

# Sleep health and its implications in First Nation Australians: A systematic review

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## Summary

Understanding the state of sleep health in First Nations Australians offers timely insight into intervention and management opportunities to improve overall health and well-being. This review explored the determinants and burden of poor sleep in First Nations Australians. A systematic search was conducted to identify studies published until August 2020 in First Nations Australian adults. Nine studies ( $n = 2640$ ) were included, three in community settings, six in clinical populations. Across studies compared with non-Indigenous people, 15–34% of First Nations Australians experience less than recommended hours (<7 h/night), 22% reported fragmented, irregular, and unrefreshing sleep with a high prevalence of OSA in clinical populations (39–46%). Findings show First Nations Australians are significantly more likely to report worse sleep health than Non-Indigenous Australians in all measured domains of sleep. Co-designed sleep programs and service delivery solutions are necessary to ensure timely prevention and management of sleep issues in First Nations communities which to date have been underserved.

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## Introduction

Indigenous Australians are the First Nation's people of Australia and represent approximately 3% of the Australian population (25.4 million).<sup>1</sup> Australia's Indigenous peoples comprise two similar but distinct traditional cultural groups – Aboriginal and Torres Strait Islander peoples comprising over 250 language groups, with unique laws and customs which identify membership of each group.<sup>2</sup> First Nations Australians share strong spiritual beliefs that connect them to land, sea and country with diverse cultural traditions across Australia.<sup>3</sup> Similar to Indigenous populations across the globe,<sup>4</sup> dispossession from their land, sea and country, historical colonisation, interruption of culture and inter-generational trauma coupled with ongoing racism and disadvantage have significantly impacted the health and wellbeing of our first nation populations.<sup>4</sup> and represent key drivers of health inequity. Improving sleep can improve general health<sup>5</sup> but as yet sleep in First Nations Australia has not been explored so its potential contribution to improving overall health is unknown.

It is notable that sleep medicine has only become a recognised subspecialty within the last 25–30 years.<sup>6</sup> Sleep as a frontline health problem is in its infancy at a public health level for the whole population. Given the relative novelty of this field, it is not surprising that considering sleep when contemplating the health of First Nation's Australians has not occurred, as historically these vulnerable populations present with demographic, psychosocial, or economic circumstances that can impede their access to health care services.

It is now clear however, that obtaining adequate sleep (a sufficient amount of sleep of acceptable quality) is imperative to sustaining optimal daytime functioning and health.<sup>7</sup> Both experimental and observational studies show that poor sleep is associated with mental health, physiologic, cardiovascular and endocrine changes.<sup>5,8</sup> All of these health domains are significant in First Nations Australian populations,<sup>9</sup> with First Nations Australians having shorter life expectancy, higher rates of chronic disease and mental health problems.<sup>9</sup>

The importance of sleep to health and well-being has been the subject of recent Australian government-sponsored enquiries and national surveys,<sup>10</sup> but overall the

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## Research in context

### *Evidence before this study*

Sleep health is inextricably linked to physical and mental health. Significant literature details the negative impact of poor sleep on the metabolic, cardiovascular, immune system and respiratory health. Both poor sleep quality and quantity are also strongly associated with deficits in emotional, educational, neuropsychological, psychosocial health, well-being, and performance. Improved sleep shows the amelioration of these deficits. Yet to date, there is a paucity of research and lack of investment into access to care and community-led service delivery of sleep health in First Nations Australians. Previous data suggest that the burden of respiratory and related sleep symptoms (sleep breathing disorders) in both First Nations Australian children and adults is disproportionately higher compared to non-Indigenous Australians. Despite ongoing efforts to close the gap, a substantial health inequity still exists between First Nations Australians and non-Indigenous Australians, and, likely; this is also the case for their sleep health. There is an ongoing and even increasing need for social and emotional well-being (SEWB) services for First Nations communities due to current (such as the 2020 bushfires and the effects of the COVID-19 pandemic) and pre-existing effects of colonisation and inter-generational trauma. Therefore, given the strong relationship between sleep and SEWB, assessing the state of sleep health in Australian First Nations adults may be key to scope community-led programs and services, to improve sleep and subsequently overall health substantially.

### *Added value of this study*

The state of sleep health and/or the major contributors affecting sleep in First Nations Australian populations are significantly unexplored. This review builds on previous research conducted in Australia regarding the prevalence and impact of respiratory sleep disorders in First Nations Australians but updates and broadens the scope to include non-respiratory sleep disorders (insomnia, sleep pattern/timing disorders). This study quantifies differences in the prevalence of sleep problems compared to normative data and discusses how and why these data are important for understanding and improving the state of sleep health and subsequent health outcomes. Determinants and contributors of poor sleep are presented. These data show that improving sleep via appropriate and community-informed service delivery offers the novel opportunity to impact the health and well-being of First Nations Australians.

