The contribution of sleep to ‘Closing the Gap’ in the health of Indigenous children: a commentary

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Abstract

Objective: While the socio-economic and environmental factors impinging on the health and daytime functioning of Indigenous children are complex, it is suggested that poor sleep quality may also be a significant contributing factor.

Results: The overall sleep quality of Australian Indigenous children is likely to be affected by their higher prevalence rates of asthma, sleep disordered breathing, diabetes and obesity. Australian Indigenous children are further reported to have a higher prevalence of emotional regulation problems, behavioural problems and lower academic performance, all of which are common indicators of impaired sleep.

Conclusions: Further research in the area of Indigenous children’s sleep quality is likely to play a significant part in ‘Closing the Gap’ between Indigenous and non-Indigenous children’s health, academic performance and social outcomes.

Keywords: Indigenous, Children, Sleep, Health, Behaviour.

Introduction

The wellbeing of Australian Indigenous children has long been an issue of concern, primarily due to the high prevalence of health problems and poor academic outcomes compared with non-Indigenous children. Recent findings on the sleep of Indigenous children suggest that this group may also be encumbered with a higher prevalence of sleep problems. A growing body of literature on physiological (with a physical aetiology) and behavioural (with a non-physical aetiology) sleep problems in children demonstrate strong associations with secondary deficits in academic performance, attention, emotional regulation and behaviour. However, the number of studies on the sleep of Indigenous children and possible secondary performance measures is limited to only a few.

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Summary of sleep data on Indigenous children

Asthma and sleep

In general, childhood asthma is common among Australian children with reported prevalence rates of between 14% to 16% [1]. Indigenous children experience a greater prevalence of asthma with 14% to 28% reported in different regional areas [2]. Although the populations of Indigenous and non-Indigenous children differ in their regional distribution, not all of the disparity in the rates of asthma can be attributed to location. Specifically, asthma has been reported to be more common among Indigenous children than non-Indigenous children even in the same urban environment (24% vs. 15% respectively) [3]. In non-Indigenous children with asthma, secondary sleep disturbance is a commonly reported complaint. Within a 1-month period, 48% of sufferers reported sleep disturbance due to asthma, and of these, almost a third reported sleep disturbance at least three or more nights per week [4, 5]. However, with only a few studies to review, the possible relationship between asthma and sleep disturbance in Indigenous children is yet to be fully explored.

Sleep disordered breathing

Asthma has similar features to a range of conditions known under the umbrella term of ‘sleep disordered breathing’. Sleep disordered breathing ranges from primary snoring to obstructive sleep apnoea, and can be accompanied by nocturnal hypoxaemia [6]. Childhood sleep disordered breathing is associated with not only physiological and general health effects, but also neuropsychological and psychosocial effects on development, behaviour, mood and learning [7, 8]. Asthma and sleep disordered breathing are linked because of common risk factors that promote airway inflammation and/or disturbed neuromuscular control of breathing [9]. Valery et al. (2004), who examined the prevalence of comorbid sleep disordered breathing and asthma among 1650 Indigenous children (0-17 years), reported a prevalence rate of 14.2% [10] compared with 10.5% in non-Indigenous pre-school children [11] and 15.2% in non-Indigenous primary school aged children [12]. Valery et al. further reports that 6% of Indigenous children had restless sleep occurring two or more nights per week during the last 6 months, although the cause of sleep disturbance was not examined further [10]. It can be assumed that some degree of sleep disturbance would be associated with both asthma or sleep disordered breathing, as reported in the non-Indigenous paediatric population [2, 3, 10], however, the association between these conditions and their impact on sleep remain to be explored in Indigenous children.

Obesity and sleep

The increasing incidence of obesity among the Indigenous population of Australia is of concern [13, 14], particularly the increasing rates of obesity among Indigenous children [15, 16]. Indigenous children (aged 6-11 years) are 1.4 times more likely to be obese than their non-Indigenous peers, whilst in Indigenous 15-19 year olds, the likelihood of obesity increases to 2.6 times [17, 18]. A recent study on Indigenous children in remote communities found that approximately 20% were overweight with approximately 5% were defined as obese [15]. Even among this population, there are sub-groups where the prevalence rates of obesity are outstanding. For example, 46% of youths residing in the remote Torres Strait region are obese [19].

