Sleep Health 5 (2019) 606–614

Contents lists available at ScienceDirect

Sleep Health

Journal of the National Sleep Foundation

journal homepage: sleephealthjournal.org

# Sleep duration and psychological well-being among New Zealanders

Carol HJ Lee, MSc *, Chris G Sibley, PhD

*School of Psychology, University of Auckland, Auckland, New Zealand*

ARTICLE INFO

*Article history:*
Received 26 October 2018
Received in revised form 2 June 2019
Accepted 17 June 2019

*Keywords:*
Sleep duration
Psychological well-being
New Zealand

ABSTRACT

*Objective:* To identify the prevalence of short and long sleep duration and examine the relationship between sleep duration and psychological well-being among New Zealand adults.
*Design:* Multiple regression using data from the New Zealand Attitudes Values Study postal questionnaire.
*Participants:* New Zealand Attitudes Values Study respondents in 2014, 2015, and/or 2016 (Ns =15,820, 13,942, and 21,937).
*Measurements:* Participants were asked, "During the past month, on average, how many hours of *actual sleep* did you get per night?" They also reported their demographic characteristics, physical and psychological health, and personality traits.
*Results:* Most New Zealanders reported having optimal sleep duration (7 to <9 hours, 58%), but more than a third reported having short (<7 hours, 37%) and 4.5% reported long sleep duration (≥ 9 hours). Māori and Pacific peoples showed particularly high rates of short sleepers. Compared to optimal sleep, short sleep consistently showed negative relationships with various measures of positive psychological well-being (eg, self-esteem, life satisfaction) independent of a broad range of demographic, health, and personality factors. Long sleep was only associated with an increased likelihood of depression. Personality traits, especially neuroticism, also showed strong associations with psychological well-being.
*Conclusions:* The high proportion of short sleepers in New Zealand is a major issue of concern because short sleep showed consistent associations with negative psychological well-being.
It is vital to implement sleep awareness campaigns and increase research on the reasons for short sleep among different groups. Given the ethnic disparity in sleep duration, target interventions for Māori and Pacific peoples are particularly crucial.


## Introduction

Although insufficient sleep is a common occurrence in modern society, its adverse mental health consequences are often overlooked. Generally, around 7 to 9 hours is regarded as the optimal amount of sleep duration linked with positive psychological well-being and subjective health.[1–3] In contrast, insomnia or insufficient sleep, as well as excessive sleep duration, has been associated with a wide range of negative psychological outcomes.[1–5] This includes lower self-rated health, lower quality of life and an increased risk for mental illnesses such as depression and anxiety disorder.

Numerous studies suggest that a considerable proportion of New Zealanders experience significant sleep problems.[4,6,7] According to a study conducted on a national sample of New Zealand adults in 2012 (N = 9425), around 30% reported restless sleep most/almost all of the time.[6] Moreover, the 2002/03 New Zealand Health Survey found that greater sleep complaints continued to show a significant effect on one's physical and mental health outcomes after controlling for key demographic factors such as ethnicity, gender, age, and deprivation.[8] With the high prevalence of mental health problems and short sleepers in New Zealand,[4,6,9] it is vital to increase insight into the relationship between sleep duration and psychological well-being among New Zealanders. Ethnic disparities in sleep health are also important to investigate, as suboptimal sleep may be perpetuating ethnic health inequalities and contributing to poorer mental health outcomes among Māori, the indigenous people of New Zealand.[4]

Previous American studies have found that being older, being an ethnic minority, being a smoker, having lower educational attainment, having lower income, and having physical or mental health problems are associated with suboptimal sleep duration.[10,11] In New Zealand, Paine and Gander[12] found that being Māori, being unemployed, and living in deprived areas were linked with short sleep on both free and scheduled days (ie, days with regular work, other

* Corresponding author at: University of Auckland, School of Psychology, Level 2, Bldg 302, Science Centre, 23 Symonds St, Auckland Central.
*E-mail address:* clee879@aucklanduni.ac.nz. (C.H.J. Lee).

https://doi.org/10.1016/j.sleh.2019.06.008
2352-7218/

commitments) and long sleep on scheduled days. Being Māori and being of lower socioeconomic status are also independent risk factors of excessive sleepiness[13] and insomnia symptoms.[14] Greater sleep problems among these groups can be linked to their increased likelihood of performing shift work and poorer health status.[9,12,13] In terms of ethnic health disparities, poor sleep health among Māori is a concerning finding because this group tends to exhibit greater mental health problems and barriers to health care access.[9]

Personality traits are also associated with one's sleep quality and psychological health.[15–18] These relationships are complex and bidirectional. One's emotions and cognitions, which are likely influenced by personality traits and mental health, are major contributors to sleep disturbances but are also impacted by sleep deprivation.[19] Previous studies have generally found that high Neuroticism and low Conscientiousness are linked to various measures of poor sleep and mental health.[15,16,18] In addition to these 2 traits, Hintsanen et al[20] found that high Extraversion and Agreeableness also predicted better sleep among Australian and Finland samples. Another Australian study found that high Extraversion, Conscientiousness, and Emotional stability were associated with better, whereas high Agreeableness was associated with worse, sleep quality and subjective well-being.[17] These findings highlight the importance of considering the influence of personality traits when assessing the relation between sleep health and mental well-being (see Appendix for definition of Big-Six personality traits).

To our knowledge, previous New Zealand studies have not assessed the relationship between sleep duration on psychological health while controlling for demographic, health, as well as personality factors. The present study aims to fill this gap in research by examining the unique association between sleep duration and various measures of psychological health in a large national sample of New Zealand adults. Using data from 3 consecutive years of the New Zealand Attitudes and Values Study (NZAVS), we assess the relationship between sleep duration (short and long) and one's level of psychological distress, subjective health, life satisfaction, self-esteem, personal well-being, rumination, and likelihood of depression and anxiety disorder. We also examine the prevalence of and ethnic disparity in short and long sleep duration in New Zealand. As sleep duration is a potentially modifiable health behavior, our findings will have important implications regarding the necessity for improved sleep awareness campaigns and target interventions for specific ethnic groups. It will also provide a useful framework for future research on the relationships between sleep health, personality traits, and psychological well-being in the context of New Zealand.