### *Implications of all the available evidence*

This review provides the first exploration of the state of sleep health in adult First Nations Australians. In conjunction with previous literature, this study offers a more comprehensive picture of the burden of sleep problems in this target population. The evidence of poor sleep presented here (defined here as problems with initiating and maintaining sleep, disrupted/restless

sleep or excessive sleepiness, and sleep/wake rhythm disruptions) suggests that First Nations' sleep disorders are common, indeed more common than for non-Indigenous Australians and more consequential. Given the aforementioned and recognised gap between the health of First Nations Australians compared to their non-Aboriginal peers, these data offer the opportunity of utilising sleep as a key predictive indicator of general health. Furthermore, because sleep health is modifiable, the prospect of improving sleep and subsequently improving downstream variables (including those chronic diseases related to poor sleep such as diabetes and hypertension, more common in First Nations Australians), appears possible and innovative. This review provides important information to support the need for investment into better access to care and sleep health evaluation, diagnosis, treatment, and healthcare delivery for sleep health in First Nations Australians.

state of adult First Nations sleep health has not been a focus and its impact on health is unknown.<sup>11</sup> The few studies in First Nations populations, consistent across the United States, Canada, and New Zealand, indicate an increased risk of sleep disorders than exist in non-Indigenous populations.<sup>12–15</sup> For example, in New Zealand, Māori (Indigenous New Zealanders, 15% of the population) suffer disproportionately from poor sleep with a higher incidence of insomnia and Obstructive Sleep Apnea (OSA).<sup>13,14,16</sup> To date, in Australia, a single comprehensive report (published in 2006) has detailed the state of respiratory sleep disorders in First Nations adults.<sup>17</sup> The report documented a prevalence of sleep-disordered breathing to be approximately 5% in First Nations Australians, although there was little empirical data to confirm this at a population health level.<sup>17</sup> This report identified known risk factors for sleep disorders such as being male, and obesity and overweight, and noted the strong (and preventable) relationship between diabetes, hypertension and cardiovascular disease between sleep disordered breathing and these chronic disease that are more common in First Nations Australians compared to their non-Indigenous peers.<sup>10,12</sup>

However, this latest report only included information on sleep-disordered breathing in First Nations Australians and there has been no recent review of the burden of sleep problems in these groups, including physiological and non-physiological sleep problems.

Advocacy for improvement and increased funding and education in sleep health for First Nations Australians is a vital contributor to bridging the gap in health outcomes for this population. Despite individual efforts and small independent studies to ascertain sleep health in these communities, no population level nor large scale data can offer a contemporary view on the prevalence and determinants of poor sleep in First Nations Australians, which could help in assessing the state of First Nations' sleep health. The current burden of sleep

problems in First Nations Australians in both urban and remote communities remains unknown. The state of sleep health in these populations must be understood to improve any related downstream variables. Reporting the burden of poor sleep and understanding these factors will be essential to inform co-designed prevention and treatment strategies to improve overall health and well-being.

Addressing the identified gap in the literature, this review aimed to explore: (1) what type of sleep problems are reported by Indigenous Australians; (2) what is the prevalence of poor sleep in First Nations Australians; and (3) what are the key determinants of poor sleep in First Nations Australian communities.

## Method

### Literature search

Based on the existing literature, two types of sleep disorders/symptoms are reported in community and sleep clinics based on studies on First Nations Australian adults. These are insomnia (namely short sleep duration, trouble falling or staying asleep) and sleep-related breathing disorders (such as OSA, snoring). The keywords adopted for this systematic search tried to capture words associated with those two types of sleep disorders and sleep quantity and quality. Keywords were: “sleep problems”; “sleep disturbances”; “sleep quality,” “sleep disorder”; “sleep apnoea”; “obstructive sleep apnoea”; “OSA”; and “sleep-disordered breathing” together with “First Nations Australians”; “Aboriginal”; and “Torres Strait Islander” and key MeSH terms such as, “Sleep,” “Snoring,” Sleep Initiation and Maintenance Disorders,” and “Population Groups\*” was used to retrieve relevant peer-reviewed and ‘grey’ literature published until August 2020.

