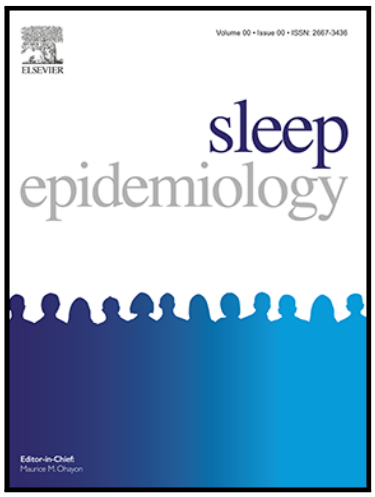

Nap time: Adolescent napping patterns and associations with sleep problems and mental health

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Nap time: Adolescent napping patterns and associations with sleep problems and mental health

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Abstract

Adolescents are at increased risk of insufficient and ill-timed sleep, with widespread effects on health and functioning. However, little is known about napping and mental health correlates in adolescence. We sought to describe napping behaviours, to examine associations between napping, mental health, and wellbeing, and whether sleep problems helped explain any relationships found. This study included data from 26,373 students (typical age: 11–18 years) who participated in the 2023 OxWell Student Survey. Correlational and multivariable regression analyses were conducted to explore associations between long daytime napping (> 1hr), evening napping (after 6pm) (measured on ASHS-r), sleep problems (SCI-02), anxiety and depression symptoms (RCADS-11), hallucination-like experiences, paranoia (B-CAP), and wellbeing (SWEMWBS). Approximately 45% of young people had taken long daytime naps and 34% had taken evening naps during the past month. More frequent naps correlated with higher levels of sleep problems, anxiety symptoms, depression symptoms, hallucination-like experiences, paranoia, and lower wellbeing. In regression models, napping predicted worse mental health and wellbeing. When added in the model, sleep problems (SCI-02 total scores) emerged as a stronger predictor with a marked increase in explained variance. Furthermore, moderated regression models revealed that napping was more strongly associated with anxiety symptoms, depression symptoms and wellbeing for those outside cutoff than those with probable insomnia (SCI-02 ≤ 2). Our findings indicate that excessive napping is distinctly associated with young people's mental health and wellbeing, although sleep quality is more strongly associated. It is therefore important to consider napping alongside sleep in relation to psychological health.

Keywords

Napping; Insomnia; Circadian Rhythm; Anxiety; Depression; Wellbeing; Adolescents

Introduction

Adolescents are consistently reported to be at increased risk of insufficient and ill-timed sleep [1,2]. Adolescents experience developmental shifts in their circadian rhythm, while school, family, and community structures around them are potentially set at times aligned with the natural rhythms of childhood and adult sleep [3,4]. Napping in adolescence is one element of the pattern of sleep that has to date been overlooked, even though young people could regularly be trying to catch up on sleep this way. Naps may be beneficial at times – for example, naps varying in duration from approximately 10–60 minutes have been found to reduce daytime sleepiness, and improve alertness, mood, attention, concentration, reaction times, and memory [5–7].

Napping may be a marker of poor sleep, reflecting the quality of an individual's sleep, and may contribute to further disruption of night-time sleep [8–11]. The need (homeostatic load) for sleep builds up during wakefulness – one of the key drivers of good quality night-time sleep – therefore, napping might lead to poorer quality sleep by reducing sleep pressure [12,13]. In sleep quality recommendations, fewer naps per 24 hours were considered to generally indicate good sleep quality while longer naps over the lifespan did not indicate good overall sleep quality [14]. This is reflected in findings that diary-reported napping predicted poorer self-reported sleep quality that night in healthy adolescents [8]. In addition, napping occurred regularly in chronically sleep-restricted adolescents, who

demonstrated shorter sleep duration and later sleep timing than the general adolescent population [10].

Naps vary in duration, timing and sleep architecture [15]. It is important to consider that napping can have detrimental consequences and whether napping has a downside may depend on a number of factors. Time of day is salient given that napping in the evening may more directly impact on that night's sleep, resulting in increased sleep latency and a reduction in the quality and quantity of sleep [15]. The duration of the nap is also noteworthy. In work with adults, "longer" naps – although not defined by consensus, but probably for those naps that are over 20–30 minutes [16] – tend to have a higher percentage of slow-wave sleep with a greater occurrence of sleep inertia [17]. Napping recommendations, albeit varying in detail, encompass the duration and timing of naps: it has been put forward that napping should be brief (around 20 minutes), and should take place no later than the early afternoon (around 3pm; for those not working night shifts) [18–20]. Adhering to this guidance is suggested to help avoid both sleep inertia and a reduction in homeostatic sleep pressure (sleep drive) that may then make it more difficult to sleep at night.

A great deal of evidence supports concurrent and longitudinal associations between sleep problems and mental health symptoms in adolescence, including anxiety, depression, and psychotic experiences (paranoia and hallucinations) [21–24]. Indeed, disrupted sleep has been proposed as a contributory causal factor in most mental health conditions [25]. Napping has been linked to negative mental health outcomes in adults, for example depression [26]. However, little is known about adolescent napping behaviour and mental

health correlates. Individuals with mental health conditions might experience a greater need to nap. As such, napping may be a possible indicator of current health conditions, and an early marker of mental health difficulties. Furthermore, it has been proposed that assessing nap behaviour in conjunction with night-time sleep is crucial when investigating the health relevance of napping, particularly regarding psychological health outcomes. For example, daytime sleep behaviour may not be associated with an increased risk of depression if night-time sleep quality is high [27].

Understanding more about napping could help to elucidate the associations between sleep and mental health as well as to shed light on whether it is important to measure naps when assessing adolescent sleep. The present study aimed to (1) map the napping behaviours of adolescents, including two types of nap that may be considered potentially problematic for night-time sleep: long daytime naps and evening naps; (2) determine if there is a relationship between napping, sleep problems, mental health problems, and wellbeing; and (3) establish whether sleep problems help explain any relationship between napping and mental health problems and wellbeing. We predicted that frequent long daytime naps and frequent evening naps would each be associated with high levels of sleep problems. In addition, we expected to find that frequent long daytime naps and frequent evening naps would each be associated with high levels of anxiety symptoms, depression symptoms, psychotic-like experiences, and low wellbeing. However, due to the scarce literature on napping in adolescence, no predictions were made regarding napping and mental health problems when controlling for sleep problems.

Methods

Participants and design

The OxWell Student Survey is a repeated cross-sectional survey of schools and further education colleges (FECs) which asks students a range of questions on mental health and wellbeing, life experiences, and behaviours [28]. We used data from the 2023 survey, collected in February to March 2023, sampled primarily from four regions in England: Oxfordshire, Berkshire, Liverpool, and Milton Keynes. Our study is based on responses provided by those in school years 7 to 13 (typical ages 11 to 18-years-old). Following recruitment by local authorities, 77 secondary schools and FECs took part and provided data.

Students were invited to participate through their school/FEC using a parental opt-out model, with those under 16 years providing assent and those 16 years and over providing consent to participate. The OxWell study was approved by the research ethics committee of the University of Oxford (R62366). The analyses for the present study was pre-registered on Open Science Framework (OSF) [29].

