The relationship between sleep duration and health among Pacific adolescents within New Zealand: Findings from the Pacific Islands families study

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Abstract

Objective: Sleep insufficiency is bi-directionally associated with adverse behavioural, physical and mental health outcomes in paediatric populations. However, little is known about the degree of sleep insufficiency and its effect on Pacific adolescents' wellbeing.

Methods: A cross-sectional study of 14-year old Pacific adolescents nested within a longitudinal birth cohort was conducted. Self-reported sleep duration was related to sentinel physical, mental, and risk taking behaviour measures in crude and adjusted logistic regression models. Complete case and multiple imputed analyses were conducted.

Results: 916 Pacific adolescents were eligible, with a mean age of 14.2 years. Valid sleep data were available from 828 (90.4%) participants, with only 220 (26.6%) meeting the recommended amount of sleep. Insufficient sleep duration was associated with significantly higher rates of depressive symptoms and risk taking behaviours. In multiple imputed analyses, increased body mass index was also significantly related.

Conclusions: Sleep insufficiency is ubiquitous among Pacific adolescents and associated with negative impacts on their health and wellbeing.

Implications for public health: Insufficient sleep duration is amenable to change. Bespoke, culturally responsive public health strategies that draw attention to the importance of positive sleep practices are needed. Particularly, among adolescents who are at risk of experiencing the greatest burden of insufficient sleep.

Key words: sleep, adolescents, Pacific people, physical health, mental health, risk taking

Sleep is essential to maintaining health and wellbeing across the lifespan. Adolescence is a period of profound change in sleep duration, timing and quality.[1] A number of biopsychosocial factors converge during this period including circadian changes affecting sleep timing and changes to an individual's propensity to sleep; increased autonomy over sleep/wake times; competing social and academic demands; and increased device use.[2,3] This "perfect storm"[4,5] culminates in later bedtimes, and dysregulated, fragmented and reduced sleep.[1] National Sleep Foundation Guidelines recommend that teenagers (14–17 years) get 8–10 hours of sleep per night.[6] However, insufficient sleep is a globally recognised problem among this age group.[7] In the most recent study of adolescents in Aotearoa New Zealand (NZ) aged 13–17 years, 39% slept less than the recommended hours of sleep (<8 h) and 57% reported poor sleep quality.[8]

Insufficient and poor quality sleep in adolescents is bi-directionally associated with an increased risk of adverse mental health outcomes, poor affective functioning and emotional regulation, poor academic performance and risk taking behaviour.[9–14] Insufficient sleep is also frequently associated with poor physical health, including obesity.[15,16] Evidence suggests that those who achieve less than the recommended amount of sleep are twice as likely to be overweight or

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obese.[17] Whilst sleep duration is the most frequently investigated sleep measure in relation to obesity outcomes, sleep quality is also known to impact obesity risk.[17] Healthy sleep in children and adolescents is also linked to appropriate timing, regularity (in sleep schedules and consistent bedtime routines) and the absence of sleep disturbances and disorders.[18,19]

Sleep is influenced by a number of socio-cultural, economic and familial factors.[4,7,20] However, little is known about cross-cultural differences in adolescents' sleep in NZ. Approximately 12% of children and young people in NZ identify as being of a Pacific ethnicity. This young and growing population has a median age of 22.1 years, 16 years younger than the NZ population overall.[21] Pacific people in NZ are diverse and their identity is evolving through different heritage cultures, migration histories, acculturation strategies and increasing generations who are NZ born. What it means to be Pacific in NZ is rapidly changing.[22,23] However, Pacific peoples generally are known to value social connectivity, interdependence, cooperation, reciprocity, communitarianism and spirituality.[24] These values can form an integral part of the health and wellbeing of Pacific people.[25]