## Participants and methods

### *Sampling procedure*

The NZAVS is a longitudinal panel study of a national probability sample of New Zealand adults. This study is reviewed by the University of Auckland Human Participants Ethics Committee every 3 years and has most recently been approved from 5 September 2017 to 3 June 2021 (reference number: 014889). In time 1 (2009), the NZAVS recruited participants by randomly selecting samples from the New Zealand electoral roll (response rate: 16.6%). A booster sample was later recruited at time 3 (2011) through an unrelated survey posted on the Web site of a major New Zealand newspaper. Further booster samples were recruited from the 2012 and 2014 Electoral Roll in subsequent time periods.

### *Participants*

This study uses data collected in the time 6 (2014; N = 15,820), time 7 (2015; N = 13,942), and time 8 (2016; N = 21,937) wave of the NZAVS. Participants for each time point had a mean age of around 50 years and median household income of $90,000.* Sixty three percent of each sample were female, with around 81% being of European, 12% being of Māori, 3% being of Pacific, and 4% being of Asian ethnicity (ethnic categories are not mutually exclusive). Roughly 77% of participants from each time point were employed, and 74% were parents.

### *Measures*

Sleep duration was measured using the open-ended question: "During the past month, on average, how many hours of *actual sleep* did you get per night?" This item was derived from the Pittsburgh Sleep Quality Index.[21] Responses to this item was split into 3 categorical groups: short sleep (<7 hours), optimal sleep (from 7 to <9 hours) and long sleep (≥ 9 hours). These cutoffs are based on that used by Paine and Grander.[12] Measures of general psychological well-being included the K6 psychological distress,[22] subjective evaluation of own health,[23] satisfaction with life,[24] rumination,[25] self-esteem,[26] and personal well-being scales.[27] See Appendix for details on scale items.

Participants were asked to report their gender, date of birth, annual household income, and smoking status. They also indicated whether they had been diagnosed with various physical or mental illnesses (eg, heart disease, diabetes, asthma, depression, anxiety) in the last 5 years and whether they had a "health condition or disability that limited them, and that has lasted for 6+ months." Body mass index was calculated using participants' reported height and weight. Ethnicity was measured using the standard New Zealand Census item in which participants could indicate each ethnic group they identified with. Education was coded into an 11-level ordinal variable (0 = no qualification to 10 = doctoral degree).

Deprivation was measured using the 2013 New Zealand Deprivation Index, which uses census information to assign a decile-rank index from 1 (least deprived) to 10 (most deprived) to each meshblock unit.[28] Socioeconomic status was measured using the New Zealand Socioeconomic Index.[29] Personality traits were measured using the Mini-IPIP6,[30] which assesses the Big-Six personality traits using 4-item subscales rated from 1 (very inaccurate) to 7 (very accurate). Example items include "I am the life of the party" for Extraversion and "I get chores done right away" for Conscientiousness.

### *Statistical analyses*

Multiple regression analyses predicting level of Kessler-6 psychological distress, self-rated health, satisfaction with life, rumination, self-esteem, and personal well-being were conducted simultaneously on Mplus for each time point separately. Sleep duration was split into a 3-category variable, and "short sleep" and "long sleep" were included as predictors (optimal sleep as reference category) in these analyses. A range of demographic and personality variables was also included as predictors. Using the same group of predictors, separate logistic regressions were conducted to predict the likelihood of a depression and anxiety disorder diagnosis (binary variables) for each time point. The proportion of participants within each sleep category group was obtained using SPSS. All analyses were conducted after applying standard NZAVS sample weighting.

### *Sample weighting procedure*

To estimate representative population proportions, the NZAVS uses a poststratification weight that corrects for sample bias in

* [T]The medium household income of New Zealanders in the 2013 NZ Census was $63,800.

gender and ethnic group identification. As the time 4 (2012) sample included regional booster samples, weights from time 4 onwards include regional information. The weighting procedure for this study was based on population demographic data from the 2013 New Zealand Census, with sample weights being determined by one's region of residence, gender, and ethnicity. Weights for men and women from each of the four primary ethnic groups were calculated separately. Refer to technical documents for details on procedures for estimating NZAVS sample weightings[31] and comparisons between the NZAVS and Census data.[32]

## Results

### *Demographic information of sleep category groups*

Figure 1 depicts the distribution of average hours of sleep per night for participants in each time point. Across all 3 time points, the mean sleep duration for all participants was around 6.87 hours, with around 58% reporting optimal, 37% short, and 4.5% long sleep duration. The distribution of participants across the sleep duration groups was very similar to that seen in total sample for both males and females. As seen in Figures 2 and 3, the proportions of participants within each sleep category group for different ethnic and age groups were also similar across all time points. In regard to ethnicity, Europeans reported the highest rate of optimal sleep (60.5%-61.1%), followed by Asian (56.0%-59.4%), Māori (48.0%-48.5%), and Pacific (40.7%-45.7%) peoples. Conversely, Māori (46.4%-48%) and Pacific peoples (49.6%-53.9%) reported the highest rate of short sleep. Younger individuals reported a lower rate of short sleep (33.8%-35.0%) compared to middle-aged (38.3%-39.0%) and older (37.0%-38.2%) individuals (see Appendix for further details).

### *Regression models predicting psychological well-being*

Separate regression models predicting psychological health outcome variables for time 6 (2014), time 7 (2015), and time 8 (2016) were conducted. Multiple linear regression was used for continuous outcomes, and logistic regression was used for binary outcomes (ie, depression and anxiety diagnosis). Short sleep and long sleep are interpreted in terms of comparison to optimal sleep duration (reference group). Europeans were used as the reference group for ethnicity. All analyses simultaneously controlled for a range of demographic, health, and personality factors. We report standardized $\beta$ values to enable comparison between predictors measured on different scales. Only key findings regarding the results of short and long sleep, ethnicity, and personality variables are reported in the text. See Appendix for full regression results.