Obesity is also a risk factor for sleep disordered breathing due to the structural changes that fat deposits produce in the mechanisms of the upper airway [9]. In a study on adult subjects, Horner et al. (1989) reports that fatty infiltration of upper airway structures caused upper airway narrowing, while subcutaneous fat deposits in the anterior neck region and other cervical structures exert forces that promote pharyngeal collapse [20]. Among obese children, there is also strong evidence to suggest that structural differences in upper airway dimension in combination with large tonsils and adenoids can make airway obstruction a significant concern [21].

While obesity is known to promote sleep disordered breathing, reduced sleep duration independent of breathing problems has also been reported to contribute to excessive increases in body weight. Gupta, Mueller, Chan et al. (2002) study found that obese adolescents experienced less sleep than non-obese adolescents and that for each hour of lost sleep, the odds of obesity increased by 80% [22]. Taheri (2006) reported associations between short sleep duration and excess body weight in all age groups and that this association was more pronounced in children [23]. Van Cauter and Knutson’s (2008) review of evidence from laboratory and epidemiological studies on children and young adults indicate that chronic partial sleep loss may increase the risk of obesity and weight gain [24]. Finally, Mamum, Lawlor, Cramb et al’s (2007) study, using birth cohort data of children born between 1981 and 1983, found that children who had sleeping problems at ages 2-4 years were more likely to have a greater BMI and a higher prevalence of obesity compared to those who had not had sleeping problems [25]. In summary, sleep appears to be strongly associated with non-Indigenous child and adolescent obesity, and may to contribute to the rates of obesity among Indigenous children.

Diabetes and sleep

Indigenous Australians experience a disproportionately high rate of diabetes when compared to the non-Indigenous communities [26], with recent reports showing an increasing incidence of type
Adolescents who report sleep difficulties are significantly more
children with endogenous-type depression report insomnia [37].
sleep-onset and sleep maintenance insomnia, and half of the
depression. Two thirds of depressed children suffered from
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were found to have at least one sleep problem, whereas the
conditions. In a study of children and adolescents with anxiety
problems such as sleep-onset delay, enuresis, and subjective
year olds, measures of anxiety were found to be related to sleep
organisation of the sleep-wake cycle may represent possible
Indigenous children. In studies on non-Indigenous children, disruptions in
acanthosis nigricans’ which is a hyperpigmentation of the
physical inactivity, genetic predisposition and socioeconomic
status have been noted [30]. Similarly, Indigenous children with
type 2 diabetes typically have a family history of diabetes and are
overweight or obese, and may have indicators of hyperinsulinism
such as ‘acanthosis nigricans’ which is a hyperpigmentation of the
skin usually found in body folds [28].

There is a growing body of research demonstrating associations
between diabetes and sleep quality. In adults, findings show
that reduced slow wave sleep (EEG defined high amplitude-low
frequency waveform) is associated with poor glucose maintenance
and lower insulin sensitivity [31, 32]. In fact, according to Perfect
(2010), inadequate sleep quantity, anomalies in sleep architecture,
sleepiness and sleep disordered breathing all contribute to
morbidity in individuals with diabetes [33]. In a later study by
Perfect et al. (2010) on non-Indigenous diabetic adolescents,
greater sleep disturbance was related to higher glucose levels
with diabetic adolescents experiencing a lower percentage of slow
wave sleep than non-diabetic adolescents [34]. Further, sleepiness
and poor sleep habits in diabetic adolescents were related to lower
quality of life scores, depressed mood, poor academic performance
and lower reading scores. Consequently, Perfect et al. suggests
that sleep be routinely assessed as part of a diabetes management
program.

