ranged in age from 18–55 years and 84% self-identified as female. The majority of students were in their first year of study (53%) and studying psychology (89%, please see Table 1). The study was advertised to students online via a participant recruitment and management portal hosted by the University and implemented using SONA systems (https://www.sona-systems.com/). When students visit this internal site they are presented with a list of available studies and can select studies they wish to take part in. The announcement text for the current study was as follows: "*If you are a full-time undergraduate please take the time to complete this online survey. We want to know if you are an early bird or a night owl and what you think would be the best start time for your first scheduled university activity of the day (lecture/seminar/workshop etc*."). Participation was entirely voluntary. Eligible students received course credit for participation.

2.2. Procedures

All procedures were approved by the relevant Institutional Review Boards (IRB) and participants provided informed consent prior to completing the online survey. All consent procedures and data collection was conducted online, using Qualtrics (Qualtrics®, Provo, UT) an online application for secure data collection. Data were collected and stored anonymously, and the researchers had no direct involvement in data collection, or contact with the participants. The survey was available from October 2017 to April 2018 and participants were free to complete the study at a time of their choosing.

2.3. Measures

Subjective sleep quality was assessed using component 1 from the Pittsburgh Sleep Quality Index, PSQI (Buysse et al., 1989). Scoring for this component is based on a four-point scale (0 = very good sleep, 1 = fairly good, 2 = fairly bad, and 3 = very bad), here dichotomised as good/poor sleepers. Chronotype was determined using the 5-item Reduced Morningness-Eveningness Questionnaire (Adan and Almirall, 1991). The rMEQ requires participants to indicate their response on a 4-point scale (e.g., "During the first half hour after you wake up in the morning, how do you feel?" "Very tired", "fairly tired", "fairly refreshed", and "very refreshed"). This scale is reported to have moderate reliability and validity (α = .56) (Urbán et al., 2011) and higher scores on this instrument indicate increased morningness. Sleep duration was determined separately for study days and free days, using the Munich Chronotype Questionnaire (Wittmann et al., 2006). Anxiety proneness was measured using the 20 item Spielberger Trait Anxiety Index (STAI) (Spielberger et al., 1970). Frequency of feelings "in general over the past month" are assessed using a four point scale: 1) almost never, 2) sometimes, 3) often, and 4) almost always. This instrument is reported to have good reliability and validity (α = .86) (Julian, 2011), with higher scores indicating higher anxiety. Daytime dozing as assessed using the Epworth Sleepiness Scale (ESS; Johns, 1991) is an 8-item questionnaire and participants are required to indicate the 'chance of dozing' in various situations (e.g. sitting and reading). Individual items are scored on a 4-point scale (0 = never doze, 1 = slight chance of dozing, 2 = moderate chance of dozing, and 3 = high chance of dozing). The ESS has been reported to have good internal consistency (α = .86) (Johns, 1992). Caffeine, coffee, tobacco use and alcohol consumption were recorded as dichotomous (yes/no) variables. Participants were also asked to indicate their preferred start time for university activities. Specifically, participants were asked; "Please indicate your preferred University start time (i.e. your preferred start time for the first scheduled activity of the day and when you would be feeling at your peak). Please note that any shifts earlier or later for start time would have a corresponding impact on finish time."

2.4. Statistical treatment

Independent samples *t*-tests were used to compare sleep groups (good vs. bad sleepers). Cohen's *d* was computed and reported as a measure of effect size with 0.2, 05 and 0.8 considered, respectively, as small, medium or large effects. Chronotype was treated as a continuous variable in the mediation analyses (see below), and as a categorical variable for descriptives and additional analyses. Mediation analyses included sleep quality (PSQI), trait anxiety (TAI), eveningness (rMEQ) as the dependent, predictor and mediator variables. Bootstrap mediation analysis was implemented through the PROCESS toolbox (Preacher and Hayes, 2004). We utilised bootstrap (5000 bootstrap samples) for coefficient and indirect estimation. The indirect effect was statistically significant if the 95% bias-corrected confidence intervals (CIs) for the indirect effect did not include zero. All statistical analyses were implemented using the Statistical Package for Social Sciences (SPSS) v21 (IBM, New York, USA).