Measures

Napping was measured from the two items that comprise the "Daytime sleep" subscale in The Adolescent Sleep Hygiene Scale – Revised (ASHS-r) [30]. Participants were asked to select how often the following things had happened during the past month: 1. "During the day, I take a nap that lasts more than 1 hour" and 2. "After 6:00 in the evening, I take a nap." Each item is rated on a 6-point scale (from 1 = "Never – has not happened" to 6 = "Always – happened 100% of the time". A higher score indicates more frequent napping. In this study, the first item is described as "Long daytime napping" while the second is described as "Evening napping".

Sleep problems were measured using the two-item version of the Sleep Condition Indicator (SCI-02) [31]; this has been validated for use in adolescents [32]. Items include: 1. “Thinking about the past month, to what extent has poor sleep troubled you in general?” (response options: “not at all” to “very much”) and 2. “Thinking about a typical night in the last month, how many nights a week do you have a problem with your sleep?” (response options: 0–1 to 5–7). Each item is rated on a 5-point scale (0–4), reverse scored, and summed. Total scores range from 0–8. Higher values indicate better sleep quality whilst lower values indicate greater symptom severity. A score of ≤ 2 is considered to reflect DSM-5 threshold criteria for insomnia disorder.

Anxiety and depression symptoms were measured using the 11-item Revised Children’s Anxiety and Depression Scales (RCADS-11) [33]. This measures anxiety symptoms (6 items) and depression symptoms (5 items). Each item is rated on a 4-point scale (from 0 = “never” to 3 = “always”) and summed to provide a total anxiety sub-score (0–18) and a total depression sub-score (0–15). Higher scores indicate greater mental health difficulties. Mean imputation was used to account for missing scores that allowed for up to one item to be missing per sub-scale.

Psychotic-like experiences were measured using four items. Two items were used to assess hallucinatory experiences [34]: 1. “Have you ever seen something or someone that other people could not see?” and 2. “Have you ever heard voices that other people could not hear?” Each item is rated on a 3-point scale (from 0 = “not true” to 2 = “certainly true”) and summed to provide a total hallucinatory experience score (0–4). Higher scores indicate greater hallucinatory experiences. Two items from the Bird Checklist of Adolescent Paranoia (B-CAP) [35] were used to assess paranoia. Participants were asked to select how often they

have had each thought over the last 2 weeks: 1. “I feel like I’m being followed or stalked” and 2. “Groups of people are planning against me”. Each item is rated on a 6-point scale (from 0 = “never” to 5 = “all the time”) and summed to provide a total paranoia score (0–10). Higher scores indicate higher paranoia.

Mental wellbeing was measured using the Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS) [36,37]. This 7-item scale includes positively worded statements about feelings and thoughts. Examples include: “I’ve been feeling optimistic about the future” and “I’ve been dealing with problems well”. Each item is rated on a 5-point scale (from 1 = “none of the time” to 5 = “all of the time”) and summed to provide a total wellbeing score (7–35). Higher scores indicate greater wellbeing. Mean imputation was used to account for missing scores that allowed for up to one item to be missing for the scale.

Demographic information comprised school year group (Year 7–13), age (11–18 by year and Over 18) and gender. Year group was treated as a categorial variable and collapsed into three categories: Younger secondary school students (Year 7–9; typical age: 11–14 years), Mid secondary school students (Year 10–11; typical age: 14–16 years), Older secondary school/Further education students (Year 12–13; typical age: 16–18 years). Participants who responded as 18+ (*n* = 179, 0.68% of final sample) were counted as 19 when calculating mean score of age in years. Gender response options included “female”, “male”, “other” (with an option to self-identify) and “prefer not to say”. To improve inclusivity and accuracy, we transformed the responses, including the free-text responses, into categories of “girl”, “boy”, “trans and gender diverse”, “gender non-disclosing”, “likely disingenuous/not gender”, and “unsure” in line with the co-produced procedure outlined by Soneson and colleagues [38]. Gender is reported in this study as “girl”, “boy”, “gender diverse”, and

"gender non-disclosing". Responses were treated as missing for "likely disingenuous/not gender", "unsure" (due to small *n*), or if a response was not provided. The complete OxWell Student Survey 2023 secondary/FEC variable guide can be accessed at osf.io/bwech.

Analysis

Descriptive statistics are presented for the napping patterns of adolescents reporting the frequency of long daytime naps and evening naps overall as well as napping patterns by year group and gender. Means and standard deviations are presented for continuous variables and frequencies and percentages for categorical variables. Napping comparisons by year group and by gender were conducted using Welch's ANOVA, followed by Games-Howell post-hoc tests. Bivariate associations between the main variables were examined using Spearman correlations, and the presence of multicollinearity between long daytime and evening napping was investigated. Bivariate correlations (>.7) or VIF (>5) were considered to indicate potential multicollinearity issues.

Multiple regression models were used in the main analyses to determine if there is a relationship between napping, sleep problems, mental health problems, and wellbeing and whether sleep problems help explain any relationship between napping and mental health. Models were run separately for each outcome variable: anxiety symptoms, depression symptoms, wellbeing, hallucination-like experiences, and paranoia. For each outcome variable, we ran two models: Model 1 included frequency of long daytime naps and frequency of evening naps entered as predictors; Model 2 adjusted for sleep problems (continuous measure) by entering it as an additional predictor. Standardised beta coefficients (β) and R^2 were used to interpret the effects of different predictors in each regression model. Next, a series of multiple regression models investigated whether any

relationship found between napping and mental health and wellbeing was further moderated by sleep problems (see footnote[1]). To explore this, we replaced sleep problems with a binary form moderator variable, where participants were grouped into two categories based on the cutoff for probable insomnia (SCI-02 score ≤ 2). Including an interaction term based on these SCI-02 scores allowed us to determine whether sleep problems (if the young person had probable insomnia or not) were associated with a difference in the strength or direction of any association found between napping and mental health and wellbeing. Unstandardised beta coefficients (*B*) were used to interpret the direction of effects in each moderated regression model, as standardising binary categorical predictors can distort their interpretation by removing their natural 0/1 coding. Bonferroni corrections were applied to control for the family-wise error rate in correlations and regression models. Analyses were carried out using R (R Development Core Team, 2015).

[1]**Footnote:** The statistical analysis of this study was pre-registered via Open Science Framework (OSF; https://osf.io/hdkbz). The regression models reported here that investigated whether any relationship found between napping and mental health and wellbeing was moderated by sleep problems were exploratory and went beyond the pre-registration analysis plans.

Results

Sample characteristics

A total of 32,965 participants in Year 7–13 accessed the OxWell Student Survey in 2023. Of these, 27,061 provided data for both napping items, while 5904 participants did not do so and were excluded at this stage. From this remaining group, 688 did not provide sufficient

data to allow the SCI-02 score to be calculated, which left 26,373 students (50% girls) in the final sample. A descriptive comparison for included and excluded participants can be found in Table S1 and S2 in supplementary material. Participant characteristics for the final sample used for all analyses, including all predictor variables, are provided in Table 1.

