

# Sleep disorders among high school students in New Zealand

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## ABSTRACT

**INTRODUCTION:** Adolescents are known to have high risk factors for sleep disorders, yet the youth rates of sleep disturbances are unknown.

**AIM:** This study aimed to determine the prevalence of sleep disorders among New Zealand high school students.

**METHODS:** The Auckland Sleep Questionnaire (ASQ) was administered to high school students at six schools in the North Island. Schools were chosen to reflect a range of ethnicities and school deciles, which identify the socioeconomic status of households in the school catchment area.

**RESULTS:** A total of 1388 students completed the ASQ. The median age was 17 years (range 14–23) and females represented 43.5% (n=604) of the total group. A total of 37.2% of the students surveyed reported having significant sleep symptoms lasting longer than one month. Depression and anxiety were present in 51.7% and 44.8% of students reporting a sleep problem, respectively. A moderate correlation was observed between sleep problems and depression ( $r=0.34$ ,  $p<0.01$ ), and sleep problems and anxiety ( $r=0.31$ ,  $p<0.01$ ). Problem alcohol use and other substance use were more common in students with sleep symptoms (12.2% and 5.5% respectively). No difference was found in the rate of sleep problems reported by different ethnic groups.

**DISCUSSION:** A considerable proportion of students surveyed reported significant sleep symptoms. This study has the potential to aid physicians within New Zealand in better appreciating the burden of sleep disorders faced by young people and in effectively assessing and managing different causes of sleep symptoms in this demographic.

**KEYWORDS:** Adolescent; insomnia; sleep disorders; New Zealand

## Introduction

Sleep problems are a significant issue within society, yet studies that examine the rate of sleep problems vary greatly in their findings. It has been estimated that an average of 20–30% of populations suffer from some form of sleep problem, with a range between 5% and 50% found in general population studies,<sup>1–3</sup> and a similar range (10–50%) found in primary care settings.<sup>4,5</sup> With such a high prevalence in general populations, it would seem desirable to better understand these phenomena; yet the diverse range of rates has been reported precisely because of the inherent

difficulty in accurately defining and standardising sleep disorders,<sup>6</sup> as well as the diversity of study populations, and the demographics and cultures within them.

It has been noted that the large majority of early epidemiologic sleep studies were limited to assessing insomnia symptoms and their associations with mental disorders and medical conditions.<sup>3</sup> In order to address the limited research in rates of actual sleep disorder diagnoses, the Auckland Sleep Questionnaire (ASQ) was developed.<sup>7</sup> This questionnaire distinguishes between more common types of sleep disorders, such as insomnias,

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excessive daytime sleepiness and parasomnias. A variety of validated screening tools have been incorporated to identify comorbid conditions, such as anxiety, depression and alcoholism.

Sleep disorders show a well-established positive correlation to mental disorders. Poor sleep quality is found in up to 90% of patients with depression,<sup>8</sup> and in a New Zealand study, nearly half of patients with a sleep disorder also suffered from anxiety.<sup>9</sup> Sleep disorders may also adversely affect quality of life<sup>10</sup> and increase the risk of substance abuse.<sup>11</sup> As well as affecting mental health, sleep deprivation has been shown to adversely affect cognitive performance, memory consolidation,<sup>12</sup> and body restitution.<sup>13</sup> Experimental and epidemiological evidence suggest that sleep loss is associated with irregular insulin homeostasis, which may increase the risk of diabetes mellitus and obesity.<sup>14–16</sup>

The high incidence of depression and anxiety in New Zealand adolescents is well established,<sup>17,18</sup> and a recent cross-sectional study of New Zealand high school students found that 21% reported getting enough sleep ‘very little of the time’.<sup>19</sup> The latter study did not describe the specific sleep disorders causing the reported sleep difficulties. Despite these high rates of risk factors and the high incidence of sleep disturbance, youth rates of sleep disturbances have been under-diagnosed<sup>20,21</sup> and may be seldom addressed in clinics.<sup>22</sup> This present study was undertaken in a large population, using the ASQ, and aimed to give a more accurate estimate of youth sleep disorders.

## Methods

### Study population

A total of six high schools in the North Island of New Zealand were included by convenience sampling to reflect a range of ethnicities and deciles. A school’s decile rating indicates the extent to which it draws its students from low socioeconomic communities. A decile is a 10% grouping. Hence, there are 10 deciles and around 10% of schools are in each decile. Decile 1 schools are the 10% of schools with the highest proportion of students from low socioeconomic

## WHAT GAP THIS FILLS

**What we already know:** High school students and adolescents are a population group that is greatly affected by sleep difficulties. The impact of sleep disorders in high school students can be severe and can affect both academic and personal activities. Despite the high rates of risk factors for sleep disorders in this age group, sleep disturbance is under-diagnosed in youth and may be seldom addressed.