3. Results

3.1. Sleep quality and duration

Across the entire sample 46% percent of participants rated their sleep as fairly bad or very bad. Average sleep duration on study days was 6.55 h with 33% of participants reporting ≤ 7 h of sleep. By contrast, average sleep duration on free days was 8.8 h with only 11% of participants reporting ≤ 7 h of sleep. In terms of daytime dozing (as measured by the ESS), nearly a quarter of students reported mild, moderate or severe excessive daytime sleepiness. We did not observe any sex differences in average sleep duration on study days (Females: $M = 6.56$ h, SD = 1.48; Males: $M = 6.47$ h, SD = 1.57; $t(544) = -.574$, $p = .57$) or free days (Females: $M = 8.79$ h, SD = 1.64; Males: $M = 8.78$ h, SD = 1.42; $t(544) = -.084$, $p = .93$). Nor did we observe any sex differences in the proportion of males vs. females that slept ≤ 7 h of sleep on study ($\chi^2(1) = .30$, $p = .59$) or free days ($\chi^2(1) = .26$, $p = .62$).

3.2. Chronotype

The majority of students were determined to be intermediate-type (49%, rMEQ score between 12 and 21), 45% were evening type (range 4–11) and 6% morning type (score > 21). Pooling early and intermediate types into a single early/intermediate group we observed an association between late chronotype and poor sleep quality ($\chi^2(1) = 14.34$, $p < .001$). Late type, as compared to early/intermediate type was associated with increased daytime dozing (late type: $M = 8.23$, SD = 4.14; early/intermediate types: $M = 7.10$, SD = 3.87; $t(544) = -3.304$, $p < .001$) and a later start time (late type: $M = 11{:}09$, SD = 1:11; early/intermediate types: $M = 10{:}21$, SD = 1:04; $t(544) = -8.13$, $p < .001$). Morningness-Eveningness scores increased with year of study (1st year $M = 11.66$, SD = 3.58, 2nd year $M = 12.29$, SD = 3.58, 3rd year $M = 13.63$, SD = 3.51, $F(2, 543) = 4.82$, $p = .008$). Post hoc analyses, with Bonferroni adjustment, showed a significant difference between years one and three (1.97, $p = .012$, 95% CI [0.33, 3.61]) suggesting a move to more morningness as students' progress through university. We did not observe any association between chronotype and gender ($\chi^2(1) = 3.6$, $p = .06$).

3.3. Good vs. poor sleeper groups

Comparing good (PSQI component one score of 0 or 1) vs. poor (score of 2 or 3) sleepers (Table 2) we observed significantly greater anxiety levels in poor sleepers ($t(544) = -.6.97$, $p < .001$, $d = .6$, Fig. 1), and higher levels of daytime dozing ($t(544) = -.3.13$, $p = .002$, $d = .3$). Poor sleepers had a significantly lower chronotype (more evening type) score as compared to good sleepers ($t(544) = 5.41$, $p < .001$). Mediation analyses demonstrated that the effect of sleep quality on anxiety proneness was not mediated by chronotype (point estimate .31, standard error (SE) = .18, 95% confidence interval (CI) [−.03, .71].

Groups did not differ in terms of gender ratio ($\chi^2(1) = 1.63$, $p = .20$), caffeine ($\chi^2(1) = 2.78$, $p = .09$), coffee ($\chi^2(1) = .583$, $p = .45$) or alcohol use ($\chi^2(1) = .357$, $p = .55$). Poor sleep was, however, associated with tobacco use ($\chi^2(1) = 9.85$, $p = .002$, $\phi_c = .13$). In terms of sleep duration, good and poor quality sleepers were similar on both free ($t(544) = 1.53$, $p = .15$) and study days ($t(544) = 1.68$, $p = .09$). Across the entire cohort, mean preferred start time was 10:42am (range 8:00am–4:00pm). Between groups, poor sleepers endorsed a moderately later time of 10:51am, as compared to 10:35am preferred by good sleepers ($t(544) = -2.52$, $p < .012$, $d = .23$).