### *Short and long sleep duration*

Compared to optimal sleep, short sleep was associated with increased psychological distress and rumination, and lower self-rated health, life satisfaction, self-esteem, and personal well-being across all time points (Table 1). Short sleep did not show significant associations with the likelihood of depression or anxiety disorders. On the other hand, long sleep was associated with higher odds of a depression diagnosis across all time points and higher odds of an anxiety diagnosis in time 7. Long sleep was associated with increased life satisfaction in time 8 but did not show significant associations with the remaining 5 measures of general psychological well-being.

### *Ethnic groups*

Relative to Europeans, Māori individuals showed lower life satisfaction in time 6 and 7, and lower personality well-being across all 3 time points (Table 2). They also showed a lower likelihood of both depression and anxiety diagnosis in time 6 and lower likelihood of depression in time 8. Pacific peoples showed higher self-rated health in time 8, higher self-esteem in time 7 and 8, and lower likelihood of depression diagnosis in time 8. Asian peoples showed higher psychological distress and rumination in time 6 and higher self-esteem across all time points. They showed a lower likelihood of depression diagnosis in all time points and lower likelihood of anxiety diagnosis in time 6 and 7.

### *Big-Six personality traits*

As seen in Table 3, being high on Extraversion, Conscientious, and Honesty-Humility was consistently associated with decreased psychological distress and rumination, and higher self-rated health, life satisfaction, self-esteem, and personal well-being. On the other hand, higher Neuroticism was consistently associated with negative psychological well-being on these same measures. Higher Neuroticism was also related to a higher likelihood of depression and anxiety across all three time points. Interestingly, being high on Honesty-Humility was associated with an increased likelihood of depression diagnosis across all time points. (See Table 3.)

Agreeableness was linked with increased life satisfaction, self-esteem, and personal well-being in at least 2 of the 3 survey years. However, it was also linked with increased psychological distress and likelihood of anxiety diagnosis in time 7 and 8 and higher likelihood of depression in all 3 time points. Similarly, Openness was linked with increased self-rated health and self-esteem, lower life satisfaction and personal well-being, and higher rumination in at least 2 survey years. Openness was also linked with a higher likelihood of depression in time 7 and 8 and higher likelihood of anxiety in time 6 and 7.

## Discussion

Using data from 3 consecutive years (2014-2016) of the NZAVS, the present study assessed the prevalence of optimal, short, and long sleep among New Zealand adults. Across all survey years, most New Zealanders reported optimal sleep duration (7 to <9 hours, 58%), but around 5% report long sleep (≥ 9 hours) and 37% reported short sleep duration (>7 hours). Older (37.0%-38.2%) and middle-aged adults (38.3%-39.0%) showed a slightly higher proportion of short sleepers compared to younger individuals (33.8%-35.0%), but this difference was not as pronounced as ethnic disparities in sleep duration. A considerably higher proportion of Māori (46.4%-48%) and Pacific peoples (49.6%-53.9%) reported short sleep duration compared to Asian peoples (36.2%-40.8%) and Europeans (34.0%-34.5%). Our findings indicate that more than one third of New Zealanders are not getting enough sleep, and this problem is particularly prevalent among Māori and Pacific peoples.

### *Short and long sleep duration*

The current study further assessed the association between sleep duration (short and long sleep) and various measures of psychological well-being. This relationship was examined while controlling for a wide range of demographic, health, and personality variables. Similar to past studies,[1,3,4] short sleep duration was associated with many adverse psychological outcomes. This included higher psychological distress and rumination, and lower self-rated health, life satisfaction, self-esteem, and personal well-being. However, long sleep did not show significant associations with any measure of general psychological well-being. Our results can be helped explained by findings that insufficient sleep is linked to a negative bias in mood and perception, increased irritability, and tendency to focus on and remember negative experiences.[19,33] These are all factors that contribute to lower