In spite of the importance of these values, Pacific people experience the effects of disproportionately high rates of socioeconomic and health inequities.[26] In particular, Pacific people, including adolescents, experience poorer physical (e.g. obesity, diabetes and respiratory illnesses) and mental health and a greater burden of disease, culminating in reduced life expectancies.[27–29] In spite of the strength, vibrancy and connectedness of Pacific communities, these sociocultural, economic and physical adversities may all negatively interact with an individual's sleep.[30] For example, family, community and cultural commitments may mean that adolescents are required to stay up late in the evening for events, they are required to give up their bed for other family or community members or that they remain awake to socialise with parents who are undertaking shift work.[30]

Recent data suggest that only 58.6% of Pacific people achieve the recommended amount of sleep (7–9 hours per night among adults[6]), compared to 80.6% of NZ Europeans[31] and that Māori and Pacific children are significantly more likely to report insufficient or disturbed sleep.[32,33] A recent cross-sectional study examining differences in sleep quality and quantity and pre-bedtime activities in NZ adolescents found that, for reason which remain unknown, bedtimes were later among Māori and Pacific adolescents when compared to NZ European adolescents.[8] Shorter sleep duration was associated with screen use as well as consumption of snacks, caffeinated drinks and alcohol.

While there is evidence of a concerning trend in sleep health for Pacific people, little is known about the effect of insufficient sleep duration on the health and wellbeing of Pacific adolescents. Most existing research into the wellbeing of Pacific people focuses on adults and older people, in spite of the fact that young people (10–14 year olds) make up 10.6% of the total Pacific population.[34] The current study uses data from the Pacific Islands Families (PIF) Study to investigate the relationship between Pacific adolescents' sleep duration and sentinel physical health, mental health and risk taking behaviour.

Methods

Study design and setting

A cross-sectional study nested within a longitudinally followed birth cohort. The PIF Study tracks a cohort of 1,398 Pacific infants born at Middlemore Hospital, South Auckland, NZ between 15 March and 17 December 2000. Children were first assessed, and their primary caregivers interviewed, at 6 weeks postpartum (baseline data collection), with follow-up assessments at ages 1, 2, 4, 6, 9, 11, and 14 years.

Participants

Participants in the PIF Study were selected from births where at least one parent was identified as being of a Pacific ethnicity and a NZ permanent resident. Recruitment was made through the Hospital's Birthing Unit, and consent was sought to make a home visit. The current analysis utilises data from singleton and first-born participants, assessed at the 14-years measurement wave.

Procedure

Approximately 6-weeks postpartum, potential maternal participants were visited at home by Pacific interviewers. Once eligibility was confirmed and informed consent obtained, mothers participated in a series of interviews. At the 14-years measurement wave (May 2014 to July 2015), after receiving caregiver consent and child assent, adolescent assessments were undertaken. Information about the cohort and procedures is described elsewhere.[35–37]

Sleep measure

Self-reported sleep duration was ascertained by asking: in the last week, on how many nights did you get at least 8 hours of sleep? Response options ranged from 0 nights to 7 nights. Contiguous categories were combined to form groups: 0–1 nights, 2–3 nights, 4–5 nights and 6–7 nights.

Primary outcome measures

At 14-years, sentinel measures of physical health, mental health and adolescent risk behaviour domains were collected. For physical health, body mass index (BMI) was utilized, derived from weight and height (kg/m^2) and categorized according to the World Health Organization BMI growth reference classification standardised for age (in months) and sex.[38] Underweight was defined as having a z-score <-2; normal as having $-2 \leq$ z-score ≤ 1; overweight as having $1 <$ z-score ≤ 2; obese as z-score >2. For mental health, the 10-item Children's Depression Inventory short form (CDI:S) was employed.[39,40] The CDI:S is a self-rated symptom-orientated screen for depressive symptoms in children aged 7 to 17 years. It has robust internal consistency (Cronbach's α=0.84), reliability and adequate validity.[41,42] The CDI:S responses fall on a 0–2 Likert scale and are summed to form an overall score of 0 to 20, with higher scores representing greater depressive symptoms.[40] A threshold score of ≥ 3 is indicative of depression[43]; and was employed within this study. For adolescent risk behaviours, a composite score was developed and employed. Participants were asked on how many days during the past month they: (1) smoked cigarettes; (2) drank alcohol; (3) used marijuana; (4) used an illegal drug (not counting cigarettes, alcohol or marijuana)—each having response options: never, 1–2 days, 3–5 days, 6–9 days and 10 or more days. The adolescent risk behaviour variable was indicated if participants reported any use of cigarettes, alcohol or drugs.