The following databases were searched using appropriate specific search strings: PubMed, PsychINFO, Informit Indigenous Collection Scopus, and CINAHL. “Lit.search tool” from the Lowitja Institute was used for relevant literature retrieval.<sup>18</sup> Two authors (YF and SY) conducted a grey literature search to retrieve government reports, theses, and conference presentations. Generic search terms such as: *Indigenous HealthInfoNet*, Google Scholar (advanced), government agencies, including the Australian Institute of Health & Welfare (AIHW) and Lowitja Institute websites were adopted. Along with this, reference lists of relevant articles and related reviews were checked by two authors for any missing studies. In cases of disagreement, the first author (SB) acted as a tie breaker.

Based on the PICOS (Participants, Intervention, Comparison, Outcome, Study Design) guidelines, studies were included if they were:

- (1) Included first nations Australian adults

- (2) Presented data on at least one sleep variable of interest in original research articles published in English.
- (3) Provided subgroup prevalence data for these populations comparable to population level data.
- (4) Study design was clear and replicable
- (5) Conference abstracts were included if the study was a part of a bigger study, methodological features of the study could be retrieved.

Studies were excluded if:

- (1) The study sample did not present separate information on poor sleep in the First Nations subgroup.
- (2) Published in languages other than English.
- (3) Descriptive discussing the factors associated with poor sleep without providing data relevant to the population.
- (4) Duplicate data, i.e., conference abstract later published as journal articles.
- (5) Were review articles or editorials without substantive data provided to support hypotheses.

In the case of duplicate studies, only the study with the largest sample size and with more detailed results was included. The number of records retrieved from each individual database was not recorded.

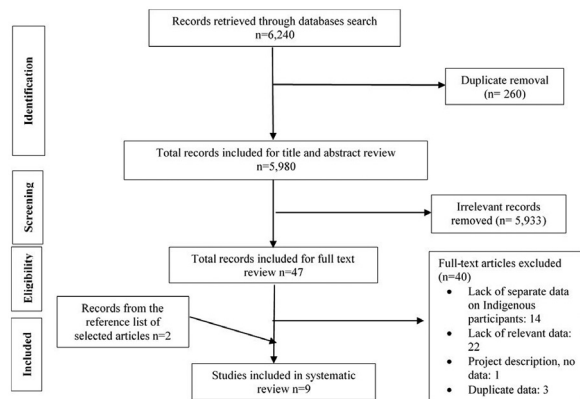
### Database search

Search results were imported into an Endnote database (Endnote 20), duplicates removed, and the title and abstract of the remaining records were screened by two reviewers (YF and SY) for eligibility. Finally, the full texts of potentially relevant papers were read, and studies meeting the inclusion criteria were selected. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart diagram shows the number of articles retrieved, screened, excluded and selected during the literature review process (Figure 1).<sup>19</sup>

Two investigators independently evaluated the selected studies to extract the following data: (i) general information (author’s name, publication, and data collection year); (ii) study site and design; (iii) study sample characteristics (size, sampling method, and age group); (iii) sleep problem/disorder assessment method and (v) results. The final articles included in the review are summarised in Table 1.

### Risk of bias assessment

The critical appraisal tool by Hoys et al. was used to independently assess the risk of bias in community-based studies included in the review.<sup>20</sup> This quality appraisal tool provides a valid measure for appraising



**Figure 1.** Flow diagram illustrating the selection process for articles included in the systematic review

*PubMed Search string:* PubMed Search string: (sleep [Title/Abstract] OR "sleep duration" [Title/Abstract] OR "short sleep"[Title/Abstract] OR "insomnia" [Title/Abstract] OR "sleep quality"[Title/Abstract] OR "quality of sleep"[Title/Abstract] OR "sleep\* problem\*" [Title/Abstract] OR "trouble sleep\*" [Title/Abstract] OR "OSA"[Title/Abstract] OR "sleep apnoea" [Title/Abstract] OR "snoring" [Title/Abstract] OR "nightmare\*" [Title/Abstract] OR "sleep\* disturbance\*" [Title/Abstract] OR "sleep disorder\*" [Title/Abstract] OR "restless leg" [Title/Abstract] OR "sleepwalk\*" [Title/Abstract] AND "First Nations Australian\*" [Title/Abstract] OR "Australian Aboriginal" [Title/Abstract] OR "Torres strait Islander" [Title/Abstract] OR ("Aboriginal and Torres Strait Islander" [Title/Abstract]) OR "First Australian\*" [Title/Abstract]).

the quality of prevalence studies and comprises nine items, plus a summary item, for overall bias assessment. Items one to four assess selection and non-response bias (external validity), items five to nine assess measurement bias, and item 10 evaluates analysis bias (internal validity).