3.4. Year of study

Given the small percentage of 3rd year students in the present sample we limited our analyses to 1st and 2nd years. There was a significant association between sleep quality and year of study ($\chi^2(1) = 25.00$, $p < .001$). The odds ratio for reporting poor sleep

Table 2
Participant characteristics (M/SD; % yes:% no). ESS – Epworth Sleepiness Scale. *P* values for independent samples *t*-test (anxiety, ESS, chronotype, sleep duration) or chi-square test (caffeinated drinks, coffee, cigarettes, alcohol).

Measure	Good sleepers (n = 293)	Bad Sleepers (n = 253)	p
Trait anxiety	44.45/10.21	50.71/10.72	< .001
ESS	7.1/4.0	8.17/ 4.0	.002
Chronotype	12.74/3.42	11.12/3.38	< .001
Sleep duration:			
Free days	8.89/1.53	8.69/ 1.70	.153
Study days	6.65/1.34	6.43/1.61	.097
Caffeinated drinks	64:36	44:56	.20
Coffee	11:89	13:87	.45
Cigarettes	10:90	20:80	.002
Alcohol	51:49	46:54	.55

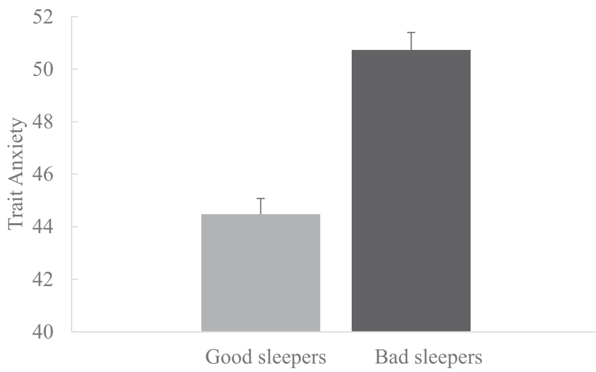

Fig. 1. Trait anxiety (STAI score) in good and bad sleepers. Bars show mean, error SEM.

quality was 1.4 times for 1st year students, whereas 2nd year students were 1.8 times more likely to self-report as good quality sleepers. We also observed a significant interaction between sleep duration on free and study days and year of study, $F(1,514) = 7.12, p = .008, \eta^2 = 0.14$. *Post hoc* analyses demonstrated that, for poor quality sleepers, 1st year students had shorter sleep duration than 2nd years on study days (1st year, $M = 6.40$, SD = 1.43, 2nd year, $M = 6.75$, SD = 1.54, $t(514) = -2.68$, $p = .008$. Whereas average sleep on free days and anxiety levels was not significantly different. Original data can be accessed using the link provided at the end of this manuscript.

4. Discussion

The current findings demonstrate a number of interesting issues related to sleep quality and wellbeing in a multi-site population of university students. First, our data suggest that over a third of students are chronically sleep deprived, obtaining, on average, less than 7 h sleep per night on study days. Second, poor sleep was also associated with increased anxiety. Third, poor quality sleep is more prevalent in the first year of university. Finally, our sample indicated they would prefer to start university activities later in the day than currently timetabled, the most parsimonious start-time being 11am.

Current UK guidelines suggest that adults under the age of 65 require 7–9 h of sleep per night (How much sleep do we need?, 2018). Here, even taking the lower limit of 7 h, 33% of students fail to meet that target on a week night. In addition, nearly a quarter of students reported mild or more extreme excessive daytime dozing and, not surprisingly, the degree of daytime dozing was more marked in students assessed as poor sleepers.