Napping patterns

Napping frequency for both nap types is reported in Table 1. The majority of participants never took long daytime naps (54.5%) or evening naps (65.8%). The number of participants then decreased while napping frequency increased, from those who took naps once in a while for long daytime naps (24.8%) and evening naps (19.6%) down to those who reported they always took long daytime naps (2.8%) and evening naps (1.6%). The napping mean scores of the entire sample, including those who never took a nap, were low (based on a 6-point scale, scored 1–6). The long daytime napping mean score was 1.87 (*SD* = 1.27), while evening napping was 1.62 (*SD* = 1.09).

Napping patterns by year group and gender

A Welch's ANOVA showed that mean scores of long daytime napping ($F(2, 8318) = 283.1$, $p < .001$) and evening napping ($F(2, 8304.9) = 203.59$, $p < .001$) significantly differed between year group categories. Games-Howell post-hoc tests revealed significant differences in mean scores for both long daytime and evening napping between all year group categories (*p*s <.001). The lowest mean score for long daytime napping was found at Year 7–9 (*M* = 1.71, *SD* = 1.14), followed by Year 10–11 (*M* = 2.06, *SD* = 1.39), while the highest was reported by those in Year 12–13 (*M* = 2.17, *SD* = 1.41). Evening napping demonstrated the same pattern (Year 7–9: *M* = 1.50, *SD* = 0.98; Year 10–11: *M* = 1.76, *SD* = 1.21; Year 12–13: *M* = 1.83, *SD* = 1.22). For napping by year group category, see Figure S1 in supplementary materials.

A Welch's ANOVA showed that mean scores of long daytime napping ($F(3, 1224.1) = 157.03$, $p < .001$) and evening napping ($F(3, 1220) = 99.53$, $p < .001$) significantly differed between genders. Games-Howell post-hoc tests indicated that boys ($M = 1.68$, $SD = 1.11$) reported significantly lower mean scores in long daytime napping than girls ($M = 2.02$, $SD = 1.35$) and gender non-disclosing ($M = 1.99$, $SD = 1.41$) ($p < .001$), and gender diverse ($M = 1.91$, $SD = 1.36$) ($p = .01$). Boys also reported lower mean scores in evening napping ($M = 1.49$, $SD = 0.97$) than all other genders categorised in this study (Girls: $M = 1.71$, $SD = 1.14$, Gender non-disclosing: $M = 1.77$, $SD = 1.28$, Gender-diverse: $M = 1.67$, $SD = 1.27$) ($p < .001$)). No significant differences were found in napping between girls, gender diverse or gender non-disclosing.

Associations between napping, sleep problems, mental health problems, and wellbeing

Bivariate correlations between variables are provided in Table 2. Long daytime napping and evening napping were significantly associated with a moderate effect size ($r_s = .68$). Long daytime napping and evening napping showed a similar pattern of association when considering all other variables, with small effect sizes (all $r_s < .3$). More frequent long daytime naps and more frequent evening naps were each associated with higher levels of sleep problems, higher levels of anxiety symptoms, depression symptoms, hallucination-like experiences, paranoia, and lower wellbeing.

A series of multiple regression models were then conducted to investigate firstly, whether napping predicted mental health and wellbeing and secondly, whether sleep problems helped to explain any relationships found between napping and anxiety symptoms, depression symptoms, wellbeing, hallucination-like experiences and paranoia. All models are presented in Table 3, with sleep problems (SCI-02 is reverse scored: lower values

indicate greater symptom severity) added in the second model for each outcome variable. Anxiety symptoms were positively predicted by long daytime napping (β = .15, *B* = 0.57) and evening napping (β = .09, *B* = 0.40), R^2 = 0.05, in Model 1, so that napping more frequently was associated with higher anxiety symptoms. Sleep problems emerged as a strong, negative predictor (β = -.52, *B* = -1.05) when added in Model 2, so that lower levels of sleep problems were associated with lower levels of anxiety symptoms. Long daytime napping (β = .03, *B* = 0.11) remained a significant predictor but with a notably reduced effect size, while evening napping (β = .02, *B* = 0.10, *p* = .003) was considered not significant with a Bonferroni-adjusted significance threshold of α = .002. The explained variance increased to 29%. Depression symptoms were positively predicted by long daytime napping (β = .22, *B* = 0.69) and evening napping (β = .11, *B* = 0.43), R^2 = 0.09, in Model 1, so that napping more frequently was associated with higher depression symptoms. Sleep problems again emerged as a strong, negative predictor (β = -.58, *B* = -0.98) when added in Model 2, so that lower levels of sleep problems were associated with lower levels of depression symptoms. Long daytime napping (β = .08, *B* = 0.27) and evening napping (β = .04, *B* = 0.15) remained significant but were now both weak predictors, with notably reduced effect sizes. The explained variance increased to 39%. Wellbeing was negatively predicted by long daytime napping (β = -.15, *B* = -0.71) and evening napping (β = -.10, *B* = -0.54) in Model 1, so that more frequent napping was associated with lower wellbeing, R^2 = 0.05. Sleep problems were a moderate predictor (β = .44, *B* = 1.11) when added in Model 2, so lower levels of sleep problems were associated with greater wellbeing. Long daytime napping (β = -.05, *B* = -0.23) and evening napping (β = -.04, *B* = -0.22) were now very weak predictors of wellbeing, with reduced effect sizes. The explained variance increased to 23%.

The two measures of psychotic-like experiences demonstrated a similar pattern of association. Hallucination-like experiences were positively predicted by long daytime napping (β = .11, *B* = 0.11) and evening napping (β = .07, *B* = 0.08) in Model 1, R^2 = 0.03, so that napping more frequently was associated with higher hallucination-like experiences. Sleep problems were a moderate, negative predictor (β = -.31, *B* = -0.16) when added in Model 2, so that lower levels of sleep problems were associated with fewer hallucination-like experiences. Long daytime napping (β = .04, *B* = 0.04) and evening napping (β = .03, *B* = 0.04) were now very weak predictors. The explained variance increased to 12%. Paranoia was positively predicted by long daytime napping (β = .11, *B* = 0.20) and evening napping (β = .09, *B* = 0.19) in Model 1, R^2 = 0.04, so that napping more frequently was associated with higher paranoia. Sleep problems were a moderate, negative predictor (β = -.34, *B* = -0.32) when added in Model 2, so that lower levels of sleep problems were associated with less paranoia. Long daytime napping (β = .03, *B* = 0.06) and evening napping (β = .05, *B* = 0.10) were now very weak predictors. The explained variance increased to 14%.

Moderation analyses

Lastly, moderated multiple regression models were run to investigate whether any relationship between napping and mental health depended on whether participants' reported sleep problems were considered to be outside (SCI-02 score $\geq$ 3) or within (SCI-02 score ≤ 2) the cutoff for probable insomnia. All models are presented in Table 4, and plots for significant interactions can be found in Figure S2 to Figure S5 in supplementary materials. There were significant main effects for long daytime napping, evening napping and sleep problems in all models (*p* <.001). Those with probable insomnia had higher levels of anxiety symptoms (*B* = 5.78), depression symptoms (*B* = 5.85), hallucination-like

experiences (*B* = 0.89) and paranoia (*B* = 1.81), and lower wellbeing (*B* = -6.53) than those whose sleep was outside the cutoff for probable insomnia. For anxiety symptoms, the predictors accounted for 17% of the variance in anxiety symptoms. There was a significant interaction between evening napping and sleep problems for anxiety symptoms (*B* = -0.36), indicating that the association between frequency of napping and anxiety symptoms differed depending on sleep problem group membership. Evening napping was more strongly associated with anxiety symptoms in the group reporting sleep outside the cutoff for probable insomnia than the group with probable insomnia. There was no significant interaction between long daytime napping and sleep problems for anxiety symptoms (*p* = .453).