Individual items are deemed to be low (scored zero) or high risk (scored one) of bias. The risk of bias for a particular item was recorded as uncertain when there was insufficient information in the article to permit a judgment for the item.<sup>21</sup> These points are then summed together into (a possible maximum of nine points) to categorise the risk of bias for each study. Scores are categorised into three groups: "low risk (scores 0-3)"; "moderate risk (scores 4-6)"; and "high risk (scores 7-9)" of bias, respectively (Supplementary Table-S1).

### Community engagement and involvement in research

Since this review exclusively focused on First Nations Australian populations, it was decided to evaluate the included studies on the level of First Nations involvement in community-based studies. In First Nations research, there has been much discussion regarding the need for research that explicitly involves First Nations populations' input, collaboration and ownership to gain

a truly First Nations perspective on their health and health inequities.<sup>22</sup> The study used the Cultural Identity Interventions Systematic Review Proforma to assess First Nations involvement and leadership in sleep health research.<sup>23</sup> This is a 21 item tool that assesses scientific rigour in studies and meets ethical and methodological standards specific to First Nations health research in Australia.<sup>23</sup> Selected questions from the Proforma were utilised to gain a general understanding of First Nations input and collaboration as not all Proforma questions applied to studies included in this review. Questions selected were guided by the eight categories identified in a recent analysis for strengthening reporting of health research involving First Nations Peoples (Governance, Prioritisation, Relationships, Methodologies, Participation, Capacity, Interpretation and Dissemination).<sup>22</sup> This review utilised questions 1, 2, 3, 4, 12, 16, 19 and 20 of the Proforma (Six items with a "yes," "no," or "not clear" response option were utilised, and the remaining two as open-ended responses) (See Supplementary Table-S2). Disagreements regarding quality items to use in the evaluation were discussed and resolved through co-author consensus.

## Results

### Characteristics of studies included in the review

A total of nine studies focusing on sleep issues in First Nations Australian adults were conducted in Australia.<sup>24-32</sup> Of these nine studies, three were community-based,<sup>25,29,32</sup> and the remaining six were based on diagnostic sleep studies. All three community-based studies were cross-sectional. In the community-based studies total sample size ranged from 245 to 646 participants,<sup>25,32</sup> whereas in the sleep clinic based studies, the sample size ranged from 91 to 403 participants.<sup>27,28</sup> Only three studies<sup>20,22,24</sup> included non-Indigenous participants for comparison purposes.

Most studies used self-reports in community-based studies, with only one reported study using actigraphy.<sup>32</sup> One study used Epworth Sleepiness Scale (ESS) to assess daytime sleepiness,<sup>32</sup> but acknowledging that the ESS has not been validated in First Nations Australian populations. All community-based studies explored sleep duration;<sup>25,29,32</sup> two studies explored problematic sleep patterns,<sup>20,24</sup> and one study explored daytime sleepiness.<sup>32</sup>

Laboratory-based diagnostic and disease management studies<sup>19,21-23,25,26</sup> mostly focused on the prevalence and severity of OSA in First Nations people within a clinically referred population. Some studies additionally focused on the gender difference in OSA prevalence<sup>30</sup> and utilisation of OSA diagnostic and management services in rural remote and First Nations