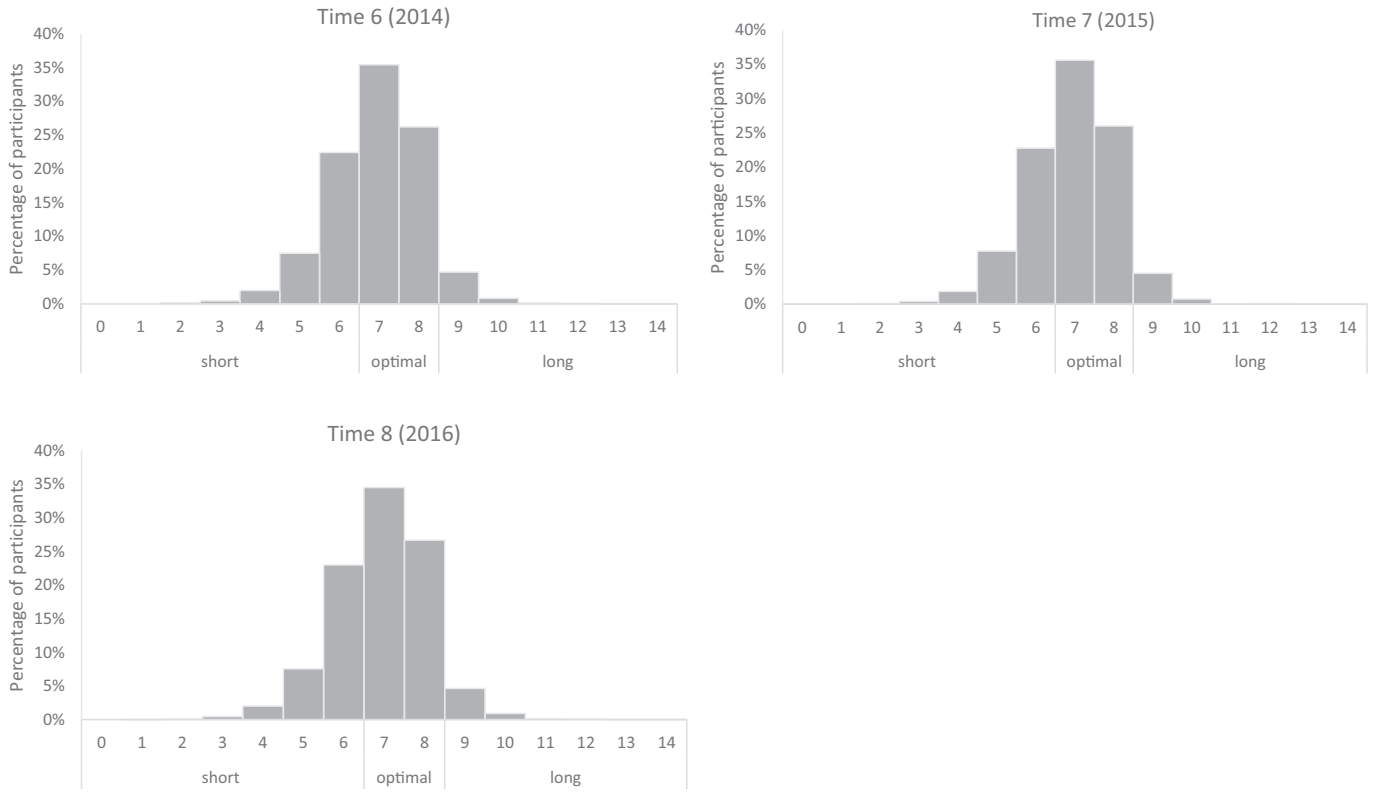


**Fig. 1.** Distribution of average hours of sleep per night for participants in time 6, 7, and 8. (hours rounded to nearest whole number).

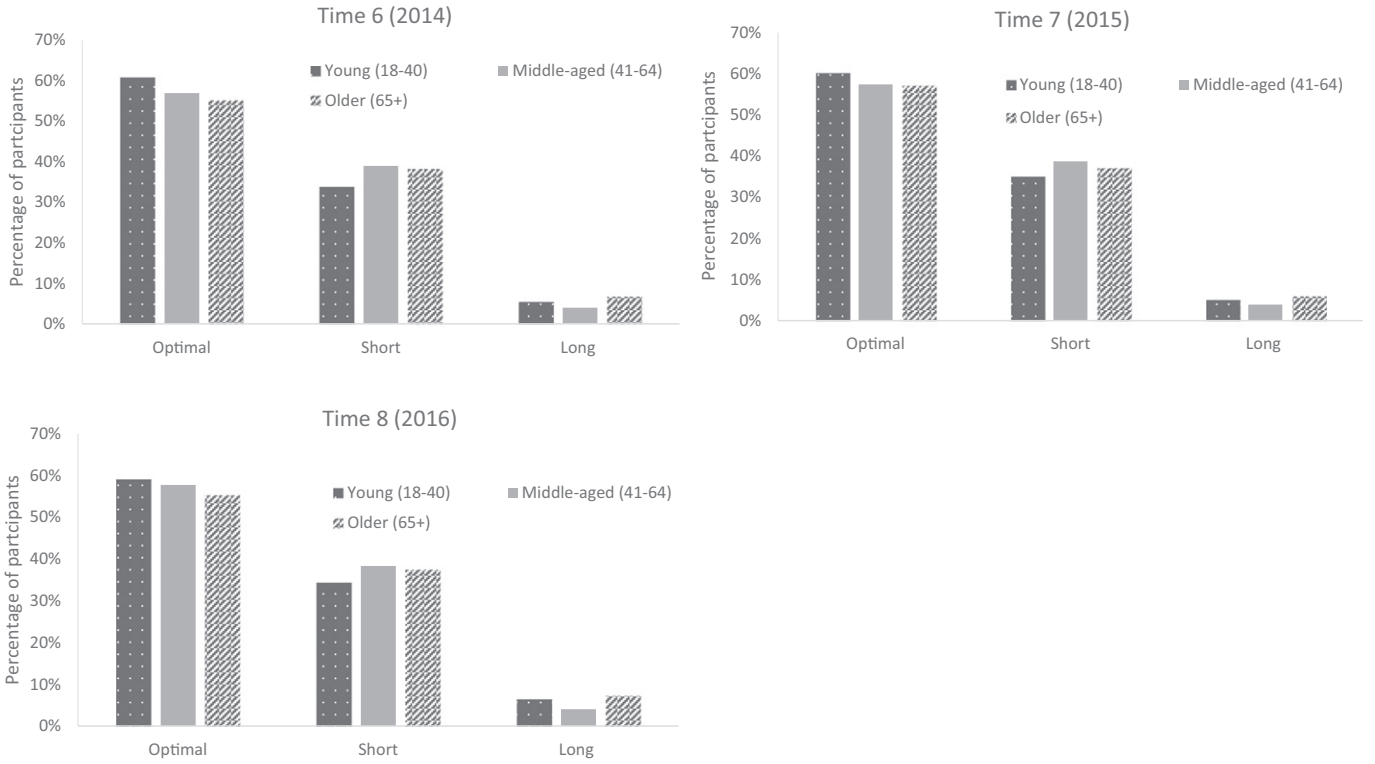


**Fig. 2.** Percentage of participants within each sleep duration category by age group across time points (optimal sleep: 7 to <9 hours; short: <7 hours; long sleep: ≥ 9 hours).