There was a significant interaction between long daytime napping and sleep problems for depression symptoms (*B* = -0.21) as well as between evening napping and sleep problems for depression symptoms (*B* = -0.36), with a stronger association between frequency of napping and depression symptoms for those outside the cutoff for probable insomnia than those with probable insomnia. There was a significant interaction between long daytime napping and sleep problems for wellbeing (*B* = 0.41), with a stronger association between frequency of napping and wellbeing for those outside the cutoff for probable insomnia than those with probable insomnia. There was no significant interaction between evening napping and sleep problems for wellbeing (*p* = .084). There were no significant interactions between long daytime napping and sleep problems for hallucination-like experiences (*p* = .432) or paranoia (*p* = .067), or between evening napping and sleep problems for hallucination-like experiences (*p* = .244) or paranoia (*p* = .539).

Discussion

Our study investigated if there is a relationship between napping, sleep problems, mental health problems, and wellbeing. As predicted, more frequent long daytime naps and more frequent evening naps were each associated with higher levels of sleep problems, albeit with small effect sizes. Furthermore, more frequent long daytime naps and more frequent evening naps were each associated with higher levels of anxiety symptoms, depression symptoms, psychotic-like experiences, and lower wellbeing. Although our findings indicate that young people's mental health and wellbeing is more strongly related to sleep problems than how frequently they nap, understanding napping behaviour remains important. For example, napping was more strongly associated with anxiety symptoms, depression symptoms and wellbeing for those without probable insomnia rather than the group considered to have poor sleep.

Just under half (45.5%) of adolescents had taken daytime naps of more than an hour and around a third (34.2%) had taken a nap after 6pm in the evening during the past month. It is noteworthy that 11.7% of participants reported taking long daytime naps and 7.3% reported taking evening naps from at least "quite often" up to "always". When school year groups were combined, the mean scores for both types of naps were highest for the oldest year group (Year 12–13), followed by the middle year group (Year 10–11), with the lowest napping scores found for the youngest year group (Year 7–9). The higher rates of napping reported by older year groups may reflect the developmental pattern of sleep with bedtimes shifting later as adolescence progresses and increased sleep restriction on school nights [3,39]. This increase in the tendency to nap is in line with evidence that daytime sleepiness increases with age across adolescence [40,41]. However, only small mean differences were found in napping scores between these groups and so these findings may not be clinically meaningful. The same may be true for our findings concerning gender, as

although boys demonstrated the lowest mean napping scores, small differences were found compared to other genders (girls, gender diverse, gender non-disclosing).

Given that napping recommendations incorporate guidance on the length and timing of naps, it is salient to consider that long daytime naps and evening naps had similar-sized correlations with sleep problems. The possibility of a bi-directional relationship cannot be ruled out: this consistency may indicate that one type of nap is not more or less influential than the other with regards to impacting sleep, or alternatively that it is young people with existing sleep problems who begin to take long daytime or evening naps. This study's cross-sectional design does not allow us to make inferences regarding the direction of associations or causal effects.

The association between long daytime naps and evening naps with mental health and wellbeing is in line with previous findings that adolescent napping was associated with negative affect [42], as well as a large, cross-sectional survey from the general population in France which found an increased likelihood of napping in adults with depression and/or anxiety [43]. Although a study with college students in the US found that same-day napping behaviour was linked to greater depression symptoms but not anxiety symptoms, study limitations included a small sample size and single item measures [44]. Strikingly, both types of naps in our study demonstrated a similar pattern of relationships with all other variables, suggesting that associations with sleep problems, mental health and wellbeing were consistent regardless of whether naps were long or occurred in the evening.

We wanted to establish whether sleep problems would help to explain any relationship found between napping and mental health and wellbeing. When considering our findings from napping regression models that included self-reported sleep problems (SCI-02 total

scores), sleep problems emerged as a moderate to strong predictor of mental health and wellbeing that resulted in a marked increase in explained variance. Napping remained a significant but notably weaker predictor, with effects largely accounted for when sleep problems were considered. This is consistent with much evidence that supports a relationship between sleep, mental health and wellbeing in adolescence [23,45,46]. Importantly, the inclusion of both nap types and sleep problems as predictors accounted for a substantial proportion of the variance in depression symptoms (39%), anxiety symptoms (29%), and wellbeing (23%) but a lower proportion for paranoia (14%) and hallucination-like experiences (12%). While acknowledging that sleep problems emerged as a stronger predictor of mental health and wellbeing, assessing sleep in conjunction with nap behaviour might better elucidate the role of (and potential intervention for) napping for each individual's psychological health.

Another novel finding that emerged from this study was that associations between evening naps and anxiety symptoms, evening naps and depression symptoms, long daytime naps and depression symptoms, as well as long daytime naps and wellbeing all depended on whether young people's self-reported sleep problems indicated that they had probable insomnia or not. For these nap types, napping was more strongly associated with anxiety symptoms, depression symptoms and wellbeing for those without probable insomnia rather than the group considered to have poor sleep. This contrasts with an earlier finding, that nappers who combined both less frequent napping and poor night-time sleep exhibited higher depressive symptoms [27]. However, as with much of the literature in the field, this was with an adult sample and used different measures.

The group with probable insomnia reported higher anxiety and depression symptoms, as well as lower wellbeing than those who reported better sleep. Although our study design does not tell us about the direction of any relationship, findings may indicate that young people whose sleep is outside the probable insomnia cutoff, nap more when anxiety and depression symptoms increase or wellbeing reduces. This contrasts with those with probable insomnia: their anxiety and depression symptoms are high and their wellbeing is low, regardless of whether or how much they nap. Therefore, napping relates to worse mental health and wellbeing mainly for those outside the probable insomnia cutoff. A ceiling effect may help explain our findings for those with sleep problems, in that already high mental health symptomology means there is less potential for napping frequency to track symptoms. The reason for napping may vary between the two groups. For those with potential insomnia, the act of napping may reflect a chronic insufficient sleep duration and an increased sleep drive during the daytime or evening irrespective of their mental health. Alternatively, it may be that those with probable insomnia, even if tired, struggle to fall asleep easily and so find it difficult to nap. For those without probable insomnia, more frequent napping might be a marker of exhaustion arising from increased cognitive hyper-arousal or difficulties with emotional regulation. It might be that for some adolescents, napping may represent a coping strategy for their symptoms or an avoidance behaviour related to their emotions or mood.