Table 1: Sociodemographic characteristics of participating adolescents and their primary caregivers at the 14-years measurement wave.

	n	(%)
Gender		
Female	452	(49.3)
Male	464	(50.7)
Main ethnic identification		
Sāmoan	377	(41.2)
Tongan	210	(22.9)
Cook Islands Māori	112	(12.2)
Niuean	37	(4.0)
Māori	41	(4.5)
New Zealand Pākehā	45	(4.9)
Other[a]	94	(10.3)
Caregiver relationship to participant		
Birth mother	857	(94.0)
Adoptive mother	11	(1.2)
Birth father	17	(1.9)
Grandmother	16	(1.8)
Aunt	7	(0.8)
Other	4	(0.4)
Caregiver age (years)		
<35	90	(9.9)
35-39	251	(27.6)
40-44	213	(23.4)
45-49	208	(22.9)
≥50	147	(16.2)
Caregiver highest educational attainment		
No formal qualification	167	(18.5)
Secondary school	382	(42.3)
Post-secondary school	354	(39.2)
Caregiver relationship status		
Married	540	(59.9)
De facto	144	(16.0)
Non-partnered	218	(24.2)
Caregivers years in New Zealand		
<20	171	(18.8)
20-29	278	(30.6)
≥30 and born overseas	174	(19.1)
≥30 and born in New Zealand	286	(31.5)
Household income (NZD)		
≤$40,000	201	(21.9)
$40,001-$80,000	220	(24.0)
>$80,000	180	(19.7)
Unknown	315	(34.4)

[a]Includes those with identify equally with multiple ethnic identifications.

Sociodemographic and potentially confounding variables

Sociodemographic and potentially confounding variables included adolescents' age, gender, self-identified ethnicity, pubertal development measured using the Pubertal development scaled,[44] average daily screen time, days physically active in the past week, daily vegetables consumption, weekly soft drinks or energy drinks consumption and weekly fast food consumption. Primary caregiver variables included relationship to the participant, age, highest education, relationship status and years in NZ. Household variables included the usual number of residents, house size, house warmth and household income. Also the environment factor of seasonality at participant assessment was considered. A list of variables and response options appears in Table S1 of the Supplementary Materials.

Statistical analysis

Strengthening the Reporting of Observational Studies in Epidemiology guidelines informed the reporting of analyses.[45] Participant recruitment and retention numbers were initially reported, followed by baseline characteristics of participants. For participant scores that comprised two or more variables (e.g. CDI:S, risk behaviour and Pubertal Development Scale), recommended corrected item mean (CIM) substitution was applied if ≤50% of score items had missing data.[46] Otherwise the participant's score was set to missing. Sleep and outcome data were then investigated and described. Crude analyses relating sleep to the outcome variables ensued. Logistic regression models were used for the investigation of CDI:S and risk behaviours, while ordinal logistic regression models were applied to BMI categories. Next, a complete case adjusted analysis followed which included the available sociodemographic and potentially confounding variables. The Hosmer–Lemeshow goodness-of-fit test was conducted, using the conventionally employed ten partitions.[47] This was followed by an area under the receiver operating characteristic curve (AUC) analysis. AUC is frequently employed as summary measure of a model's predictive accuracy.[48] Adopting the recommendations of Hosmer and Lemeshow,[47] an AUC of 0.5 suggests no discrimination, 0.7–0.8 is considered acceptable, 0.8–0.9 is excellent and more than 0.9 is outstanding.[47] For ordinal logistic regression models, statistics were calculated by collapsing combinations of contiguous categories. Finally, a sensitivity analysis was conducted, using chained equations multiple imputation (M=50) methods. Aligned with the recommendations of Kontopantelis et al.,[49] all variables were used in this imputation strategy (including primary variables). Statistical significance of variables included with the regressions was assessed via Wald's Type III score statistic. However, in the spirit of Sun et al., no variable selection was made in these adjusted analyses.[50] All analyses were performed using Stata SE version 17.0,[51] employed robust variance estimators, and two-sided α=.05 defined statistical significance.