**What this study adds:** This study provides further evidence that sleep difficulties are common in adolescents. Depression, anxiety and substance abuse was common among students with sleep symptoms.

communities, whereas decile 10 schools are the 10% of schools with the lowest proportion of these students. The schools that were included in this study had a wide range of deciles to assess the implications of the socioeconomic status on reported sleep problems. All year 12 and year 13 students from the six schools were included in the study.

The study investigators administered the ASQ to the whole year 12 and year 13 group at each school, with the prior consent of the teachers and participants. The students at each school completed the questionnaires at the same time as a whole year group. The ASQ is a questionnaire designed to diagnose sleep disorders, particularly primary insomnia, and it was validated on New Zealanders in a primary care setting.<sup>7</sup> The questions used in the ASQ were derived from either standard primary care inventories—namely the Generalized Anxiety Disorder 7-item scale (GAD-7)<sup>23</sup> for anxiety, the Patient Health Questionnaire-9 (PHQ-9)<sup>24</sup> for depression, the CAGE screening tool<sup>25</sup> for alcohol abuse, or the International Classification of Sleep Disorders (ICSD).<sup>26</sup> The most difficult item to convert was that of delayed sleep-phase disorder, which is very non-specific in the ICSD manual. The assumptions relating to some of the diagnostic criteria in the ASQ and the validation method used are described elsewhere.<sup>7</sup>

There were no exclusion criteria for participation in the study. Ethical approval for this study was granted by the Northern Regional Ethics Committee (MEC/10/068/EXP).

### Variables

The categories of variables included in the study as part of the ASQ were:

1. demographic information: age, gender, ethnicity and marital status
2. reported sleep problem significantly affecting life, duration of sleep problem and use of sleep-enhancing medication
3. medical problems affecting sleep
4. depression or anxiety
5. breathing problems affecting sleep

6. substance use: alcohol and recreational drugs, and
7. other sleep disorders: restless legs syndrome, sleep walking, sleep talking, bruxism (teeth grinding), and delayed sleep-phase disorder.

Table 1 provides the criteria used to define the sleep disorders and related conditions included in this study.

### Data analysis

The different types of sleep disorders were only calculated for the students who reported a significant sleep problem lasting more than a month. A similar logic to that of the study by Arroll et al.<sup>9</sup> was used for the data analysis. The students who reported a significant sleep problem lasting for more than a month were initially identified, and for these students the rates of identifiable causes of insomnia (except delayed sleep-phase disorder and primary insomnia) as defined in Table 1 were calculated. The rate of delayed sleep-phase disorder and primary insomnia were calculated by excluding students with a significant sleep problem lasting more than a month who met the criteria for any other disorder that could contribute to a subjective reporting of a significant sleep problem. Subgroup analyses between ethnicity, gender and high school deciles were also carried out. The Chi-squared test was used for subgroup comparison. Spearman correlation was used to quantify associations between groups. The 95% confidence intervals (95% CI) were calculated for rates of specific sleep disorders and other conditions. The reported differences were considered significant at  $p$ -value  $<0.05$ . The analyses were carried out using the Statistical Package for the Social Sciences 2010 (SPSS for Windows, release 19.0.0, IBM Corporation, Somers, NY, USA).

### Results

A total of 1388 students completed the questionnaire (69.9% completion rate). The median age was 17 years (range 14–23 years) and 43.5% ( $n=604$ ) of the total group were female. School A was a single-sex school for girls. Schools B, D and E were single-sex schools for boys. Table 2 summarises the demographic details of the students.