Adolescents may experience a range of sleep problems, whether it is trouble falling asleep, maintaining sleep, sleeping at the wrong times, or irregular sleep patterns. Sleep disorders reported at this time include insomnia, circadian rhythm sleep disorders, sleep-related breathing disorders, hypersomnias, and parasomnias (e.g., sleepwalking, sleep terrors) [47]. Self-reported sleep disturbance is common and transdiagnostic among young people with

psychiatric disorders [48,49]. Sleep problems may differ in their relationship with, or contribution to, different mental health problems [50]. Our findings point towards the need to measure naps – as well as other types of sleep disturbance. The implication is that in order to untangle causal processes, napping could be further investigated and targeted as a potential pathway to improve mental health problems.

Strengths and limitations

The items answered by participants in this study allowed us to examine the complexity of napping beyond a simple binary measurement of whether they did or did not nap, and in the context of a large population survey where actigraphy or sleep diaries are not available. We asked about napping proposed as problematic for night-time sleep, following suggestions that both the length of nap and time of nap may be important [15,16].

There are limitations. The cross-sectional nature of this study does not allow us to infer the direction of associations or the presence of causal effects between napping, sleep problems, and mental health. The assessment of daytime napping behaviour may have introduced bias as it gathers information solely on naps of more than one hour and does not capture actual average nap duration. This constraint does not allow identification of short naps (e.g., up to 20 minutes) that could potentially be beneficial, or indeed naps longer than 20 minutes but less than an hour, that may already be considered prolonged and possibly negatively associated with sleep and mental health. Actigraphy, in addition to a daily sleep diary, could provide a more rigorous method of data collection to inform us about the day-to-day timing and duration of naps. Although we asked about how often young people were napping, we did not ask participants for information on why they were napping. This may have helped to contextualise these findings and to provide a greater understanding of a possible

multiplicity of reasons for napping. For example, we do not know whether people were napping for enjoyment, to avoid feelings of anxiety or low mood, because they felt tired because of poor mental health, or to compensate for poor sleep.

We assessed psychotic-like experiences, however, we did not ask about psychotropic medication use or prescription. Furthermore, the students were not asked about clinical diagnoses of mental health disorders. These constitute omissions as the use of psychotropic medications, or the presence of clinical diagnoses such as anxiety and depression, can significantly influence sleep patterns with experiences of sleep disturbance and daytime sleepiness [25,51,52]. It may have been informative if we had been able to examine napping in relation to a measure of daytime sleepiness, such as the Cleveland Adolescent Sleepiness Questionnaire [53]. Additionally, napping may take place as a way of coping with fatigue, and so it would have been interesting to incorporate a measure of fatigue, such as the Flinders Fatigue Scale [54] in our study.

Implications for future research and practice

Given the high proportion of adolescents reporting napping behaviour, we need to better understand if there are specific disadvantages for adolescents of long daytime napping and evening napping that may arise in the context of sleep inertia and sleep disruption that night. Prospective studies would enable an investigation into the direction of effect of napping and mental health. We currently lack knowledge on whether napping acts as a coping mechanism for those experiencing anxiety and depression, and how napping may influence mood. Future research needs to examine a wider range of nap durations, as short naps may be beneficial whereas longer naps may be associated with adverse outcomes, potentially following a J-shaped relationship. Qualitative research, co-designed and

produced with young people with lived experience, could help inform the first step in planning any intervention work on napping habits. Given that adolescent napping behaviour may be viewed negatively within households, future research is needed to explore whether changing the napping habits of frequent long daytime nappers or evening nappers, who report high levels of anxiety or depression symptoms or low wellbeing, has the potential to impact on their mood either positively or negatively.

Frequent napping may be an indicator of potential difficulties with mood in adolescents, for example, anxiety or depression, for those who do not also report sleep problems more than those who do. In this way, napping may be a marker of low mood. Our findings need to be further explored in clinical samples. We propose that it could be valuable for clinicians assessing the mental health of young people to ask about napping habits as well as about sleep. This study suggests that for young people without sleep problems, specifically those whose sleep does not indicate probable insomnia, and who report symptoms of anxiety, depression or low wellbeing, it could be particularly informative to explore whether they are taking long daytime naps or napping in the evening. Asking about napping habits may accordingly provide insight into anxiety, depression or low wellbeing.

Conclusion

This study addresses a notable gap in the literature regarding current adolescent napping patterns. Our findings indicate that more frequent long daytime naps and more frequent evening naps were each associated with higher levels of sleep problems, anxiety symptoms, depression symptoms, psychotic-like experiences, and lower wellbeing. Although sleep quality remained more strongly related to mental health, understanding napping behaviour has the potential to complement strategies for intervention. Notably, those with sleep

outside the cutoff for insomnia, rather than with probable insomnia, had stronger napping associations with symptoms of anxiety and depression, and low wellbeing. For researchers and clinicians, asking about timing and duration of napping habits, as well as sleep, may provide clinically meaningful insights/contexts into assessment and care.

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Data availability

The data that support the findings are available upon reasonable request. Researchers may access the data by applying through the BrainWaves Data Portal where applications are reviewed to ensure appropriate use. Further details, including the full list of questions, study protocol, and other supporting materials, are available via the OxWell project's Open Science Framework page: https://osf.io/sekhr/.

Declaration of competing interest

The authors declare no competing interests.

Supplementary materials

Supplementary materials can be found online at…

References

[1] Gariepy G, Danna S, Gobiņa I, Rasmussen M, Gaspar de Matos M, Tynjälä J, et al. How Are Adolescents Sleeping? Adolescent Sleep Patterns and Sociodemographic Differences in 24 European and North American Countries. Journal of Adolescent Health 2020;66:S81–8. https://doi.org/10.1016/j.jadohealth.2020.03.013.

[2] Tarokh L, Short M, Crowley SJ, Fontanellaz-Castiglione CEG, Carskadon MA. Sleep and Circadian Rhythms in Adolescence. Curr Sleep Medicine Rep 2019;5:181–92. https://doi.org/10.1007/s40675-019-00155-w.

[3] Crowley SJ, Wolfson AR, Tarokh L, Carskadon MA. An update on adolescent sleep: New evidence informing the perfect storm model. Journal of Adolescence 2018;67:55–65.

[4] Kwon M, Page SD, Williamson AA, Morgan S, Sawyer AM. Social determinants of health at multiple socio-ecological levels and sleep health in adolescents: A scoping

review. Sleep Medicine Reviews 2024;78:102008. https://doi.org/10.1016/j.smrv.2024.102008.

[5] Leong RLF, Lau T, Dicom AR, Teo TB, Ong JL, Chee MWL. Influence of mid-afternoon nap duration and sleep parameters on memory encoding, mood, processing speed, and vigilance. Sleep 2023;46:zsad025. https://doi.org/10.1093/sleep/zsad025.

[6] Santos JS, Beijamini F, Louzada FM. Napping behavior in adolescents: Consensus, dissents, and recommendations. Sleep and Vigilance 2021;5:189–96.

[7] Short MA, Chee MWL. Chapter 3 - Adolescent sleep restriction effects on cognition and mood. In: Van Dongen HPA, Whitney P, Hinson JM, Honn KA, Chee MWL, editors. Progress in Brain Research, vol. 246, Elsevier; 2019, p. 55–71. https://doi.org/10.1016/bs.pbr.2019.02.008.

[8] Jakubowski KP, Hall MH, Lee L, Matthews KA. Temporal relationships between napping and nocturnal sleep in healthy adolescents. Behavioral Sleep Medicine 2017;15:257–69.