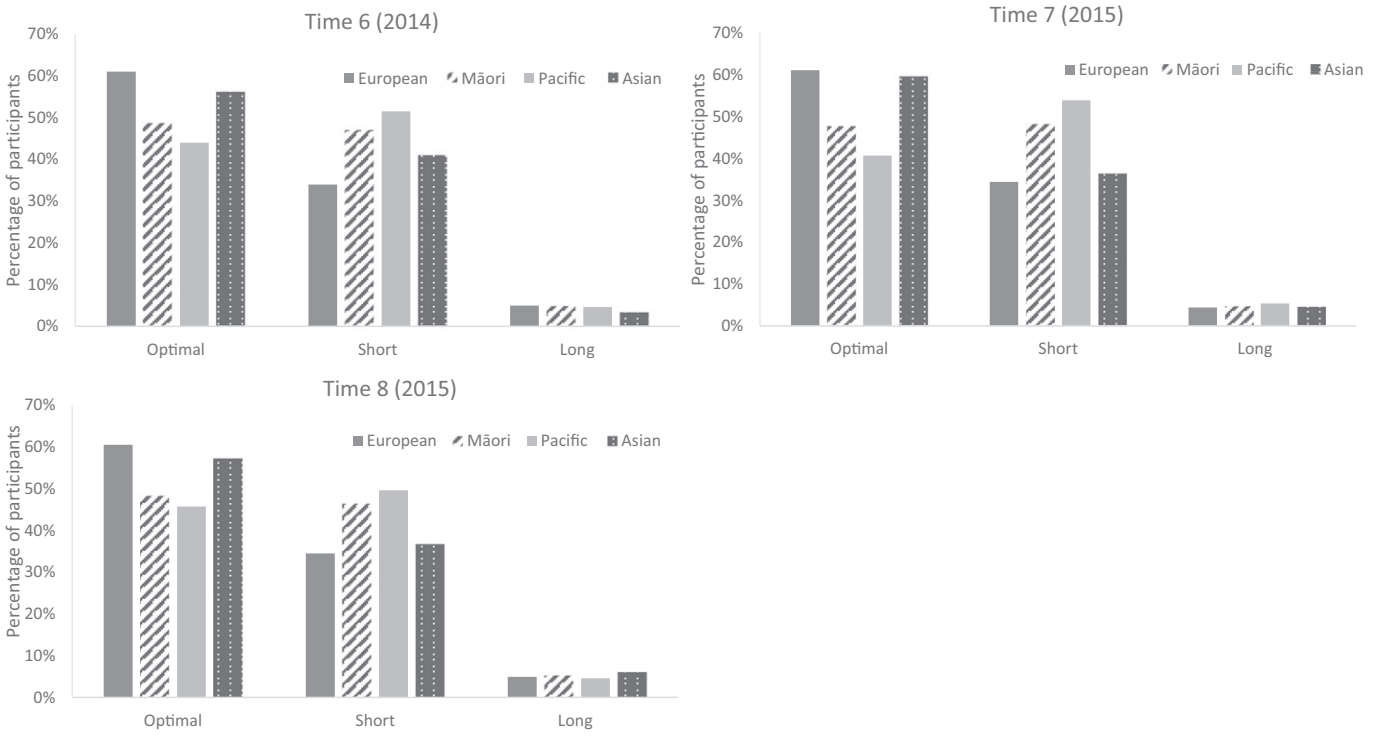


**Fig. 3.** Percentage of participants within each sleep duration category by ethnic group across time points (optimal sleep: 7 to <9 hours; short: <7 hours; long sleep: ≥ 9 hours).

**Table 1**
Short and long sleep duration predicting measures of psychological well-being

| | Short sleep | | | Long sleep | | |
|---|---|---|---|---|---|---|
| | Time 6 | Time 7 | Time 8 | Time 6 | Time 7 | Time 8 |
| K6 distress | .056** | .075** | .072** | −.009 | .003 | −.010 |
| Self-rated health | −.052** | −.034** | −.053** | −.009 | −.014 | −.015 |
| Life satisfaction | −.078** | −.072** | −.068** | .006 | .016 | .022** |
| Rumination | .029** | .038** | .039** | −.005 | −.007 | −.009 |
| Self-esteem | −.038** | −.040** | −.041** | .007 | .011 | .013 |
| Personal well-being | −.081** | −.071** | −.081** | .002 | .009 | .000 |
| Depression | .897 | .898 | .935 | 1.650** | 1.727** | 1.533** |
| Anxiety | .915 | 1.007 | .917 | 1.288 | 1.410* | 1.091 |

Odds ratios reported for diagnosis of depression and anxiety (binary outcome). Standardized coefficients reported for all other continuous outcomes. Analyses controlled for large range of demographic, health, and personality variables (see Appendix for full regression results).

* $P < .05$.

** $P < .01$.

psychological well-being. Moreover, as increased stress, rumination, and negative emotional regulation can in turn lead to insufficient sleep,[19] short sleep and negative psychological well-being appear to perpetuate each other in a vicious cycle.

Long sleep did not show significant associations with any measure of general psychological well-being. However, long sleep but not short sleep was associated with an increased likelihood of depression across all 3 survey years. Neither short nor long sleep was significantly associated with the likelihood of an anxiety disorder diagnosis in any year. These findings contradict past research in which short sleep and long sleep have been typically associated with an increased risk of both depression and an anxiety disorder.[5,17,34] This unexpected finding may be at least partially explained by the fact that our question asked about whether one had been diagnosed in *the past 5 years* and did not distinguish between those with a current or previous diagnosis. Perhaps, those previously diagnosed with anxiety no longer experience sleep problems after successful treatment, or those with a current diagnosis use medication to help them sleep better. As for depression, the association between antidepressant medication and long sleep duration[35] suggests that the use of medication following a diagnosis, rather than the illness itself, may be driving the relationship between long sleep and depression.

### *Ethnic health disparities*

In New Zealand, Māori and Pacific peoples tend to exhibit poor mental health and lower health care access.[9,36] Asian peoples are generally found to exhibit good mental health,[9] but they are likely to encounter cultural barriers to mental health care.[36] It is thus important to understand the factors that contribute to ethnic inequalities in health and health care access. As noted above, Māori and Pacific peoples reported a higher prevalence of short sleep compared to other ethnic groups. The subsequent finding that short sleep is associated with multiple measures of negative psychological well-being suggests that sleep duration may be an important contributor to the high prevalence of mental problems among Māori and Pacific peoples. As sleep problems and negative psychological health are likely to have a bidirectional relationship,[19,37] addressing the problem of short sleep among these groups may be a small but crucial step in reducing persistent ethnic disparities in mental health.

In addition to disparities in sleep duration, our study revealed the unique association between ethnic identification and psychological well-being independent of a wide range of demographic, health, and personality variables. Contrary to the lower rate of psychological distress noted in the New Zealand Health Survey,[9] being of Asian ethnicity was associated with higher distress and rumination in time 6. Investigating the different stressors that distinct subgroups within the "Asian" category are exposed to may help clarity these mixed findings. Being of Pacific ethnicity did not show consistent significant associations with any indicator of negative psychological well-being in our study. This suggests that the disparity in mental health between Pacific peoples and Europeans[9,36] is largely accounted for by differences in demographic, health, and personality characteristics. Both Asian and Pacific peoples also showed increased self-esteem, a promising characteristic that may help enhance resilience against racial discrimination among these groups.