Table 1. Definitions used in the study for sleep disorders and other disorders

Condition	Measure
<b>Reported sleep problem</b>	ASQ criteria: Do you have problems getting to sleep, staying asleep or waking early such that it affects your work function the next day? This includes feeling excessively sleepy the next day for the duration of at least one month.
<b>Depression</b>	PHQ-9 score $\geq 10$
<b>Anxiety</b>	GAD-7 score $\geq 8$
<b>Obstructive sleep apnoea</b>	Having $\geq 4$ of: (1) Have excessive daytime sleepiness, (2) pauses in between breaths during sleep, (3) morning headache, (4) dry mouth, (5) loud snoring. 1 and 2 must be present.
<b>Delayed sleep-phase disorder</b>	All of the following: Considers self to be an evening person, choosing to go to bed late or choosing to wake up late and has no medical problem, mood disorder, substance problem, breathing disorder or other sleeping disorder. Going to bed after midnight.
<b>Parasomnias</b>	Reported sleepwalking, started before a teenager, difficulty arousing during episode and no subjective awareness OR sleep-talking occurring $\geq 3$ /week causing disturbance to bed partner and no subjective awareness of episode OR reported teeth grinding and one of: abnormal wear of teeth, sounds associated with grinding or jaw muscle discomfort occurring $\geq 3$ /week OR unpleasant sensations (aches, pains or creeping) in legs affecting sleep, relieved by movement or rubbing, occurring $\geq 3$ /week.
<b>General health problem</b>	Significant health problems affecting ability to sleep well occurring $\geq 3$ /week.
<b>Alcohol problem</b>	CAGE score $\geq 2$
<b>Other substance problem</b>	Reported drugs affecting sleep or quality of sleep.
<b>Primary insomnia</b>	Reports a sleep problem but has no other diagnosable disorder in Table 1.

PHQ-9 Patient Health Questionnaire-9

GAD-7 Generalized Anxiety Disorder 7-item scale

Table 2. Demographic details of the surveyed participants in each of the different schools

	School A (n = 193)	School B (n= 200)	School C (n = 167)	School D (n = 80)	School E (n = 118)	School F (n = 630)	Total group (n=1388)	
School decile rating	3	3	1	8	4	10	–	
Response rate	63.1%	74.6%	56.0%	27.6%	92.9%	90.5%	69.9%	
Median age (range) in years	16 (15–18)	17 (15–18)	17 (16–23)	17 (17–21)	17 (17–18)	17 (14–19)	17 (14–23)	
Females n (%)	193 (100)	0 (0)	104 (62.3)	0 (0)	0 (0)	307 (48.7)	604 (43.5)	
Ethnicity	NZ European n (%)	79 (40.9)	51 (25.5)	17 (10.2)	44 (55.0) *	45.8 (54)	151 (24.0)	396 (28.5)
	NZ Maori n (%)	80 (41.5)	111 (55.5) *	54 (32.3)*	2 (2.5)	41 (34.7)	29 (4.6)	317 (22.8)
	Pacific n (%)	7 (3.6)	4 (2.0)	58 (34.7)	12 (15.0)	13 (11.0)	25 (4.0)	119 (8.6)
	Asian n (%)	14 (7.3)	19 (9.5)	27 (16.2)	17 (21.3)	7 (5.9)	321 (51.0) *	405 (29.2)
	Other n (%)	13 (6.7)	15 (7.5)	11 (6.6)	5 (6.3)	3 (2.5)	104 (16.5)	151 (10.9)

\* Statistically significant higher rate of an ethnicity compared to other schools ( $p < 0.05$ )

School B and C had significantly more Maori students than other ethnicities. School D had significantly more NZ European students than other ethnicities. School F had significantly more Asian students than other ethnicities.

In total, 37.2% of the students surveyed reported having significant sleep symptoms lasting longer than one month (see Table 3). The rates of specific conditions contributing to sleep symptoms are provided in Table 4. A statistically significant, moderate correlation was observed between reported sleep problems and depression ( $r = 0.34$ ,  $p < 0.01$ ), and reported sleep problems and anxiety ( $r = 0.31$ ,  $p < 0.01$ ).

### Subgroup analysis

No statistically significant difference was found between ethnicities in the rate of students who reported a sleep problem for more than one month ( $p > 0.05$ ). In terms of specific causes of sleep disorders, alcohol was more common among Maori (20.5%) and Pacific (19.5%) students compared to other ethnicities (10.2% in NZ European, 5.1% in Asian, and 12.5% in Other). No significant difference was observed in the other specific causes of sleep disorders between the different ethnic groups.

More female students reported a sleep problem lasting for more than one month compared to

males (42.7% females and 33% males;  $p < 0.05$ ). In terms of specific associations with sleep disorders, female students reported more anxiety (50.6% vs 39% in males,  $p < 0.01$ ) and general health problems affecting sleep (18.4% vs 11.6% in males,  $p < 0.05$ ). However, among students with sleep disorders, more male students were found to have delayed sleep-phase disorder compared to females (17% in males vs 8.5% in females,  $p < 0.05$ ).