Results

Participants

At the baseline (6-week) measurement wave, 1,376 mothers and 1,398 infants (with 22 sets of twins) were included in the PIF Study. At the 14-years measurement wave, 931 (66.6%) adolescents participated, of whom 916 were singleton or first-borns from twin births. Primary caregivers for 912 of these 916 adolescents were also interviewed at 14-years. All participants resided in NZ at the time of data collection.

Sociodemographics

The average age at assessment was 14.2 years (Q_1=14.0, Q_3=14.6 years), 453 (49.3%) were female and 377 (41.2%) primarily identified as being of Samoan ethnicity. Sociodemographic characteristics of participating adolescents, primary caregivers and households are presented in Table 1. Multiple ethnic identifications were common, with 247 (27.0%) participants identifying with two, 65 (7.1%) with three, 10 (1.1%) with four and 2 (0.2%) with five ethnicities. Most caregivers at assessment were birth mothers and household income

Table 2: Participant self-report of at least 8 hours of sleep in the previous week, overall and by gender.

Sleep (nights)	Total[a]	Gender[a]	
		Females	Males
	n (%)	n (%)	n (%)
0–1	79 (9.5)	42 (10.4)	37 (8.7)
2–3	207 (25.0)	117 (28.9)	90 (21.3)
4–5	322 (38.9)	146 (36.0)	176 (41.6)
6–7	220 (26.6)	100 (24.7)	120 (28.4)

[a]88 (9.6%) participants had missing self-reported sleep data.

exceeded NZD$80,000 for 180 (30%) of the 601 participants with valid data. In 2014, the estimated average NZ household income was NZD$88,835.[52]

Self-reported sleep duration

Valid data were available from 828 (90.4%) participants. Of these, 220 (26.6%) participants reported at least 8 hours of sleep over the last 6–7 nights and 322 (38.9%) on 4–5 nights; see Table 2. In bivariable ordinal logistic models, gender (p=0.02) and age (p=0.002) differences in reported sleep duration were identified. Compared to males, females were more likely to report 0–1 night and 2–3 nights' sleep of at least 8 hours and less likely to report 4–5 nights and 6–7 nights' sleep of this duration; see Table 2. Older participants were more likely to report fewer nights of at least 8 hours sleep than young participants, with estimated odds ratio of 0.64 [95% confidence interval (CI): 0.48, 0.84] for an increased age of one year.

Sleep duration was not associated with main ethnic identification (p=0.31), pubertal development (p=0.17), screen time (p=0.09), physical activity time (p=0.25), vegetable consumption (p=0.12), soft drinks or energy drinks consumption (p=0.28), fast food consumption (p=0.29), caregiver relationship to participant (p=0.83), caregiver age (p=0.81), caregiver highest educational attainment (p=0.22), caregiver relationship status (p=0.83), caregivers' years in NZ (p=0.75), household usual residential numbers (p=0.48), house size (p=0.70), house warmth (p=0.24), household income (p=0.25) or season of assessment (p=0.57).