Author (Year)	Study sample	Age-group	Study design & recruitment	Study tools(Reporter)	Outcome measures	Findings
<i>Results from community-based studies</i>						
Macniven et al. <sup>29</sup>	59,489 participants (0.6% Aboriginal, 43.4% males) of the baseline cohort of the 45 and up study.	≥45 y	Cross-sectional, random sample identified through Medicare database	Self-reported sleep duration (Self)	Prevalence of short sleep and factors associated with unhealthy sleep (5-7/9+ hours).	Compared with non- First Nations people, First Nations people had a higher prevalence of unhealthy sleep (OR: 2.03; 95% CI: 1.60-2.59).
Deacon-Crouch et al. <sup>25</sup>	5204 non- First Nations (48.1% male) and 646 First Nations (41.8% male) adults participants in National Nutrition and Physical Activity Survey and the National Aboriginal and Torres Strait Islander Nutrition and Physical Activity Survey 2011–2013	Non- First Nations group: 49 ± 16.2 y First Nations group: 42 ± 15.5 y	Cross sectional data from nationally representative Health Survey	Self-report	Sleep duration in First Nations adults its association with body mass index (BMI)	15% First Nations people reported sleeping for short duration (<7 h/night), while 41% reported sleeping for long duration (> 9 h/night). The association between sleep duration and BMI was not significant but a possible dose-response relationship was evident
Yiallourou et al. <sup>32</sup>	245 First Nations (43% male) Participants of the Better First Nations Risk stratification for Cardiac Health (BIRCH) cohort	45 ± 13 y	Cross-sectional, convenience sample recruited from Aboriginal communities in the Northern Territory and Queensland	Actigraphy (n = 46) and a validated questionnaire to assess daytime sleepiness measured through Epworth Sleepiness Scale (ESS)	Prevalence of short sleep and sleep problems in First Nations Australians, and their association with cardio-metabolic Risk	Over one-third of participants obtained sleep < 7 hr/night and experienced poor-quality sleep, with 27% reporting severe daytime sleepiness (ESS score > 10) and a high number of objectively measured awakenings/night (6 ± 4). Short sleep duration was an independent predictor of diastolic ( $\beta = 5.37$ , $p = .038$ ) and systolic blood pressure ( $\beta = 14.30$ , $p = .048$ ), nighttime awakenings were associated with increased glycated haemoglobin levels ( $\beta = 0.07$ , $p = .020$ ) and greater sleep fragmentation was associated with lower high-density lipoprotein levels ( $\beta = -0.01$ , $p = .025$ ).
<i>Results from sleep clinic-based studies</i>						
Mehra et al (2020) <sup>30</sup>	337 Aboriginal adults (50.1% male) who underwent a diagnostic PSG	Mean age 47.8 y	Patients referred to the specialist sleep service based at the Royal Darwin Hospital and Darwin Private Hospital disorders, in particular OSA.	Polysomnography (PSG)	Obstructive Sleep Apnoea (OSA) diagnosis in Aboriginal adults and gender difference in OSA	Compared with females, males had higher prevalence (37% vs 63%) of severe OSA (Apnoea Hypopnea Index (AHI)>30/hour).
Heraganahally et al. <sup>27</sup>	3078 patients (13% First Nations Australians, 61% male) who underwent for a diagnostic sleep study	Non-Indigenous group: 51.5 y First Nations group: 47.8 y	All adult patients who underwent a diagnostic PSG at the Respiratory and Sleep Service, Royal	PSG	Comparison of PSG characteristics of First Nations and non-First Nations adult patients	Among the First Nations patients, 46% had severe OSA. The median total AHI value was higher in the First Nations population (25,

Table 1 (Continued)

Author (Year)	Study sample	Age-group	Study design & recruitment	Study tools(Reporter)	Outcome measures	Findings
			Darwin Hospital, between 2011 and 2015			interquartile range [IQR]: 11–58) compared to the non-Indigenous (17, IQR: 7–36), and in rural/remote population (19, IQR: 8–42) compared to urban (17, IQR: 7–37)
Heraganahally et al. <sup>26</sup>	348 Adult First Nations Australians (51% male) who underwent a diagnostic PSG a diagnostic polysomnography (PSG) between 2011 and 2015	Mean age 47 years	Retrospective study reviewing patients referred for sleep assessment and underwent a diagnostic sleep study between 2011 and 2015	PSG	OSA and cardiovascular disease in First Nations Australians from the NT	According to AHI 78/348 (22%), 69/348 (20%) and 158/348 (45%) were noted to have mild, moderate, and severe OSA, respectively
Atos et al (2019) <sup>24</sup>	156 First Nations (50% male) patients from the regional and remote communities	Mean age 47 years	Adult First Nations patients living in the remote and regional communities underwent a diagnostic PSG over a 5 year period	PSG	OSA prevalence in First Nations Australians patients from the regional and remote communities	Mean AHI was 40/hr and 77 (49%) patients had an AHI of more than 30/hr.
Woods et al (2015) <sup>31</sup>	200 adults (50% First Nations Australians, 67% males) with a confirmed sleep related breathing disorder diagnosed prior to September 2011	Non- First Nations group: 50.6 (±12.6) y First Nations group: 47.3 (±12.6) y	A retrospective audit (conducted in 2012–2013) to assess the utilisation of OSA diagnosis and management at Alice Springs Hospital and Cairns Hospital	PSG	Sleep disorders in First Nations Australians and residents of regional and remote Australia	87% of First Nations patients reported snoring 58% Witnessed apnoea and 97% had ESS score > 10. All regional and remote residents accessed diagnostic sleep studies at a rate less than overall Australian rates (31/100,000/y vs 575/100,000/y)
Lee et al (2009) <sup>28</sup>	91 First Nations patients from Far North Queensland (FNQ) who underwent for a diagnostic sleep study	Mean age was 54.3 years (range of 23 to 78)	Audit of formal sleep study and portable studies of First Nations patients from July 2003 to March 2009 in FNQ	PSG and home based sleep study	Prevalence and severity of sleep disordered breathing in First Nations populations in FNQ	35 patients (39%) had severe OSA (AHI > 30), 20 (22%) had moderate OSA (AHI 15–30) and 21 (23%) had mild OSA

**Table 1: Characteristics of studies included in the systematic review of poor sleep in First Nations communities in Australia (based on references).** <sup>19–27</sup>

OR: Odds Ratio, CI: Confidence Interval.



communities.<sup>27,31</sup> Characteristics of the included studies are shown in [Table 1](#).