Sleep quality has important associations with mental health. Here, we observed elevated anxiety levels in poor vs. good quality sleepers; poor sleep had a medium-to-large effect on anxiety ($d = .6$). Across the general population, chronic, insufficient sleep (similar to as reported here) is associated with increased depressive and anxious symptomatology (Sullivan and Ordiah, 2018). In university populations Haregu et al. (2015) reported that students with poor sleep quality (as assessed by the PSQI) were nearly 5 times more likely to suffer from a common psychiatric disorder (e.g. anxiety or depression) (Haregu et al., 2015). In a sample of nearly 500 Lebanese students Choueiry et al. (2016) observed that nearly 30% of students presented with clinically significant anxiety and that anxiety was significantly associated with sleep quality (Choueiry et al., 2016). Two independent studies in medical students (Fawzy and Hamed, 2017; Kalyani et al., 2017) reported high prevalence of moderate to severe anxiety (70% and 40%, respectively) which correlated with sleep quality. Although these latter two studies (Fawzy and Hamed, 2017; Kalyani et al., 2017) included medical students only who may be exposed particular levels of emotional and physical stress, the results are consistent with other work indicating a link between sleep quality and anxiety. We also found that poor quality sleepers were more likely to be evening types, although the mediation analysis showed that chronotype did not mediate the effect of sleep quality on anxiety levels. Previous work has linked eveningness to anxiety in students (Azad-Marzabadi and Amiri, 2017; Hsu et al., 2012) although sleep quality was not considered. Another study in healthy young adult males found that both poorer sleep efficiency and eveningness correlated with anxiety, but no further analyses were conducted (Pace-Schott et al., 2015). Our results underline the importance of measuring sleep quality, and the use of mediation analyses or similar, in order to fully characterise the nature of these relationships.

In addition to the widely recognised negative impact of sleep on physical health, poor sleep is also associated with detrimental effects on cognition. Attention, which supports goal-directed behaviour, is particularly susceptible to sleep loss and attentional maintenance becomes more variable and erratic with accrued time awake (Belenky et al., 2003). Working memory, a limited capacity system for holding and manipulating information is also disrupted following sleep loss. For example, partial (four consecutive nights sleep restricted to 4 h) or total (one night with no sleep) sleep deprivation spares visual memory capacity (the ability to retain multiple items of visual information) but the ability to ignore distractor information is significantly reduced following total sleep deprivation (Drummond et al., 2012). By contrast, Gosselin and colleagues (Gosselin et al., 2017) reported a small detrimental effect of partial sleep deprivation on a visuospatial working memory task and Van Dongen (2003) demonstrated significant and cumulative deficits on a digit symbol substitution task in participants with sleep restricted to either 4- or 6-h relative to 8 h of time in bed. General memory is also negatively impacted by sleep loss. Cousins et al. (2018) reported reduced recognition of previously encoded images after 5 consecutive nights or restricted sleep (5 h) as compared to a control group and Chatburn et al. (2017) observed reduced veridical recognition and recall, and false memory recognition following both total and partial sleep deprivation (Chatburn et al., 2017).

Related to the above observations that report reduced cognitive function following sleep loss, poor sleep quality and short sleep duration also negatively impact on academic achievement. For example, Gilbert and Weaver (2010) reported a negative association between academic performance (as indexed by GPA) global sleep quality (PSQI) and sleep duration in a cohort of psychology students similar in terms of age and gender profile to the current sample (Gilbert and Weaver, 2010). Gomes et al. (2011) demonstrated that self-report sleep quality and frequency of sufficient sleep were significant predictors of academic achievement (Gomes et al., 2011). In a study of US college students Gaultney (2010) reported that over 25% of students surveyed were at risk for one or more sleep disorders and that the presence of sleep disorder and poor quality sleep was associated with significantly lower GPA (Gaultney, 2010). By contrast, Onyper et al.,observed no benefit of delayed start-time on academic performance despite this being associated with longer sleep time and reduced daytime dozing (Onyper et al., 2012). Of interest, Onyper and colleagues found that later start-time was associated with increased alcohol consumption which may have negatively impacted on academic performance. In addition, Valladares et al. (2017) observed greater GPA in morning type individuals as compared to evening types (Valladares et al., 2017). Unfortunately, Valladares et al., did not measure sleep quality and late chronotype is widely associated with poor sleep quality - the direct effect of chronotype, independent of sleep measures, therefore cannot be determined. Similarly, Beşoluk et al. (2011) reported that individuals with more of a morning preference performed better on their final examination (administered at 9:30am) as compared to evening types. In a novel approach, Evans and colleagues invited 1st and 2nd year undergraduate students attending a North American university to rate their fitness for cognitive activities across each hour of the day (thereby creating a full 24-hour circadian profile for each student)