Adolescent mental health, risk and BMI outcomes

Overall, 333 (36.4%) participants had valid data for all ten CDI:S items, 179 (19.5%) had nine items, 140 (15.3%) had eight, 108 (11.8%) had seven, 65 (7.1%) had six, 32 (3.5%) had five and the remaining 59 (6.4%) had between six and ten items missing. CIM substitution was employed for those with one to five items missing. CDI:S scores were thus calculated for 857 participants of whom 196 (22.9%) were indicated for depression. For the behaviour risk variables, 56 (6.3%) children reported drinking alcohol, 58 (6.5%) had smoked cigarettes, 32 (3.6%) used marijuana and 17 (1.9%) children reported other illegal drug use. Some 877 (95.7%) participants gave valid responses to all four questions, 14 (1.5%) to three, 3 (0.3%) to two and 22 (2.4%) to one or no questions. Again, applying CIM substitution to those with one or two missing responses yielded 894 participants with a behaviour risk score, of whom 91 (10.2%) were indicated as having engaged in risk taking. A valid BMI score was available for 898 (98.0%) participants, and when classified, 4 (0.4%) were underweight, 190 (21.2%) were normal, 249 (27.7%) were overweight and 455 (50.7%) were obese. Due to the small underweight numbers, these were combined with the normal category.

Table 3: Distribution of Children's Depression Inventory short form indication, risk behaviour indication and body mass index categories by groupings of number of nights with at least 8 hour sleep, together with odds ratios and associated 95% confidence intervals estimates from crude, adjusted complete case and multiple imputed adjusted logistic models.

Sleep (nights)	N	Indications		Crude[a]	Adjusted[b,c]	MI adjusted[c,d]
		n (%)		OR (95% CI)	OR (95% CI)	OR (95% CI)
		CDI:S				
0-1	76	24 (31.6)		2.41 (1.31, 4.43)	2.75 (1.21, 6.24)	2.47 (1.22, 4.97)
2-3	200	65 (32.5)		2.51 (1.56, 4.04)	2.57 (1.43, 4.64)	2.40 (1.43, 4.02)
4-5	309	64 (20.7)		1.36 (0.86, 2.16)	1.50 (0.83, 2.70)	1.38 (0.84, 2.28)
6-7	205	33 (16.1)		1 (reference)	1 (reference)	1 (reference)
		Risk behaviour				
0-1	78	9 (11.5)		1.87 (0.78, 4.52)	1.91 (0.60, 6.05)	1.86 (0.74, 4.70)
2-3	204	31 (15.2)		2.57 (1.33, 4.99)	3.00 (1.29, 7.00)	2.58 (1.26, 5.26)
4-5	318	27 (8.5)		1.33 (0.68, 2.60)	1.22 (0.50, 3.02)	1.16 (0.57, 2.39)
6-7	215	14 (6.5)		1 (reference)	1 (reference)	1 (reference)
		BMI				
		Overwgt	Obese			
0-1	77	19 (24.7)	49 (63.6)	1.93 (1.16, 3.20)	1.85 (0.97, 3.53)	1.74 (1.01, 3.02)
2-3	204	61 (29.9)	101 (49.5)	1.07 (0.75, 1.53)	1.14 (0.75, 1.73)	1.04 (0.71, 1.51)
4-5	317	90 (28.4)	147 (46.4)	0.91 (0.65, 1.26)	0.82 (0.55, 1.24)	0.89 (0.62, 1.28)
6-7	215	62 (28.8)	104 (48.4)	1 (reference)	1 (reference)	1 (reference)

[a]N=790 for CDI:S analysis, N=815 for risk behaviour analysis, and N=813 for BMI analysis.
[b]N=639 for CDI:S analysis, N=656 for risk behaviour analysis, and N=656 for BMI analysis.
[c]Adjusted for gender, age, main ethnic identification, Pubertal Development Scale (PDS), screen time, physically active time, vegetable consumption, soft drinks or energy drinks consumption, fast food consumption, caregiver relationship to participant, caregiver age, caregiver highest educational attainment; caregiver relationship status; caregiver years in New Zealand, household usual residential numbers, house size, house warmth, household income, and season of assessment.
[d]N=916 for all analyses.

Crude and adjusted analyses

Crude and adjusted logistic regression estimates and associated 95% CIs for child outcomes are presented in Table 3, and Tables S2–S4 within the Supplementary Materials. In the crude analyses, sleep was significantly related to CDI:S ($p<0.001$), risk taking behaviour ($p=0.02$) and BMI category ($p=0.03$). Compared to the 6–7 nights of at least 8 hours sleep reference category, increased sleep insufficiency was associated with a greater odds of child depression indication, risk taking behaviours and obesity.