Interestingly, Māori individuals continued to exhibit decreased personal well-being (all time points) and life satisfaction (time 6 and 7) after controlling for demographic, health, and personality variables. This finding may be demonstrating the lasting impact of colonization, which resulted in the loss of rights, power, and land,[38] on Māori satisfaction with various aspects of their life and current New Zealand society. Hence, to appropriately address Māori health disparities, it is important to acknowledge and understand the unique historical contributors to their mental health. Possibly due to this cultural barrier, Māori showed a lower likelihood of depression and/or anxiety in time 6 and 8. Asians also showed a lower likelihood of mental illness diagnosis, highlighting the importance of ensuring that these groups are being provided culturally relevant mental health care.

### *Big-Six personality traits*

In line with previous research,[15,17,18] low Conscientiousness and high Neuroticism were consistently associated with negative general psychological well-being. As with short sleep, this included higher psychological distress and rumination, and lower self-rated health, life satisfaction, self-esteem, and personal well-being. On the other

**Table 2**
Ethnicity variables predicting measures of psychological well-being

| | Māori | | | Pacific | | | Asian | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time 6 | Time 7 | Time 8 | Time 6 | Time 7 | Time 8 | Time 6 | Time 7 | Time 8 |
| K6 distress | .010 | −.010 | −.007 | .012 | .007 | −.002 | .030* | .015 | .016 |
| Self-rated health | −.007 | .000 | −.006 | .003 | .011 | .026* | −.022 | −.024 | .021 |
| Life satisfaction | −.026** | −.023* | −.009 | .025 | .025 | .021 | .001 | −.017 | −.003 |
| Rumination | .010 | −.012 | −.005 | .027 | .019 | .017 | .060** | .017 | .018 |
| Self-esteem | .000 | .009 | .014 | .047** | .026 | .037** | .049** | .045** | .053** |
| Personal well-being | −.061** | −.066** | −.044** | −.003 | −.007 | .005 | .006 | .002 | .008 |
| Depression | .670** | .821 | .781* | .679 | .752 | .428** | .409** | .632* | .530** |
| Anxiety | .601** | .813 | .862 | .636 | 1.036 | .722 | .389** | .538 | .481** |

Europeans used as reference group. Odds ratios reported for diagnosis of depression and anxiety (binary outcome). Standardized coefficients reported for all other continuous outcomes. Analyses controlled for large range of demographic, health, and personality variables (see Appendix for full regression results).

* $P < .05$.

** $P < .01$.

**Table 3**
Big-Six personality traits predicting measures of psychological well-being*

| | Extraversion | | | Agreeableness | | | Conscientiousness | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time 6 | Time 7 | Time 8 | Time 6 | Time 7 | Time 8 | Time 6 | Time 7 | Time 8 |
| K6 distress | −.101** | −.103** | −.107** | −.003 | .027** | .026** | −.096** | −.084** | −.104** |
| Self-rated health | .076** | .073** | .091** | .017 | .017 | .007 | .111** | .130** | .115** |
| Life satisfaction | .143** | .123** | .144** | .042** | .033** | .028** | .085** | .054** | .095** |
| Rumination | −.089** | −.082** | −.084** | .009 | .005 | .016 | −.064** | −.056** | −.057** |
| Self-esteem | .190** | .177** | .182** | .026** | .028** | .010 | .133** | .132** | .143** |
| Personal well-being | .116** | .097** | .117** | .039** | .035** | .030** | .093** | .094** | .115** |
| Depression | .950 | .963 | .978 | 1.167** | 1.166** | 1.170** | .968 | .971 | .910** |
| Anxiety | .940 | .931 | .955 | 1.087 | 1.197** | 1.123** | .994 | .988 | .952 |

Odds ratios reported for diagnosis of depression and anxiety (binary outcome). Standardized coefficients reported for all other continuous outcomes. Analyses controlled for large range of demographic, health, and personality variables (See Appendix for full regression results).
* $P < .05$.
** $P < .01$.

hand, Extraversion and Honesty-Humility were consistently associated with positive general psychological well-being. In terms of mental illness, Neuroticism was linked with an increased likelihood of diagnosed depression and anxiety. Unexpectedly, Honesty-Humility and Agreeableness also showed associations with a greater likelihood of depression. Perhaps, as those high on Honesty-Humility and Agreeableness are less likely to engage in egoistic or deceitful attitudes,[30] their tendency to act in the best interest of others may ironically lead to increased depressed emotions. Alternatively, those high on these traits may be more likely to be diagnosed as they are more likely to access mental health services.

Personality traits generally showed stronger associations with psychological well-being than demographic or health variables as well as short sleep duration. In fact, Neuroticism showed the strongest association with measures of psychological well-being in our model. These findings point to the importance of increasing insight into the mechanisms driving the association between personality traits and psychological health in New Zealand. One specific area that requires further research is the relationship between personality traits and sleep duration. This is because negative emotions and cognitions that stem from one's personality traits may influence psychological well-being through increased sleep disturbances,[17,18] and compared to personality traits, sleep health is a relatively modifiable behavior. Increased research in this area will help identify New Zealanders more likely to suffer from insufficient sleep and develop tailored sleep interventions for those with differing personality characteristics.