Mental health and sleep

At present, there is a lack of literature examining the relationships
between mental health and sleep behaviour in Indigenous children. In studies on non-Indigenous children, disruptions in
the organisation of the sleep-wake cycle may represent possible
early markers of emerging psychopathology [35]. Among 5 to 12
year olds, measures of anxiety were found to be related to sleep
problems such as sleep-onset delay, enuresis, and subjective
daytime sleepiness [36]. Equally, children and adolescents who
report sleep difficulties were also more likely to report symptoms
of anxiety [37] showing a bi-directionality between the two
conditions. In a study of children and adolescents with anxiety
disorders (i.e., generalised, separation, and social anxiety), 88%
were found to have at least one sleep problem, whereas the
majority (55%) demonstrated having at least three or more sleep
problems. The total number of sleep problems were also found to
be positively associated with the severity of the anxiety and further,
the degree of interference in the child’s family functioning [38].

Among non-Indigenous children and adolescents, there are
also strong relationships found between sleep problems and
depression. Two thirds of depressed children suffered from
sleep-onset and sleep maintenance insomnia, and half of the
children with endogenous-type depression report insomnia [37].
Adolescents who report sleep difficulties are significantly more
likely to report symptoms of depression, anxiety, tension, lethargy,
irritability, poor self-esteem, daytime stress, worry, negative
thoughts, and emotional lability and are more likely to consume
nicotine, caffeine and alcohol as adults [39-42]. Furthermore,
sleep dysregulation is the most prevalent symptom of major
depression in adolescents [13], [43-45] particularly in adolescent
males [46, 47] with adolescent males also more likely to report
symptoms of depression [48-50]. While it is unclear whether sleep
deficits induce depression or vice versa, what is clear is that the
mental health status reported by young people is significantly
worse under conditions of sleep loss, and furthermore, have been
reported to improve after their sleep problems have been resolved
[51]. Therefore, the contribution to the mental health of young
people through amelioration of sleep disturbance should not be
discounted [52], and in fact should be actively pursued.

Research studies focused on the sleep of Indigenous children

As noted above, sleep disorders with a physiological aetiology
are common in Indigenous children. Sleep disorders with a non-
physiological aetiology have also been implicated with daytime
consequences in Indigenous children. Blunden and Chervin
(2010) investigated parental report data on the sleep of 25
Indigenous and 25 non-Indigenous children (aged 7–11 yrs) from
six Northern Territory primary schools. Sleep duration was similar
between groups, but in terms of sleep quality, 32% of Indigenous
children report behavioural sleep problems (poor sleep habits
and poor sleep hygiene), 20% had sleep wake transitional
problems and 20% report having excessive daytime sleepiness
that reached clinical cut-off scores on the Sleep Disturbance
Scale for Children [53, 54]. Whilst behavioural sleep problems
of initiating and maintaining sleep, and/or parasomnias were
commonly reported in both groups, Indigenous children under
9 years old reported the most problems with significantly higher
scores on sleep-wake transition problems, total sleep problems
and a tendency for increased excessive daytime sleepiness. In
addition, this study measured the potential impact of reduced
sleep quality on behavioural deficits and academic performance.
Significant relationships were detected between sleep quality
and externalised behaviours such as aggression, and internalised
behaviours such as withdrawn behaviours and thought problems,
particularly among Indigenous children [53]. Despite this trend
of interest, no between group differences were found in parental
reports of academic performance. Given the lack of difference in
sleep duration between Indigenous and non-Indigenous children,
the authors suggest that differences in sleep quality rather than
sleep duration merit further examination.