[9] Leong RLF, Tian L, Yu N, Teo TB, Ong JL, Chee MWL. Bidirectional associations between the duration and timing of nocturnal sleep and daytime naps in adolescents differ from weekdays to weekends. Sleep 2024;47:zsae147. https://doi.org/10.1093/sleep/zsae147.

[10] Rea EM, Bohnert AM, Crowley SJ. Napping, sleep and affect in late- and short-sleeping adolescents: An actigraphy and daily diary study. Sleep Health 2025;11:317–25. https://doi.org/10.1016/j.sleh.2025.03.003.

[11] Santos JS, Pereira SIR, Louzada FM. Chronic sleep restriction triggers inadequate napping habits in adolescents: a population-based study. Sleep Medicine 2021;83:115–22. https://doi.org/10.1016/j.sleep.2021.04.016.

[12] Borb AA, Achermann P. Sleep Homeostasis and Models of Sleep Regulation. J Biol Rhythms 1999;14:559–70. https://doi.org/10.1177/074873099129000894.

[13] Borbély AA, Daan S, Wirz-Justice A, Deboer T. The two-process model of sleep regulation: a reappraisal. Journal of Sleep Research 2016;25:131–43. https://doi.org/10.1111/jsr.12371.

[14] Ohayon M, Wickwire EM, Hirshkowitz M, Albert SM, Avidan A, Daly FJ, et al. National Sleep Foundation's sleep quality recommendations: first report. Sleep Health 2017;3:6–19. https://doi.org/10.1016/j.sleh.2016.11.006.

[15] Faraut B, Andrillon T, Vecchierini M-F, Leger D. Napping: A public health issue. From epidemiological to laboratory studies. Sleep Medicine Reviews 2017;35:85–100. https://doi.org/10.1016/j.smrv.2016.09.002.

[16] Dhand R, Sohal H. Good sleep, bad sleep! The role of daytime naps in healthy adults. Current Opinion in Pulmonary Medicine 2006;12:379–82.

[17] Milner CE, Cote KA. Benefits of napping in healthy adults: impact of nap length, time of day, age, and experience with napping. Journal of Sleep Research 2009;18:272–81.

[18] How to get a great nap. Mayo Clinic n.d. https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/napping/art-20048319 (accessed October 13, 2025).

[19] How to Sleep Longer. Sleep Foundation 2023. https://www.sleepfoundation.org/sleep-hygiene/how-to-sleep-longer (accessed October 13, 2025).

[20] Robards K. FAQs of Zzz's: Answering your top 10 sleep questions. Sleep Education 2024. https://sleepeducation.org/faqs-of-zzzs-answering-your-top-10-sleep-questions/ (accessed October 13, 2025).

[21] Freeman D, Sheaves B, Goodwin GM, Yu L-M, Nickless A, Harrison PJ, et al. The effects of improving sleep on mental health (OASIS): a randomised controlled trial with mediation analysis. The Lancet Psychiatry 2017;4:749–58. https://doi.org/10.1016/S2215-0366(17)30328-0.

[22] Gradisar M, Kahn M, Micic G, Short M, Reynolds C, Orchard F, et al. Sleep's role in the development and resolution of adolescent depression. Nat Rev Psychol 2022;1:512–23. https://doi.org/10.1038/s44159-022-00074-8.

[23] Orchard F, Gregory AM, Gradisar M, Reynolds S. Self-reported sleep patterns and quality amongst adolescents: cross-sectional and prospective associations with anxiety and depression. Journal of Child Psychology and Psychiatry 2020;61:1126–37. https://doi.org/10.1111/jcpp.13288.

[24] Waite F, Sheaves B, Isham L, Reeve S, Freeman D. Sleep and schizophrenia: From epiphenomenon to treatable causal target. Schizophrenia Research 2020;221:44–56. https://doi.org/10.1016/j.schres.2019.11.014.

[25] Freeman D, Sheaves B, Waite F, Harvey AG, Harrison PJ. Sleep disturbance and psychiatric disorders. The Lancet Psychiatry 2020;7:628–37. https://doi.org/10.1016/S2215-0366(20)30136-X.

[26] Liu Y, Peng T, Zhang S, Tang K. The relationship between depression, daytime napping, daytime dysfunction, and snoring in 0.5 million Chinese populations: exploring the effects of socio-economic status and age. BMC Public Health 2018;18:1–9.

[27] Devine JK, Wolf JM. Integrating nap and night-time sleep into sleep patterns reveals differential links to health-relevant outcomes. Journal of Sleep Research 2016;25:225–33. https://doi.org/10.1111/jsr.12369.

[28] Mansfield KL, Puntis S, Soneson E, Cipriani A, Geulayov G, Fazel M. Study protocol: the OxWell school survey investigating social, emotional and behavioural factors associated with mental health and well-being. BMJ Open 2021;11:e052717.

[29] Illingworth G, Skripkauskaite S, Fazel M, Waite F. Napping patterns and associations with sleep problems and mental health in the 2023 OxWell Student Survey 2025. https://doi.org/10.17605/OSF.IO/HDKBZ.

[30] Storfer-Isser A, Lebourgeois MK, Harsh J, Tompsett CJ, Redline S. Psychometric properties of the Adolescent Sleep Hygiene Scale. Journal of Sleep Research 2013;22:707–16. https://doi.org/10.1111/jsr.12059.

[31] Luik AI, Machado PF, Siriwardena N, Espie CA. Screening for insomnia in primary care: using a two-item version of the Sleep Condition Indicator. Br J Gen Pract 2019;69:79–80. https://doi.org/10.3399/bjgp19X701045.

[32] Illingworth G, Mansfield KL, Skripkauskaite S, Fazel M, Waite F. Insomnia symptoms in children and adolescents: screening for sleep problems with the two-item Sleep Condition Indicator (SCI-02). BMC Public Health 2024;24:2957. https://doi.org/10.1186/s12889-024-20310-5.

[33] Radez J, Waite P, Chorpita B, Creswell C, Orchard F, Percy R, et al. Using the 11-item Version of the RCADS to Identify Anxiety and Depressive Disorders in Adolescents. Res Child Adolesc Psychopathol 2021;49:1241–57. https://doi.org/10.1007/s10802-021-00817-w.

[34] Laurens KR, Hobbs MJ, Sunderland M, Green MJ, Mould GL. Psychotic-like experiences in a community sample of 8000 children aged 9 to 11 years: an item response theory analysis. Psychological Medicine 2012;42:1495–506. https://doi.org/10.1017/S0033291711002108.

[35] Bird JC, Loe BS, Kirkham M, Fergusson EC, Shearn C, Stratford H, et al. The assessment of paranoia in young people: Item and test properties of the Bird Checklist of Adolescent Paranoia. Schizophrenia Research 2020;220:116–22. https://doi.org/10.1016/j.schres.2020.03.046.

[36] McKay MT, Andretta JR. Evidence for the Psychometric Validity, Internal Consistency and Measurement Invariance of Warwick Edinburgh Mental Well-being Scale Scores in Scottish and Irish Adolescents. Psychiatry Research 2017;255:382–6. https://doi.org/10.1016/j.psychres.2017.06.071.