### *Implications*

Our results revealed that a considerable proportion of New Zealanders, especially Māori and Pacific peoples, are not getting enough sleep. This is a major issue of concern because insufficient sleep consistently showed significant associations with negative psychological well-being independent of key demographic, health, and personality factors. These findings suggest that sleep duration may be an important and overlooked contributor to the high level of mental health problems in New Zealand. On a more positive note, as sleep duration is a potentially modifiable health behavior, the successful implementation of sleep awareness campaigns and interventions may be effective in encouraging optimal sleep and enhancing psychological well-being among the general public. It is particularly vital to develop target interventions for Māori and Pacific peoples because these groups show the highest prevalence of short sleepers and persistently exhibit poorer mental health outcomes and lower health care access.[9]

### *Limitations and future research*

Firstly, we are unable to infer causality from our results because of the cross-sectional nature of our analyses. As there is likely to be a bi-directional relationship between short sleep and mental health,[19,37] additional research is needed to better understand the degree to which sleep duration may determine or is influenced by one's psychological characteristics or mental well-being. Moreover, as our study included only 1 item asking about the average hours of sleep duration, we were unable to examine the reasons behind why one experiences short or long sleep or the different types of sleep disturbances they experience. Whereas some may suffer from insomnia or experience frequent awakenings, others may report insufficient sleep due to work schedules or environmental factors. Differing reasons for insufficient sleep may further be linked to distinct demographic or personality characteristics such as low socioeconomic status or high Neuroticism. Increased research on these nuanced factors will enable the development of more relevant and effective sleep health interventions.

**Table 3**
Continued

| | Neuroticism | | | Openness | | | Honesty-Humility | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time 6 | Time 7 | Time 8 | Time 6 | Time 7 | Time 8 | Time 6 | Time 7 | Time 8 |
| K6 distress | .476** | .479** | .477** | .012 | .004 | .003 | −.084** | −.092** | −.092** |
| Self-rated health | −.223** | −.217** | −.217** | .028** | .024* | .013 | .074** | .071** | .070** |
| Life satisfaction | −.297** | −.326** | −.313** | −.021* | −.011 | −.017* | .081** | .087** | .096** |
| Rumination | .420** | .431** | .438** | .030** | .037** | .019* | −.065** | −.064** | −.067** |
| Self-esteem | −.492** | −.491** | −.492** | .036** | .024** | .033** | .077** | .098** | .073** |
| Personal well-being | −.243** | −.257** | −.240** | −.021* | −.026** | −.037** | .081** | .097** | .102** |
| Depression | 2.297** | 2.282** | 2.345** | 1.067 | 1.088* | 1.089** | 1.082** | 1.109** | 1.068** |
| Anxiety | 2.094** | 2.089** | 2.069** | 1.085* | 1.128** | 1.044 | 1.042 | .983 | 1.060 |

Odds ratios reported for diagnosis of depression and anxiety (binary outcome). Standardized coefficients reported for all other continuous outcomes. Analyses controlled for large range of demographic, health, and personality variables (see Appendix for full regression results).
* $P < .05$.
** $P < .01$.

Another point to note is that different demographic groups are not equally likely to respond to the NZAVS.[39] For example, women and those living in areas with low deprivation are more likely to respond compared to counterparts. This suggests that there may be some degree of response bias in our study. To correct for this bias and obtain a more representative sample, the NZAVS estimates and applies poststratification sample weighting based on gender, ethnicity, and region of residence.[31] After applying sample weighting, the NZAVS demonstrated high validity in measuring New Zealanders' political attitudes over time.[40] Similarly, potential response biases in our sample are likely to have been corrected by the application of sample weighting in our analyses.

## Conclusion

The current study examined the prevalence of suboptimal sleep and association between sleep duration and psychological well-being using a national sample of New Zealand adults across 3 years. More than a third of New Zealanders (37%) reported short sleep, and 4.5% reported long sleep duration. Compared to optimal sleep, short sleep but not long sleep showed consistent associations with various indicators of negative general psychological well-being. However, only long sleep was associated with an increased likelihood of depression. Personality traits, particularly Neuroticism, showed strong associations with psychological well-being. Further research on the relationship between personality traits and sleep duration may help better identify and understand the cognitions of those at greater risk of experiencing sleep problems. Given the high rate of short sleepers in New Zealand, it is vital to increase insight into the mechanisms of insufficient sleep and implement improved sleep awareness campaigns for the general public. Target interventions for Māori and Pacific peoples are also essential, as these groups are more likely to exhibit poor sleep health and psychological well-being.

## Acknowledgments

The New Zealand Attitudes and Values Study is supported by the Templeton Religion Trust (grant TRT0196) and a Doctoral Scholarship awarded to Carol Lee during the preparation of this manuscript.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sleh.2019.06.008.