In a later study, Blunden and Camfferman (2012) used self-report
questionnaires to examine sleep quantity, sleep quality and related
health data from 19 Indigenous children and 49 non Indigenous
children, (age range 9-15 years) from a remote rural South Australian area school at Cooper Pedy [55]. This study reports that Indigenous children had significantly (p <0.05) less Total Sleep Time (M = 9hrs:36mins, SD = (2hrs: 05mins) before a school day compared to non-Indigenous children (M = 9hrs:52mins, SD = (1hr: 22mins). Furthermore, Indigenous children reported poorer sleep quality. One component of poor sleep quality is the variability in bedtimes and wake-up times [56] which has been assessed in non-Indigenous children. Biggs et al. (2011) used parental report in a community sample of 1622 non-Indigenous Australian children (aged 5-10 years) and found that inconsistent sleep schedules, particularly changes to bedtimes and wake times, were associated with daytime performance deficits in non-Indigenous Australian children [56]. They found that children who had a bedtime and wake-up time variability of > 60min during the week, significantly increased the risk of problematic behaviour, notably, Internalising, Hyperactive and Total Problem scale scores on the Child Behaviour Checklist [57]. Indeed, Blunden and Camfferman's (2012) study with Indigenous children reported similar findings. They recorded the variability in Indigenous and non-Indigenous bedtimes in 30 minutes increments, up to 3 hours. The higher the rating, the more variability in bedtimes and wake-up times (range 1- 5). Indigenous children had significantly more variability in wake-up times during the school week, with greater incremental differences in their wake times compared to non-Indigenous children, [4.8(3.6) vs. 2.69 (2.5), F(1,52)=4.88, p =.032], respectively. Interestingly, among Indigenous children, less total sleep time before a school day was related to less stable bedtimes before a school day (r2 = .85, p = .00) [55]. Whilst, it is important to note that subjective, questionnaire-based studies, such as these, are subject to self-report bias, they begin to assist us in understanding sleep wake patterns in Indigenous children.

Indeed, all of the above studies were undertaken using subjective measures, either through the children themselves or parental report. However, Cooper, Kohler and Blunden (2012) assessed the sleep of 21 Indigenous children (aged 6-13 years) from a remote community near Katherine, in the Australian Northern Territory, utilising an objective sleep measure, (an Actiwatch, a watch like device than can estimate sleep duration). In addition neurocognitive testing was undertaken using the Wechsler Individual Achievement Test and the NEuroloPSYcological Assessment-I & II (NEPSY & NEPSY II) [58] which measured domains of learning, and literacy. Poor sleep quality, as shown by lower sleep efficiency (actual time asleep while in bed) and greater nocturnal movement, were both found to be associated with reduced reading ability (r2 = .50 and r2 = -.52 respectively). Sleep fragmentation was also found to be strongly associated with reduced reading ability and numerical skills (r2 = -.62 and r2 = -.47, respectively). Interestingly, no significant associations were found between Total Sleep Time and academic and executive performance measures, but the association between reduced sleep quality and neurocognitive deficits were prominent features of concern.

Conclusion

In conclusion, Australian Indigenous children experience a higher prevalence of asthma, sleep disordered breathing, obesity and diabetes. All of these conditions are known to either reduce sleep quality or be exacerbated by poor sleep. Sleep quality is also reported to have a strong relationship with common mental health problems in non-Indigenous youth, and is also likely to play a part in the mental health of Indigenous children. The few studies undertaken on Indigenous children’s sleep suggest that rather than the amount of sleep, the broad concept of sleep quality (e.g. sleep scheduling, sleep fragmentation) is more of an issue for these children than their non-Indigenous peers, and further, that it impacts on their daytime performance and behaviour.

If future studies are to evaluate sleep in these children in order to understand how better sleep health can contribute to overall health and wellbeing, we need to consider what factors need to be taken into account. Accordingly, the authors of this commentary will provide a companion paper outlining relevant issues and methodological considerations to measure the sleep behaviour of Australian Indigenous children.
References


Table 1: A list of publications on the sleep and related academic and behavioural performance in Australian Indigenous children.