### Study quality

Each study included in the systematic review was evaluated for the risk of bias and the involvement of First Nations people in the research. All three community-based studies were deemed to be at low risk of bias.<sup>25,29,32</sup> Most of the studies suffered from selection bias and limited generalisability.

### Community engagement and involvement in research

For evaluating First Nations communities' involvement in the research, the use of the existing Proforma was helpful, but the limited information provided in the papers made it challenging to assess accurately First Nations communities' involvement in the research. While an attempt was made to retrieve as much information as possible for each paper, co-authors of this review were able to inform the analysis of First Nations involvement with personal knowledge, for some studies. For the remainder, it was difficult to gauge the community engagement based on the information shared in the paper. There was a lack of information on First Nations leadership in research. It is possible that the research teams engaged well with the community, but due to constraints such as lack of reporting guidelines, or word limit constraints, the information on community engagement was not adequately presented in some papers.

### Burden of poor sleep in first nations Australians

The following two types of sleep disorders/symptoms were reported from community and sleep clinic-based studies in First Nations Australian adults.

- 1 Insomnia Symptoms (e.g., short sleep duration, trouble falling or staying asleep) and
- 2 Sleep-Related Breathing Disorders (e.g., OSA, snoring)

### Insomnia symptoms

Evidence across all studies suggested that First Nations Australians are significantly more likely to experience short and unhealthy sleep compared to data in non-Indigenous Australians.<sup>10</sup> Approximately 22% of First Nations adults reported a high number of objectively measured awakenings/night (>3).<sup>32</sup> Severe daytime sleepiness (ESS score > 10) was reported in up to 27%.<sup>32</sup> Studies focusing on the prevalence of short sleep duration in the adult population defined short sleep as <7 hours/night, which aligns with recommended sleep duration.<sup>33</sup> While 15-35% of First Nations adults reported sleeping for less than recommended hours (<7

hours/night),<sup>29,33</sup> which is a higher prevalence to non-Indigenous Australians at 11%,<sup>10</sup> 29-41% report long sleep (>9 hours/night).<sup>25,32</sup> Compared with non-Indigenous adults, First Nations Australians were more likely to report a higher prevalence of unhealthy sleep (defined as problems with initiating and/or maintaining sleep, short sleep, disrupted/restless sleep or excessive sleepiness), 34.7 % compared to non-Indigenous adults with 20.8 % (OR: 2.03; 95% CI: 1.60-2.59).<sup>29</sup> One study also explored the association between sleep duration and cardiometabolic functions, finding short and fragmented sleep was associated with hypertension, elevated glycated haemoglobin levels and increased high-density lipoprotein levels.<sup>32</sup> Others found a possible relationship between higher body mass index (BMI) and shorter sleep. Overall, inadequate sleep was significantly associated with poor health in these studies.

### Sleep-related breathing disorders

Up to 58% of adults reported snoring.<sup>32</sup> The results from sleep clinic-based studies, suggest that 39-46% of adults had severe OSA (AHI > 30) from referred populations. While normative data for the community prevalence of OSA in First Nations Australians are not available, one<sup>27,28</sup> laboratory study of 1014 participants with severe OSA,<sup>22</sup> reported a higher proportion of First Nations Australians in the severe range (46.3%) compared to the non-Indigenous group (31.1%). Other studies<sup>19,21,23,25</sup> also reported severity levels higher than the threshold of 31% in their First Nations samples. There was some evidence of gender difference in snoring, as First Nations Australian males reported a higher prevalence of OSA than First Nations Australian females. This is similar to non-Indigenous Australians.<sup>34</sup> The data from sleep clinic based studies suggest that despite the high burden of severe OSA in First Nations patients and rural and remote communities,<sup>27</sup> service utilisation was lower than Australia in general (31/100,000/y vs 575/100,000/y).<sup>31</sup> Although timely access and availability of services and follow-up are major barriers to treatment, when appropriate services are available, significant proportions of First Nations patients are found to be compliant with treatment plans and have derived considerable benefits from treatment.<sup>28</sup>