(Evans et al., 2017). In that study peak performance (as assessed by the above question) began at ~11am and remained stable late into the evening - data that are in good agreement with the current findings. A burgeoning corpus therefore, from a number of different countries and using a variety of methods, highlights the benefits of later start-time on sleep duration and the majority of findings indicate a positive impact of later start time on academic performance (but see Onyper et al., 2012). Here, we did not measure academic performance although the current participants endorsed a start time 2 h later than currently implemented. Future studies, including well-designed longitudinal designs that can assess and immediate and long-term effects, are required to further understand the impact of delayed start time on academic performance.

This study has a number of limitations that should be taken into consideration when interpreting the results. First, we assessed sleep quality with a single item from the PSQI (component 1). Future studies would benefit from applying the entire questionnaire, additional subjective metrics (e.g. measures of insomnia) and objective quantification of sleep (e.g. actigraphy). Second, the majority (89%) of respondents were psychology students. We cannot, therefore, generalise the current findings to other disciplines or fields of study conducted at university (i.e. arts or history). Previous work examining start time in student samples from across a range of degree programmes (e.g. Evans et al., 2017) report similar results to ours; this suggests results might be generalizable but follow-up studies are needed to confirm this. Third, we did not observe any sex differences in average sleep duration on study or free days or the proportion of males to females assessed good or bad sleepers. However, only 16% of the study sample was male. Future studies that include similar numbers of male and female students are warranted. Finally, as a cross-sectional study, temporality cannot be inferred and clearly the directionality of the association between sleep quality and anxiety is critical to inform prevention and treatment. Sleep (and circadian rhythm) disorders show widespread comorbidity with established psychiatric disorder. However, disturbed sleep may not simply be a sequela of distressing symptoms. Rather, disturbed or poor sleep can precede acute psychiatric symptoms thereby marking sleep as an potential important mediator of disorder onset, maintenance and relapse (Sheaves et al., 2016). Sleep, therefore, offers a modifiable behaviour that could be targeted to prevent or modify subsequent progression of psychiatric disorder. Indeed, limited intervention research (Trockel et al., 2011) indicates a cognitive behavioural self-help program designed to improve sleep increased both sleep quality and reduced depressive symptoms in participants classified as poor sleepers at baseline. Longitudinal studies are required to determine directionality and pinpoint intervention targets.

In conclusion, our findings support earlier work demonstrating that a large proportion of students are chronically sleep deprived, obtaining, on average, less than 7 h sleep per night on week days and this was more marked in first year students. In addition, we show that poor sleep is associated with increased anxiety. Finally, the current sample indicated a preferred start to university activities approximately two hours later than currently timetabled. Based on our observations and previous work we recommend Universities consider providing better education on the importance of sleep quality (e.g. leaflets and workshops on sleep hygiene) supported by access to fully-trained and well-provisioned student counselling services.

Conflict of interest

There authors report no conflicts of interest.

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Author contributions

Initial conception, design and implementation of the study were conducted by RN. Data collection was performed by RN and SE. Initial drafting of this article was completed by RN with critical revisions provided by SE. All authors gave final approval for the original submission and subsequent revisions.

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