No significant correlation was found between the reported sleep problems and the decile value of the school ( $r = 0.017$ ,  $p = 0.52$ ). Furthermore, there was no statistically significant difference in the specific causes of sleep disorders between lower decile schools (schools A, B, C and E) and higher decile schools (schools D and F).

Table 3. Proportion of students reporting a significant sleep problem

School	n (%)	95% confidence interval
School A	94 (48.7)	42–56
School B	52 (26.0)	20–32
School C	44 (26.3)	20–33
School D	23 (28.8)	19–39
School E	67 (56.8)	48–66
School F	237 (37.6)	43–41
Total	517 (37.2)	34–41

Table 4. Rates of specific conditions contributing to sleep symptoms in participants reporting a significant sleep problem lasting more than a month by school

Condition	School A (n=94)	School B (n=52)	School C (n=44)	School D (n=23)	School E (n=67)	School F (n=237)	Total group (n=517)
Depression (PHQ-9 $\geq 10$ ) n (%)	59 (62.8)	21 (40.4)	29 (65.9)	10 (43.5)	30 (44.8)	118 (50.0)	267 (51.7)
Anxiety (GAD-7 $\geq 8$ ) n (%)	46 (48.9)	16 (30.8)	23 (52.3)	6 (26.1)	21 (31.3)	119 (50.4)	231 (44.8)
General health problem n (%)	20 (21.3)	10 (19.2)	5 (11.4)	2 (8.7)	3 (4.5)	37 (15.7)	77 (15.0)
Obstructive sleep apnoea n (%)	5 (5.3)	3 (5.8)	1 (2.3)	0 (0)	0 (0)	11 (4.7)	20 (3.9)
Parasomnias n (%)	9 (9.6)	6 (11.5)	4 (9.1)	1 (4.3)	3 (4.5)	25 (10.5)	48 (9.3)
Alcohol problem (CAGE $\geq 2$ ) n (%)	19 (20.2)	10 (19.2)	3 (6.8)	1 (4.3)	12 (17.9)	18 (7.6)	63 (12.2)
Other substance problem affecting sleep n (%)	8 (8.5)	3 (5.8)	2 (4.5)	0 (0)	3 (4.5)	12 (5.2)	28 (5.5)
Delayed sleep-phase disorder n (%)*	7 (7.4)	7 (13.5)	5 (11.4)	6 (26.1)	16 (23.9)	28 (11.8)	69 (13.3)
Primary insomnia n (%) *	14 (14.9)	12 (23.1)	11 (25.0)	3 (13.0)	10 (14.9)	39 (16.5)	89 (17.2)

PHQ-9 Patient Health Questionnaire-9

GAD-7 Generalized Anxiety Disorder 7-item scale

\* Primary insomnia and delayed sleep-phase disorder are mutually exclusive. All other conditions are not.

## Discussion

### Summary of findings

This study sought to expand the knowledge of sleep problems in New Zealand youth through use of a diagnostic sleep questionnaire. Using criteria adapted from the ICSD,<sup>26</sup> the ASQ was administered to a selected group of schools in the North Island of New Zealand. The results are striking, with a mean rate of significant sleep disorders of 37.2% across schools. Two individual schools showed much higher rates ( $p < 0.01$ )—for School A almost 50% of year 12 and 13 students surveyed had some form of sleep problem, and for School E, the proportion was even higher at 56.8% of year 12 and year 13 students surveyed. School A also showed the highest rate of alcohol use among those with sleep disorders. Interestingly, these schools are both single-sex schools. School A is a school for girls only and School E is a school for boys only.

There was an increased rate of sleep disorders in female students compared to their male counterparts, with female students also demonstrating higher rates of anxiety and general health problems affecting sleep. Both genders showed a moderate correlation between sleep disorders and

both anxiety and depression. This is in keeping with studies across the globe: these factors are known to have a strongly positive correlation with sleep disorders.<sup>9,27</sup> Of the specific diagnoses, female students with sleep disorders reported less delayed sleep-phase disorder than male students.

Alcohol played a significant role in sleep disturbance, and was more prevalent among Maori and Pacific youth, but there was no other significant association found between ethnicity and sleep disorders.