[37] Ringdal R, Bradley Eilertsen M-E, Bjørnsen HN, Espnes GA, Moksnes UK. Validation of two versions of the Warwick-Edinburgh Mental Well-Being Scale among Norwegian adolescents. Scand J Public Health 2018;46:718–25. https://doi.org/10.1177/1403494817735391.

[38] Soneson E, O'Leary S, Fazel M. Trans and gender diverse identities in adolescent health research: making the most of imperfect data. BMJ Ment Health 2024;27. https://doi.org/10.1136/bmjment-2024-301150.

[39] Carskadon MA. Sleep in Adolescents: The Perfect Storm. Pediatric Clinics of North America 2011;58:637–47. https://doi.org/10.1016/j.pcl.2011.03.003.

[40] Liu Y, Zhang J, Li SX, Chan NY, Yu MWM, Lam SP, et al. Excessive daytime sleepiness among children and adolescents: prevalence, correlates, and pubertal effects. Sleep Medicine 2019;53:1–8. https://doi.org/10.1016/j.sleep.2018.08.028.

[41] Campbell IG, Burright CS, Kraus AM, Grimm KJ, Feinberg I. Daytime Sleepiness Increases With Age in Early Adolescence: A Sleep Restriction Dose–Response Study. Sleep 2017;40:zsx046. https://doi.org/10.1093/sleep/zsx046.

[42] Gradisar M, Dohnt H, Wright H, Robinson J, Paine S, Gamble A. Adolescent napping behavior: Dysfunctional cognitions and negative affect. Sleep and Biological Rhythms 2008;6:260–3.

[43] Léger D, Torres MJ, Bayon V, Hercberg S, Galan P, Chennaoui M, et al. The association between physical and mental chronic conditions and napping. Scientific Reports 2019;9:1795.

[44] Ostrow KD, Shattuck L, Seehuus M. The relationships between wanting to nap, actually napping, and depressed and anxious mood. SLEEP Advances 2024;5:zpae080. https://doi.org/10.1093/sleepadvances/zpae080.

[45] Bacaro V, Miletic K, Crocetti E. A meta-analysis of longitudinal studies on the interplay between sleep, mental health, and positive well-being in adolescents. International Journal of Clinical and Health Psychology 2024;24:100424. https://doi.org/10.1016/j.ijchp.2023.100424.

[46] O'Callaghan VS, Couvy-Duchesne B, Strike LT, McMahon KL, Byrne EM, Wright MJ. A meta-analysis of the relationship between subjective sleep and depressive symptoms in adolescence. Sleep Medicine 2021;79:134–44. https://doi.org/10.1016/j.sleep.2021.01.011.

[47] Gruber R, Carrey N, Weiss SK, Frappier JY, Rourke L, Brouillette RT, et al. Position Statement on Pediatric Sleep for Psychiatrists. J Can Acad Child Adolesc Psychiatry 2014;23:174–95.

[48] Lunsford-Avery JR, Falls A, Cary S, Duke NN. The Role of Sleep Disturbances in the Onset and Maintenance of Psychiatric Disorders in Childhood and Adolescence: A Review of Subjective and Polysomnographic Findings. Curr Sleep Medicine Rep 2024;10:301–13. https://doi.org/10.1007/s40675-024-00300-0.

[49] Waite F, Evans S, Rebello A, Sharpe T, Otaiku J, Iredale E, et al. Sleep disruption and its psychological treatment in young people at risk of psychosis: A peer methods qualitative evaluation. British Journal of Clinical Psychology n.d.;n/a. https://doi.org/10.1111/bjc.70002.

[50] Hysing M, Heradstveit O, Harvey AG, Nilsen SA, Bøe T, Sivertsen B. Sleep problems among adolescents within child and adolescent mental health services. An epidemiological study with registry linkage. Eur Child Adolesc Psychiatry 2022;31:121–31. https://doi.org/10.1007/s00787-020-01676-4.

[51] Gastel AV. Drug-Induced Insomnia and Excessive Sleepiness. Sleep Medicine Clinics 2022;17:471–84. https://doi.org/10.1016/j.jsmc.2022.06.011.

[52] Doghramji K, Jangro WC. Adverse Effects of Psychotropic Medications on Sleep. Psychiatric Clinics 2016;39:487–502. https://doi.org/10.1016/j.psc.2016.04.009.

[53] Spilsbury JC, Drotar D, Rosen CL, Redline S. The Cleveland Adolescent Sleepiness Questionnaire. Journal of Clinical Sleep Medicine 2007;03:603–12. https://doi.org/10.5664/jcsm.26971.

[54] Gradisar M, Lack L, Richards H, Harris J, Gallasch J, Boundy M, et al. The Flinders Fatigue Scale: Preliminary Psychometric Properties and Clinical Sensitivity of a New Scale for Measuring Daytime Fatigue associated with Insomnia. Journal of Clinical Sleep Medicine 2007;03:722–8. https://doi.org/10.5664/jcsm.27030.

Table 1. Sample characteristics for students who provided all predictor variables (napping and SCI-02)

	Provided napping and SCI-02 scores (*n* = 26,373)
Age (years)	
Mean (SD)	13.8 (1.88)
Missing	271 (1.0%)
Year group category, n (%)	
Year 7–9	15542 (58.9%)
Year 10–11	7312 (27.7%)
Year 12–13	3519 (13.3%)
Gender, n (%)	
Girl	13241 (50.2%)
Boy	11746 (44.5%)
Gender Diverse	348 (1.3%)
Gender Non-Disclosing	783 (3.0%)
Missing	255 (1.0%)
Long daytime nap (ASHS-r), n (%)	
Never	14380 (54.5%)
Once in a while	6551 (24.8%)
Sometimes	2355 (8.9%)
Quite often	1396 (5.3%)
Frequently, if not always	946 (3.6%)
Always	745 (2.8%)
Mean (SD)	1.87 (1.27)
Evening nap (ASHS-r), n (%)	
Never	17358 (65.8%)
Once in a while	5171 (19.6%)
Sometimes	1890 (7.2%)
Quite often	932 (3.5%)
Frequently, if not always	592 (2.2%)
Always	430 (1.6%)
Mean (SD)	1.62 (1.09)
Sleep problems (SCI-02)	
Mean (SD)	5.59 (2.38)
Sleep problems (SCI-02 binary), n (%)	
Outside cutoff	22534 (85.4)
Probable insomnia	3839 (14.6)
Anxiety symptoms (RCADS-11)	
Mean (SD)	5.65 (4.80)
Missing	2703 (10.2%)
Depression symptoms (RCADS-11)	
Mean (SD)	5.10 (4.03)
Missing	2724 (10.3%)
Wellbeing (SWEMWBS)	
Mean (SD)	22.0 (6.00)
Missing	2325 (8.8%)

Hallucination-like experiences	
Mean (SD)	0.86 (1.20)
Missing	7606 (28.8%)
Paranoia (B-CAP)	
Mean (SD)	1.46 (2.25)
Missing	7631 (28.9%)

Note. Participants who responded as 18+ were counted as 19 when calculating mean score of age in years.