### Determinants of sleep health

The data suggest that male gender<sup>27</sup> and older age significantly increased the risk of OSA, poor sleep quality and sleep disruption.<sup>27,32</sup> A higher level of remoteness was related to OSA diagnosis in adults.<sup>31</sup> Higher BMI was associated with shorter sleep duration<sup>25</sup> and increased severity of OSA.<sup>27</sup> Chronic conditions such as diabetes and kidney disease were also associated with OSA<sup>31</sup> and sleep disruption.<sup>32</sup> Other comorbid illnesses,

such as hypertension and heart disease, were also present in higher proportions in First Nations participants potentially contributing to poorer sleep.<sup>22</sup>

## Discussion

Before this investigation, the state of sleep health in Australian First Nations adults was relatively unknown. This review presents the first data specifically focused on the sleep health of First Nations Australian adults and informs our understanding of First Nations sleep collated a variety of sources including: longitudinal studies; epidemiological studies; together with objective and subjective collection.

Several key findings are drawn from this data. Firstly, this evidence suggests poor sleep health (including OSA, short sleep duration and poor sleep quality) may be higher in First Nations Australians than is the case for non-Indigenous Australians, as measured by standard and current sleep measures. Specifically, First Nations Australians present with high rates of sleep disordered breathing, especially in referred populations<sup>19,22,23,25,26</sup> together with other indicators of poor quality sleep such as snoring and sleepiness.<sup>26,27</sup> In the only comparative data available,<sup>22</sup> there were a greater proportion of severe OSA cases<sup>19,21–23,25</sup> in First Nations populations. Similar findings have been reported for New Zealand Māori, who reportedly present disproportionately with OSA and sleepiness.<sup>10</sup> The morbidities associated with medical/physiological sleep disorders such as OSA include a range of serious and chronic health conditions, including cardiovascular disease,<sup>21,27</sup> stroke,<sup>27</sup> diabetes<sup>27</sup> and increased risk of overweight/obesity.<sup>20</sup> Serious consideration of these findings in the context of public health messages and the development of First Nations specific health service initiatives must be a priority.

Secondly, sleep disorders without a primary physiological aetiology (such as insomnia and irregular sleep/wake patterns) are common and can also result in shorter duration of sleep. Insomniac short sleepers (< 7 hours per night and below recommendations) were recorded in three<sup>20,24,27</sup> of the nine studies with symptoms of insomnia<sup>24,27</sup> or irregular sleep-wake patterns,<sup>20</sup> also reported. Normative or population-level data for First Nations Australians are not available, but the current review suggests short sleep may be common and consequential<sup>27</sup> in First Nations Australians and significantly worse than non-indigenous Australians in many aspects of sleep health.<sup>10</sup> Similar findings are reported in other Indigenous populations. Insomnia is more prevalent in Māori compared to non-Māori New Zealanders<sup>10</sup> while problematic short sleep (< 6 hours) is reported in 25.4% of Cree First Nations Canadians and 30–34% of North American Indians/Alaskan First Nations populations.<sup>35</sup> Non-physiological sleep disorders such as these are often termed behavioural sleep

disorders<sup>29</sup> as their aetiologies are in behaviour or behavioural choices. Behavioural sleep disorders are generally amenable to change, with an internal locus of control, through lifestyle choices to improve sleep behaviours (such as regulating bed and wake times) which may offer opportunities for sleep health amelioration.<sup>36</sup> However, implementation of healthy sleep practices are constantly at risk of negative impacts from systems beyond the individual adult or the community,<sup>37</sup> and would include social and health disadvantages evident after years of intergenerational trauma and dispossession<sup>31</sup> racial discrimination<sup>35,36</sup> and lower socio-economic status.<sup>38,39</sup> Therefore, sleep health inequities must be considered within the context of the broader First Nations social emotional wellbeing frameworks suggested by Dudgeon and Walker,<sup>33</sup> or an holistic bio-psychosocial lens such as that presented in Bronfenbrenner's model.<sup>38</sup> It is suggested that local capacity building and community empowerment coupled with a context responsive approach to impact sleep health behaviours in First Nations peoples. The current review highlights that some key determinants of sleep health, including age<sup>22</sup> gender<sup>22,26</sup> presence of chronic disease<sup>20,26</sup> and higher levels of remoteness,<sup>39,40</sup> are significant. Levels of remoteness deserve special focus. Disparities in health care delivery are well documented in this domain. In other First Nations Australian populations,<sup>41</sup> geographical remoteness can impede access to health care and the ability to comply with management plans, further adding to health care costs, morbidity, and mortality, especially if sleep disorders are not accurately diagnosed and treated. As First Nations Australians are more likely to live in remote or very remote regional Australia,<sup>1</sup> the challenges of health care delivery are considerable. The need for a more targeted approach to delivering sleep health services in regional Australia remains. For sustainable change and improvement in sleep (and therefore health equity) in First Nations Australians, it is necessary to attend to sleep within the broader social determinants of health context since these are the drivers of poor sleep health.<sup>42</sup>