### Comparison with existing literature

This is the second study to use the ASQ since its validation, the first being a study conducted in primary care.<sup>9</sup> The proportion of the respective populations indicating sleep disorders is comparable—41% in the primary care study and 37.2% in this study. Patients attending a general practice would be expected to have a higher rate of illness compared to a general population, which should increase the rates of secondary sleep disorders identified. The authors of the primary care study noted that mental health problems, such as depression and anxiety, are one of the primary causes of sleep disorders, which this present study also indicates. Another recent study

reported that sleep disorders increase the risk of depression and may also 'reflect [a] prodromal symptom of depression'.<sup>8</sup>

Physical health problems were identified as the other major factor in sleep disorders in the primary care study.<sup>9</sup> Adolescents would be expected to have fewer physical health problems than patients attending a primary care clinic. The data reflects this, with 43% of sleep disturbance associated with physical health problems in the primary care study,<sup>9</sup> and only 15% in this adolescent study population. A specific example of this is obstructive sleep apnoea, which in primary care was associated with 9% of sleep disorders,<sup>9</sup> and in this study of adolescents, comprised only 3.9% of sleep disorders.

Circadian rhythm disorders, and specifically delayed sleep-phase disorder, were much more prevalent in this adolescent study group (13% of sleep disorders) than in the primary care study group (9% of sleep disorders). This would be anticipated, with delayed sleep-phase disorder having been described as a teenage pattern of sleep behaviour.<sup>9</sup> The contribution of alcohol use to sleep disorder is also noticeably different between the two studies: alcohol was significant in 12.2% of sleep disorders in high school students, and only 8% of sleep disorders in primary care patients.<sup>9</sup> The contribution of other substance use was comparable in the two studies, at 5.5% of high school students and 4% of the general primary care population. Primary insomnia was also considerably higher in the adolescents studied, representing 17.2% of sleep disorders compared to 12% in the primary care study.

The one other specific study of New Zealand adolescent sleep found 21% reporting inadequate sleep.<sup>19</sup> This lower rate of reported sleep problems compared to our study may be able to be explained by differing methodology. The previous study is different from this present one in that this current study encompasses many different sleep disorders, and has diagnostic ability. Another study performed recently in Australia, using sleep diaries, found that 37.6% of Australian adolescents obtained inadequate sleep on school nights,<sup>28</sup> which is comparable to this study's finding of 37.2% having inadequate sleep.

Previous studies have suggested a significant difference between ethnic groups in New Zealand in terms of sleep disorders, with Maori reporting higher rates of sleep difficulties than non-Maori.<sup>19,29</sup> Analysis of the data in this present study found no statistically significant differences in rates of sleep disorders between different ethnic groups.

### Strengths/limitations

This study provides an indication of rates of diagnosable sleep disorders within the selected population to which the ASQ was administered. The inventories from which the ASQ was built—the ICSD, PHQ-9, GAD-7 and CAGE—have been well validated and documented in a variety of clinical and general population settings. The ASQ itself has been validated within a New Zealand population. Schools varying in decile, and in ethnic and gender composition took part in the study, and after analysis the data presents much statistically significant information. The study had a high response rate at 69.9%.

### Limitations

The study was limited in scope by the sampling-by-convenience method having only been administered to schools in the central and upper North Island. Very little causal information can be derived from a cross-sectional study such as this, and any conclusions about rates of sleep disorders going into adulthood in this population must be speculative. In addition, the ASQ has not been validated for application in youth studies. Furthermore, the definitive diagnosis of obstructive sleep apnoea is made by observing and making measurements of patients' breathing and oxygen saturations in an overnight sleep study. However, this assessment is not readily available to general practitioners due to the very limited number of sleep laboratories in New Zealand. Due to the nature of the surveying tool used in this study, the amount of alcohol use was not quantified; the CAGE questions are also known to overestimate the potential impact of alcohol.

Furthermore, acute stressors (such as upcoming assignments, tests or exams) may have contributed to some of the sleep, mood and anxiety symptoms



reported by the students. Re-administering the questionnaire to the same group of students at different times of the year to use the individual students as their own control would have eliminated the impact of acute stressors on sleep symptoms; however, the resources of the project were limited. There are a number of other assumptions relating to some of the diagnostic categories used in the ASQ, as described elsewhere.<sup>7</sup>

### Implications

This study has the potential to aid physicians within New Zealand in better appreciating the sleep-related health problems faced by young people in this country. As these issues become better understood, this should lead to better management and treatment options, and better outcomes. Early diagnosis of sleep disorders and their symptoms may allow for early intervention, and the lessening of potential consequences. Greater understanding should allow for better service planning in the health sector. Schools, also, may gain a better understanding of the health of their students, which could in turn encourage initiatives to be put in place to improve both health and academic performance. This study's focus on youth highlights differences in rates of sleep disorders and contributory conditions to those found in an older study population, and gives a narrow but important view of adolescent sleep disturbance.

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### COMPETING INTERESTS

None declared.