## References

1. Hamilton NA, Nelson CA, Stevens N, Kitzman H. Sleep and psychological well-being. *Soc Indicators Res*. 2007;82:147–163. https://doi.org/10.1007/s11205-006-9030-1.
2. Hirshkowitz M, Whiton K, Albert SM, et al. National sleep foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health*. 2015;1(1):40–43. https://doi.org/10.1016/j.sleh.2014.12.010.
3. Magee CA, Caputi P, Iverson DC. Relationships between self-rated health, quality of life and sleep duration in middle aged and elderly Australians. *Sleep Med*. 2011;12:346–350. https://doi.org/10.1016/j.sleep.2010.09.013.
4. Paine S, Gander PH, Harris RB, Reid P. Prevalence and consequences of insomnia in New Zealand: disparities between Maori and non-Maori. *Aust N Z J Public Health*. 2005;29:22–28. https://doi.org/10.1111/j.1467-842X.2005.tb00743.x.
5. Zhai L, Zhang H, Zhang D. Sleep duration and depression among adults: a meta-analysis of prospective studies. *Depress Anxiety*. 2015;32:664–670. https://doi.org/10.1002/da.22386.
6. Prendergast KB, Mackay LM, Schofield GM. The clustering of lifestyle behaviours in New Zealand and their relationship with optimal wellbeing. *Int J Behav Med*. 2016;23:571–579. https://doi.org/10.1007/s12529-016-9552-0.
7. Samaranayake CB, Arroll B, Fernando AT. Sleep disorders, depression, anxiety and satisfaction with life among young adults: a survey of university students in Auckland, New Zealand. *NZ Med J*. 2014;127:13–22.
8. Paine S, Harris R, Cormack D, Stanley J: Self-reported sleep complaints are associated with adverse health outcomes: cross-sectional analysis of the 2002/03 New Zealand health survey. Ethn Health 2017:1–13.
9. Ministry of Health. Annual Update of Key Results 2015/16: New Zealand Health Survey. Ministry of Health; 2016.
10. Krueger PM, Friedman EM. Sleep duration in the United States: a cross-sectional population-based study. *Am J Epidemiol*. 2009;169:1052–1063. https://doi.org/10.1093/aje/kwp023.
11. Whinnery J, Jackson N, Rattanaumpawan P, Grandner MA. Short and long sleep duration associated with race/ethnicity, sociodemographics, and socioeconomic position. *Sleep*. 2014;37:601–611. https://doi.org/10.5665/sleep.3508.
12. Paine S, Gander PH. Explaining ethnic inequities in sleep duration: a cross-sectional survey of Māori and non-Māori adults in New Zealand. *Sleep Health*. 2016;2:109–115. https://doi.org/10.1016/j.sleh.2016.01.005.
13. Gander PH, Marshall NS, Harris R, Reid P. The Epworth sleepiness scale: influence of age, ethnicity, and socioeconomic deprivation. Epworth sleepiness scores of adults in New Zealand. *Sleep*. 2005;28:249–254. https://doi.org/10.1093/sleep/28.2.249.
14. Paine S, Gander PH, Harris R, Reid P. Who reports insomnia? Relationships with age, sex, ethnicity, and socioeconomic deprivation. *Sleep*. 2004;27:1163–1169. https://doi.org/10.1093/sleep/27.6.1163.
15. Goodwin RD, Friedman HS. Health status and the five-factor personality traits in a nationally representative sample. *J Health Psychol*. 2006;11:643–654. https://doi.org/10.1177/1359105306066610.
16. Hakulinen C, Elovainio M, Pulkki-Råback L, Virtanen M, Kivimäki M, Jokela M. Personality and depressive symptoms: individual participant meta-analysis of 10 cohort studies. *Depress Anxiety*. 2015;32:461–470. https://doi.org/10.1002/da.22376.
17. Lai CC. The mediating role of sleep quality in the relationship between personality and subjective well-being. *SAGE Open*. 2018;8:2158244018773139. https://doi.org/10.1177/2158244018773139.
18. Huang V, Peck K, Mallya S, Lupien SJ, Fiocco AJ. Subjective sleep quality as a possible mediator in the relationship between personality traits and depressive symptoms in middle-aged adults. *PloS one*. 2016;11:e0157238. https://doi.org/10.1371/journal.pone.0157238.
19. Kahn M, Sheppes G, Sadeh A. Sleep and emotions: bidirectional links and underlying mechanisms. *Int J Psychophysiol*. 2013;89:218–228. https://doi.org/10.1016/j.ijpsycho.2013.05.010.
20. Hintsanen M, Puttonen S, Smith K, et al. Five-factor personality traits and sleep: evidence from two population-based cohort studies. *Health Psychol*. 2014;33:1214–1223. https://doi.org/10.1037/hea0000105.
21. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28:193–213. https://doi.org/10.1016/0165-1781(89)90047-4.
22. Kessler RC, Green JG, Gruber MJ, et al. Screening for serious mental illness in the general population with the K6 screening scale: results from the WHO world mental health (WMH) survey initiative. *Int J Methods Psychiatr Res*. 2010;19:4–22. https://doi.org/10.1002/mpr.310.
23. Ware Jr JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. conceptual framework and item selection. *Med Care*. 1992:473–483.
24. Diener ED, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. *J Pers Assess*. 1985;49:71–75.
25. Nolen-Hoeksema S, Morrow J. Effects of rumination and distraction on naturally occurring depressed mood. *Cognit Emot*. 1993;7:561–570.
26. Rosenberg M. Society and the Adolescent Self-Image. Princeton, NJ: Princeton University Press; 1965.
27. Cummins RA, Eckersley R, Pallant J, Van Vugt J, Misajon R. Developing a national index of subjective wellbeing: the Australian unity wellbeing index. *Soc Indicators Res*. 2003;64:159–190. https://doi.org/10.1023/A:1024704320683.
28. Salmond C, Crampton P. NZDep2013 Index of Deprivation. Department of Public Health; 2014.
29. Statistics New Zealand: Statistical Standard for Occupation; 2013.
30. Sibley CG, Luyten N, Purnomo M, et al. The mini-IPIP6: validation and extension of a short measure of the big-six factors of personality in New Zealand. *New Zealand Journal of Psychology*. 2011;40:142–159.
31. Sibley CG. Procedures for Estimating Post-Stratification NZAVS Sample Weights. NZAVS Technical Documents; 2017.
32. Sibley CG. Comparison of Demographics in the NZAVS and New Zealand Census. NZAVS Technical Documents; 2014.
33. Killgore WD. Effects of sleep deprivation on cognition, in Prog Brain Res Vol 185. Elsevier; 2010:105–129. doi: https://doi.org/10.1016/B978-0-444-53702-7.00007-5
34. van Mill JG, Hoogendijk WJ, Vogelzangs N, van Dyck R, Penninx BW: Insomnia and sleep duration in a large cohort of patients with major depressive disorder and anxiety disorders. J Clin Psychiatry 2010;71:239–259. oi: https://doi.org/10.4088/JCP.09m05218gry.
35. Patel SR, Malhotra A, Gottlieb DJ, White DP, Hu FB. Correlates of long sleep duration. *Sleep*. 2006;29:881–889. https://doi.org/10.1093/sleep/29.7.881.
36. Lee CH, Duck IM, Sibley CG. Ethnic inequality in diagnosis with depression and anxiety disorders. *NZ Med J*. 2017 Apr 28;130:10–20.
37. Alvaro PK, Roberts RM, Harris JK. A systematic review assessing bidirectionality between sleep disturbances, anxiety, and depression. *Sleep*. 2013;36:1059–1068. https://doi.org/10.5665/sleep.2810.
38. Wirihana R, Smith C. Historical trauma, healing and well-being in Māori communities. *Mai Journal*. 2014;3:197–210.
39. Robertson A, Sibley CG. Research sampling: a pragmatic approach, in advanced research methods for applied psychology. *Edited by Paula Brough Routledge*. 2018:27–48.
40. Sibley CG, Robertson A, Osborne D, et al. Bias and tracking accuracy in voting projections using the New Zealand attitudes and values study. Pol Sci 2017:1–19. doi: https://doi.org/10.1080/00323187.2017.1321589.