Table 2. Spearman's rho correlation matrix for variables in sample

	1	2	3	4	5	6	7
1. Long daytime nap	1						
2. Evening nap	.68	1					
3. Sleep problems	-.28	-.26	1				
4. Anxiety symptoms	.18	.17	-.53	1			
5. Depression symptoms	.28	.25	-.61	.75	1		
6. Wellbeing	-.21	-.19	.47	-.53	-.62	1	
7. Hallucination-like experiences	.16	.15	-.31	.35	.36	-.28	1
8. Paranoia	.16	.15	-.35	.46	.43	-.34	.46

Note. Bonferroni multiple comparison correction across all tests. Sleep problems are coded so a higher score indicates better sleep. All correlations p <.001.

Table 3. Multiple regression analyses of long daytime napping, evening napping and sleep problems as predictors of mental health and wellbeing

	B	SE *B*	95% CI	β	*t*	R^2	*p*
Anxiety symptoms							
Model 1						0.05	<.001
Long daytime nap	0.57	0.03	0.50, 0.63	.15	16.64		<.001
Evening nap	0.40	0.04	0.32, 0.47	.09	9.99		<.001
Model 2						0.29	<.001
Long daytime nap	0.11	0.03	0.05, 0.17	.03	3.77		<.001
Evening nap	0.10	0.03	0.04, 0.17	.02	3.02		.003
Sleep problems	-1.05	0.01	-1.07, -1.02	-.52	-89.71		<.001
Depression symptoms							
Model 1						0.09	<.001
Long daytime nap	0.69	0.03	0.64, 0.75	.22	24.70		<.001
Evening nap	0.43	0.03	0.36, 0.49	.11	13.06		<.001
Model 2						0.39	<.001
Long daytime nap	0.27	0.02	0.22, 0.31	.08	11.42		<.001
Evening nap	0.15	0.03	0.10, 0.21	.04	5.76		<.001
Sleep problems	-0.98	0.01	-1.00, -0.96	-.58	-107.82		<.001
Wellbeing							
Model 1						0.05	<.001
Long daytime nap	-0.71	0.04	-0.79, -0.62	-.15	-16.78		<.001
Evening nap	-0.54	0.05	-0.63, -0.44	-.10	-10.89		<.001
Model 2						0.23	<.001
Long daytime nap	-0.23	0.04	-0.31, -0.16	-.05	-6.04		<.001
Evening nap	-0.22	0.04	-0.31, -0.14	-.04	-5.03		<.001
Sleep problems	1.11	0.02	1.08, 1.14	.44	73.57		<.001
Hallucination-like experiences							
Model 1						0.03	<.001
Long daytime nap	0.11	0.01	0.09, 0.13	.11	11.22		<.001
Evening nap	0.08	0.01	0.06, 0.11	.07	7.27		<.001
Model 2						0.12	<.001
Long daytime nap	0.04	0.01	0.02, 0.06	.04	4.47		<.001
Evening nap	0.04	0.01	0.02, 0.06	.03	3.42		<.001
Sleep problems	-0.16	0.00	-0.16, -0.15	-.31	-42.61		<.001
Paranoia							
Model 1						0.04	<.001
Long daytime nap	0.20	0.02	0.17, 0.24	.11	10.96		<.001
Evening nap	0.19	0.02	0.15, 0.24	.09	9.01		<.001
Model 2						0.14	<.001
Long daytime nap	0.06	0.02	0.02, 0.09	.03	3.36		<.001
Evening nap	0.10	0.02	0.06, 0.14	.05	5.04		<.001
Sleep problems	-0.32	0.01	-0.34, -0.31	-.34	-47.58		<.001

Note. β = standardised beta coefficients. Anxiety symptoms, *n* = 23,670; Depression symptoms, *n* = 23,649; Wellbeing, *n* = 24,048; Hallucination-like experiences, *n* = 18,767; Paranoia, *n* = 18,742. Sleep problems are coded so a higher score indicates better sleep. Bonferroni-adjusted significance threshold α = .002.

Table 4. Multiple regression analyses of long daytime napping, evening napping and sleep problems (SCI-02 groups) as predictors of mental health and wellbeing and interaction terms

	B	SE *B*	95% CI	*t*	R^2	*p*
Anxiety symptoms					.17	<.001
Long daytime nap	0.34	0.04	0.27, 0.41	9.37		<.001
Evening nap	0.34	0.04	0.26, 0.43	7.87		<.001
Sleep problems (probable insomnia vs outside cutoff)	5.78	0.15	5.48, 6.08	37.80		<.001
Long daytime nap x Sleep problems	-0.06	0.08	-0.20, 0.09	-0.75		.453
Evening nap x Sleep problems	-0.36	0.08	-0.53, -0.19	-4.22		<.001
Depression symptoms					.25	<.001
Long daytime nap	0.52	0.03	0.46, 0.58	17.72		<.001
Evening nap	0.39	0.03	0.32, 0.46	11.27		<.001
Sleep problems (probable insomnia vs outside cutoff)	5.85	0.12	5.61, 6.09	47.94		<.001
Long daytime nap x Sleep problems	-0.21	0.06	-0.33, -0.09	-3.48		<.001
Evening nap x Sleep problems	-0.36	0.07	-0.49, -0.22	-5.26		<.001
Wellbeing					.14	<.001
Long daytime nap	-0.56	0.05	-0.65, -0.47	-12.22		<.001
Evening nap	-0.44	0.05	-0.55, -0.33	-8.11		<.001
Sleep problems (probable insomnia vs outside cutoff)	-6.53	0.19	-6.91, -6.16	-33.85		<.001
Long daytime nap x Sleep problems	0.41	0.10	0.22, 0.60	4.28		<.001
Evening nap x Sleep problems	0.19	0.11	-0.03, 0.40	1.73		.084
Hallucination-like experiences					.08	<.001
Long daytime nap	0.08	0.01	0.06, 0.10	6.99		<.001
Evening nap	0.07	0.01	0.04, 0.09	4.98		<.001
Sleep problems (probable insomnia vs outside cutoff)	0.89	0.05	0.80, 0.98	19.64		<.001
Long daytime nap x Sleep problems	-0.02	0.02	-0.06, 0.03	-0.79		.432
Evening nap x Sleep problems	-0.03	0.03	-0.08, 0.02	-1.17		.244
Paranoia					.10	<.001
Long daytime nap	0.14	0.02	0.10, 0.18	6.70		<.001
Evening nap	0.13	0.02	0.08, 0.18	5.45		<.001
Sleep problems (probable insomnia vs outside cutoff)	1.81	0.08	1.64, 1.97	21.50		<.001
Long daytime nap x Sleep problems	-0.08	0.04	-0.16, 0.01	-1.83		.067
Evening nap x Sleep problems	0.03	0.05	-0.06, 0.12	0.62		.539

Note. Reference group for Sleep problems is "Outside cutoff for probable insomnia" (SCI-02 $\geq$ 3). Anxiety symptoms, *n* = 23,670; Depression symptoms, *n* = 23,649; Wellbeing, *n* = 24,048; Hallucination-like experiences, *n* = 18,767; Paranoia, *n* = 18,742. Bonferroni-adjusted significance threshold α = .002.

Declaration of Interest Statement

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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