One important limitation of the studies included in this review is the lack of information on the involvement and leadership of First Nations peoples in research design and conduct. Missing information may be a reporting issue rather than a study design or conduct issue. Based on experience, changes in the current reporting template for research focusing on First Nations communities is strongly recommend, so that there is clear information on community engagement, leadership, and involvement with the research beyond participation. Future studies will be served better to systematically include this information and/or use frameworks such as those recently cited by Huria et al.<sup>22</sup> to strengthen reporting of health research involving First Nations peoples. This systematic review was not registered in advance with PROSPERO which may have



enabled comparison with other reported review methods and protocols of First Nations populations. For example, as the number of records retrieved from each individual database was not specified here, exact contributions cannot be compared to other databases and protocols.

Another important limitation is the paucity of comparative data on sleep patterns and sleep health between First Nations and non-indigenous Australian adults. Only three of the identified studies provided comparative data which clearly showed poorer sleep health for First Nations Australians. Without population level data, the true burden of disease for First Nations Australians remains unclear.

Most of the studies that were reviewed suffered from varied diagnostic classifications, selection bias, and limited generalisability. Sample sizes varied and were as low as 91 in one study. Whilst the evaluation of sleep is based on the physiology of sleep, many aspects of what has been presented rely on the interpretation of sleep problems from a non-First Nations perspective. Given the paucity of First Nations sleep health workers, physicians, and clinicians, this is currently an unavoidable limitation. One avenue to explore includes the understanding of sleep from a First Nations perspective. There is a growing need to explore health through a First Nations lens,<sup>22,43</sup> so that “two ways of knowing”, encompassing both First Nations and non-First Nations opinion and perspectives can be embraced. Failure to explore these avenues maintains the status quo, which reflects non-inclusiveness and a missed opportunity to understand sleep from an Indigenous perspective. In Australia, small steps have been taken to demonstrate that the concept of sleep is culturally loaded and embedded in physical health and spiritual health.<sup>44,45</sup> In Arnhem Land, Northern Territory, Turvey conducted an exploratory qualitative study of sleep through and with the First Nations Yolngu Elders’ “way of knowing”.<sup>44</sup> Elders’ described sleep as part of holistic physical, emotional, and spiritual health so “good” sleep was inextricably linked to good overall health. Embracing First Nations ways of knowing about sleep may bridge gaps in understanding and enhance efforts to address sleep health in these populations. Collaboration with First Nations stakeholders is a clear imperative, and in recent years, there have been gains in momentum with patient involvement in health policy, clinical care, and research. The recent coining of the expression “Nothing about us, without us” from the wider health literature in disadvantaged populations,<sup>46</sup> necessitates the inclusion of lived experience in health delivery and policy domains.

## Conclusions

First Nations health has been the focus of numerous national partnerships, action plans and government policies across Australia,<sup>47</sup> primarily because of the high

disparity and inequality in health outcomes amongst First Nations Australians. Data from the present review identifies poor sleep as an opportunity to increase First Nations well-being through the evaluation of sleep, in order to better understand and enable improvements in their sleep health. The relatively few studies undertaken on the sleep health of First Nations populations suggest that their sleep health is not seen as a research priority for research organisations nor health policymakers. This paucity of research indicates a lack of understanding of how sleep health represents a marker of health inequity between First Nations and non-Indigenous Australians.

Because sleep health is a cornerstone of general health and has a cause and effect relationship opportunity for a new conversation. A better understanding of the state of sleep health in First Nations communities represents a modifiable target for improving overall health in these populations. To achieve this, First Nations ways of knowing must be considered. Addressing these issues alongside the development of programs, informed, guided, and led by First Nations Australians, may represent a strategic pathway to improve sleep health in First Nations communities.

## Declaration of interests

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## Author Contributions

All authors confirm that they had full access to all the data in the study and accept responsibility to submit for publication.

S. Blunden origin of concept contribution to writing editorial input scrutiny of articles and literature reviews

S. Yiallourou

Data analysis and verifying underlying data

Contribution to writing

Editorial input

Scrutiny of articles and literature reviews

Y. Fatima

Data search

Data analysis and verifying underlying data

Contribution to writing

Editorial input

Scrutiny of articles and literature reviews

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### Data sharing statement

Data collected for this review including search results and study protocol, will be made available to others, from the publication date, by emailing the corresponding author.

### Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.lanwpc.2022.100386.

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