<table>
<thead>
<tr>
<th>Title</th>
<th>Year &amp; Author</th>
<th>Aim</th>
<th>Method</th>
<th>Subjects and age mean (S.D)</th>
<th>Sleep results</th>
<th>Behaviour &amp; academic performance results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snoring and its association with asthma in Indigenous children living in the Torres Strait and Northern Peninsula Area [4]</td>
<td>(2004) Valery P.C., Masters I.B. &amp; Chang A.B.</td>
<td>To examine the prevalence of snoring among Indigenous children and adolescents with asthma symptoms and relate its association to sleep disordered breathing.</td>
<td>Parental report through structured interview based on a standardized questionnaire</td>
<td>1650 children, aged 0-17, were included in the study from five randomly selected communities in the Torres Strait region.</td>
<td>Overall, the prevalence of snoring was 14.2% (95 CI 12.5-15.9); snoring was 3.6% (CI 2.7-4.6), and 6% (CI 4.9-7.2) reported restless sleep. Snoring was higher in males than females (17.1% vs. 10.8%, p=0.005)</td>
<td>N/A</td>
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<tr>
<td>The burden of asthma in children: an Australian perspective. [3]</td>
<td>(2005) Poulos L.M., Toelle B.G. and Marks G.B.</td>
<td>To review the incidence and outcomes of asthma in Australian children</td>
<td>Review of meta data.</td>
<td></td>
<td>Urban Indigenous children were found to experience a greater burden of asthma than other children. More than one third of children with asthma have sleep disturbance due to the illness.</td>
<td>60% have missed school and/or experienced other restrictions in their activities due to the disease</td>
</tr>
<tr>
<td>Sleep, performance and behaviour in Australian Indigenous and non-Indigenous children: An exploratory comparison.[15]</td>
<td>(2009) Blunden S. &amp; Chervin R.D.</td>
<td>To investigate sleep in Indigenous children and potential associated deficits in behaviour and academic performance.</td>
<td>Parental report via Questionnaire; The Sleep Disordered Scale for Children, Child Behaviour Checklist</td>
<td>25 Indigenous children aged 8.8yrs (1.4) compared to 25 non-Indigenous children aged 9.0yrs(1.5) from urban primary schools in the N.T.</td>
<td>Among Indigenous children behavioural sleep problems 32%, sleep wake transitional problems 20% and excessive daytime sleepiness 20%.</td>
<td>Behavioural sleep problems of initiating and maintaining sleep, or parasomnias were commonly reported in both groups (24-40%), with Indigenous children under 9yrs old reporting the most problems. No between group differences were found in school performance. Significant relationships between sleep quality and behaviours were found, particularly for Indigenous children. Such as more externalised behaviour, specifically, more aggression, and more withdrawn behaviours, thought problems and internalised behaviours related to sleep quality.</td>
</tr>
<tr>
<td>Research</td>
<td>Year</td>
<td>Study Title</td>
<td>Participants</td>
<td>Methods</td>
<td>Findings</td>
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<tr>
<td>Sleep and academic performance in Indigenous Australian children from a remote community: an exploratory study.</td>
<td>2012</td>
<td>Cooper P, Kohler M. &amp; Blunden S.</td>
<td>21 children from a remote Australian Indigenous community, (aged 6-13 yrs)</td>
<td>Actigraphy for two consecutive nights, reported, Wechsler Individual Achievement Test, NEuroLOPYSical Assessment-II</td>
<td>Reduced academic performance and auditory attention compared to non-Indigenous norms. Sleep duration was not associated with performance measures. Sleep fragmentation was associated with reduced reading and numerical skills.</td>
<td></td>
</tr>
<tr>
<td>Sleep patterns of Indigenous vs. no Indigenous children in a rural setting.</td>
<td>2012</td>
<td>Blunden S. &amp; Camfferman D.</td>
<td>19 Indigenous children and 49 non-Indigenous children, (age 11.6 (2.1yrs) range 9-15yrs from a remote South Australia school at Cooper Pedy.</td>
<td>Self-report Questionnaire</td>
<td>Less sleep on a school day for Indigenous children compared to non-Indigenous children which could potentially equate to 100 minutes less TST per week. Indigenous children had significantly less stable wake up times on school days with a larger distribution of wake times before a school day. Less TST was related to less stable sleep times.</td>
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