When accounting for sociodemographic and potentially confounding variables, complete cases were available for 639 (69.8%) participants. In these adjusted analyses, sleep duration remained significantly related to depression ($p=0.005$) and risk taking behaviour ($p=0.02$), but not BMI category ($p=0.06$); see Table 3. However, the estimated effect sizes were little different to the crude estimates, suggesting that the considered sociodemographic and potentially confounding variables had negligible effect on these adolescent outcome and sleep relationships. In terms of model fit, the adjusted models have adequate fit and acceptable accuracy (see Supplementary Materials).

Sensitivity analyses

After undertaking chained equations multiple imputed (MI) for missing data (M=50) and repeating the adjusted logistic regressions, the resulting estimates were strikingly similar to those derived from the complete case analyses; see Tables 3 and S2–S4. Although the effect sizes were dampened slightly, the increased sample size in these MI adjusted analyses resulted in a significant association between sleep duration and BMI, with those reporting 0–1 nights of at least 8 hours sleep having odds of obesity 1.74 (95% CI: 1.01, 3.02) times higher than those reporting 6-7 nights ($p=0.04$). All relationships between sleep duration and depression and risk taking behaviors remained significant. The models yielded Hosmer–Lemeshow goodness-of-fit and AUC statistics that continued to represent adequate fit and acceptable accuracy.

Discussion

In this general population of Pacific adolescents, only 26.6% of people achieved the recommended duration of sleep, and both females and older participants received less sleep than their male and younger counterparts. Moreover, nearly 10% reported no or one night sleep of at least 8 hours in the previous week, suggesting high levels of sleep deprivation. This is consistent with previous research, indicating that Pacific adolescents[7,20,33] and females[53] receive less sleep than their non-Pacific and male counterparts. In the 2017/2018 NZ Health Survey, 76.3% of children aged 10–14 years usually met sleep duration recommendations, though Pacific children were significantly less likely to meet these thresholds than non-Pacific children.[54] In our slightly older sample, 542 (65.5%) self-report at least 8 hours of sleep over 4–7 days in the previous week. This result suggests around one-in-three Pacific 14-year-olds likely suffer from insufficient sleep, a rate higher than their non-Pacific peers.

In this study, insufficient sleep duration was associated with higher rates of depressive symptoms, risk taking behaviour and BMI. The issues of poor sleep and mental health are inextricably linked[9,10,12–14] and is particularly pronounced in cases of severe sleep deprivation (e.g. <5hrs sleep per night).[13] Longitudinal and treatment studies suggest sleep disturbance may even act as a precursor to depression in adolescents.[55] However, this association has scarcely been examined among Pacific adolescents with the current findings suggesting that this is an important avenue for further research. The relationship between obesity and insufficient sleep is also well-established[17] and the extant findings align with preliminary evidence suggesting that shorter sleep duration is associated with higher BMI.[16]

In this study, it was somewhat surprising that sleep duration was not associated with a number of child-specific variables including screen time, physical activity and nutritional factors. Current research suggests that nutritional factors such as caffeine consumption and night-time technology use can negatively affect sleep among children and adolescents.[53,56–60] Physical activity has also been identified as a protective factor for optimal sleep and is associated with earlier bedtimes and efficient sleep onset.[53,56,61] It is possible that the lack of association found in this study is a reflection of limitations inherent in some of the measures.

It was equally unexpected to find that household characteristics, such as household residential numbers, size or warmth, were not associated with sleep duration in this study. Further research is needed to investigate whether and how household characteristics affect different dimensions of children's sleep[62,63] including among the Pacific community. Using Youth' 12 survey data, Fa'alili-Fidow et al.[64] found that sleeping in rooms that are not bedrooms was four times higher among Pacific teenagers' households than NZ European teenagers' households. However, the impact of such sleep settings on sleep is not well-established and research into the effects of overcrowding on sleep is variable.[33] The relationship between household, parent and child characteristics and sleep is likely to be complex and multifaceted and to include factors aside from the physical environment and sleep hygiene, such as social dynamics, levels of interpersonal conflict and evening activities.[56,62,65]

There is an urgent need for further research among adolescents who are at risk of experiencing the greatest burden of insufficient sleep. This includes research that examines the determinants of poor sleep health in Pacific adolescents. Such research can enhance our understanding of the interaction between sleep and mental health and wellbeing and can subsequently inform priorities and layers of support. Likewise, there is a need for further research that enhances our understanding of the relationship between sleep and adolescent mental and physical health and daytime behaviour. In particular, whether improved sleep among Pacific adolescents results in collateral wellbeing benefits. This has important implications for the development of public health approaches to prevention and intervention for poor sleep.

Sleep insufficiency is a modifiable factor, amenable to change. However, little attention has been devoted to promoting positive sleep practices,[66] and less still for Pacific teenagers. There are social, familial, cultural and religious factors that are unique to Pacific people that play a role in sleep and that should be integrated into public health prevention and clinical intervention strategies. This may include the design of parent or adolescent focused psychoeducation, which specifically targets the later sleep onset times[7,20] and higher rates of pre-bedtime activities[7] observed among Pacific adolescents. At a systemic level, recent attention has been focused on delaying school start times in response to the biopsychosocial changes that emerge during adolescents, and there is increasing evidence that doing so can increase sleep duration.[14,67] Bespoke solutions that meet the needs of Pacific adolescents are important to consider in future

planning, if we are to decrease sleep problems and the deleterious effects of such problems, among this population.

This is one of few studies to examine sleep patterns among Pacific adolescents across a myriad of apposite variables. It also included a relatively large and ethnically representative sample of Pacific adolescents within NZ. Furthermore, this study employs careful and contemporary data capture, management and analysis methods, and adheres to best practice guidelines for reporting observational studies. In spite of these strengths, it also suffers from important limitations. The reliance on self-reported sleep is arguably the greatest limitation. However, adolescent self-reported sleep often over estimates amount of sleep rather than underestimates.[68] There are also inherent limitations associated with the measurement of sleep using retrospective self-report and the absence of validated and standardized measures. Further, it is not possible to determine how frequently sleep duration was less than the recommended duration (<7 hours) or the degree of insufficient sleep. The available data also preclude the possibility of determining whether insufficient sleep duration is the result of later bedtimes, earlier wake times or fragmented sleep, each of which may be influenced by a unique set of underpinning sociocultural factors and could have differential effects on mental health and wellbeing. Likewise, as the data was collected in 2014/2015, some data may be less reflective of current sociocultural norms (e.g. adolescent technology use). While both BMI and CDI:S variables have robust psychometric properties, the childhood risk taking behaviour variable was created for this analysis. Despite having reasonable face validity, the psychometric properties of this variable is unknown, and may be subjected to misclassification error. Lastly, data were missing for a number of participants and variables, which may introduce bias. CIM substitution and MI analyses sought to minimize this effect, but if data were not missing at random, then potential important biases may exist.

Conclusions

Failure to address poor health and well-being in Pacific adolescents (a critical time in child development) can have enormous deleterious consequences for their lifetime ahead. Teenagers as individuals become increasingly independent in the management of their daily activities and routines. Support through educating them about the importance of sleep, combined with a good understanding of their own sociocultural context, may assist in preventing the gradual deterioration in sleep observed during this critical developmental period with consequences for improved health and well-being. This is particularly important for Pacific adolescents who are exposed to increased risk of adverse physical and mental health outcomes.

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Ethics

Ethical clearance was obtained from the Auckland Branch of the National Ethics Committee (6-weeks [baseline]; reference number 99/055), and the Southern Health and Disability Ethics Committee (14-years measurement wave; reference number 13/STH/159).

Conflicts of interest

The authors have no competing interests to declare.

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Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anzjph.2023.100021.