

Submission No. 81

(Inq into Obesity)

JE 18/06/08



Australian Government
National Health &
Medical Research Council

Centre for Clinical Research Excellence
in Respiratory and Sleep Medicine

June 13, 2008

Committee Secretary
Standing Committee on Health and Ageing
House of Representatives
PO Box 6021
Parliament House
CANBERRA ACT 2600
AUSTRALIA

Dear Madam/Sir,

I would like to make the following submission on behalf of the CCRE for Respiratory and Sleep Medicine. We have been funded by the NHMRC since 2005 to promote clinical research in respiratory and sleep medicine and translate research outcomes to community and government. The following document has been prepared by Dr Nathaniel Marshall, CCRE Epidemiology Research Fellow and myself.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Ron Grunstein'.

RON GRUNSTEIN MB BS MD PhD FRACP
Chief Investigator, NHMRC CCRE for Sleep Medicine
Clinical Professor of Medicine, University of Sydney

Office: 02-95158630
Mobile: 0407247336
rrg@med.usyd.edu.au

1. Introduction

This submission focuses on providing a brief outline of the important of sleep health and clinical sleep disorders contributing to the current prevalence and morbidity of obesity.

2. Short Sleep Hours (Sleep Restriction or Loss) Promotes the Development of Obesity and Diabetes

2.1 Sleep Hours and Obesity

Obesity and sleep deprivation are interacting epidemics. The committee is obviously aware of the rising prevalence of overweight and obesity in Australian society but they may be less aware that this has been paralleled by an increase in people reporting chronic sleep restriction at the same time.{US Centres for Disease Control, 2005}.

There is **increasing evidence** that sleep loss is associated with the development of obesity both in children and adults. The data that supports this is both cross-sectional (showing the association at one time point) and longitudinal (showing the association developing over time) and has attracted comment in leading science journals such as *Science* and *Nature* as well as important lay magazines such as *Time* and *Newsweek*. The association between the rise in obesity and the rise in chronic sleep restriction is now under intense scrutiny around the world and there are now in excess of 30 epidemiological studies that report that chronically short sleep durations are independently associated with greater obesity.{Cappuccio, 2008;Patel, 2008} . These findings have been made in a range of countries including the USA, UK, Spain and Japan.

Meta-analytic studies (combining studies to increase the statistical strength of the data) have been performed both in children {Chen, 2008} and adults {Cappuccio, 2008}

#1292}. Important longitudinal studies also report this association.{Agras, 2004; Dieu, 2007; Reilly, 2005; Snell, 2007; Gangwisch, 2005; Hasler, 2004; Patel, 2006}.

2,2 Association between Sleep Hours and Obesity Strongest in Children

Cross-sectional studies in children in Canada, France, Germany and Japan have found increased risk of overweight and/or obesity associated with short sleep durations. The lower the sleep duration at age 3 to 5 years, the greater the risk of being overweight at 9.5 years of age. A study in the UK collected sleep duration information at 38 months of age and examined obesity at age 7 years, and observed that sleep durations of <10.5 h and 10.5-11.4 h were associated with an increased risk of obesity at age 7 relative to sleep durations of ≥ 12 h per night. One study in the US, however, used direct sleep measurements instead of self-report to quantify sleep duration and found that for every extra hour of sleep there was 80% reduction in risk of being obese. (for review Chen, 2008)

Sleep Hours and Diabetes

In addition, there are an increasing number of studies showing an association between sleep duration or disturbance and the development of diabetes (Gottlieb, 2005). The Nurses Health Study, which recruited married female nurses aged 30–55 years in 1976, found a 15–30% increased risk of new diabetes cases over 10 years among those reporting sleep durations of 6 hours or less and 9 or more hours relative to 7–8 hours. Those reporting sleeping 5 hours or less remained at a 37% increased risk of developing symptomatic diabetes, which may reflect more severe disease. Similar observations have been made in Japanese populations. A prospective Swedish study that examined men aged 35–51 years between 1974 and 1984 and again 7–22 years later and found a 50% increased risk of incident diabetes among those who reported difficulty falling asleep or use of sleeping pills. Another Swedish study followed 1,187 men and women free of diabetes at baseline for 12-years and found those who reported sleep duration of 5 hours or less had almost 3 times the risk of developing diabetes. Additional studies from

Germany and The Massachusetts Male Aging Study again are consistent with the findings of an association between short sleep hours and risk of developing type 2 diabetes (summarised in Knutson, 2007).

The strength of these associations means that significant research effort is now being placed on developing studies examining the role of *lengthening sleep hours* to combat weight gain and assist weight loss.

Mechanism

The link between shortened sleep hours and obesity may seem paradoxical as it would appear logical that less time in bed would mean more time for activity and energy expenditure resulting in weight loss. However, there are a number of reasons why sleep loss contributes to obesity (Pearson,2006). Firstly, sleep deprived people are less active during their extended waking hours due to the fatigue and sleepiness caused by sleep restriction. Secondly, more time awake also allows more time to eat as well as more time for activity. Thirdly, both experimental {Spiegel, 2004} and observational studies {Taheri, 2004} have found that short sleep causes unfavourable changes in the appetite hormones leptin and ghrelin. The ratio of these hormones is tightly correlated with subjective feelings of hunger, particularly for energy dense foods, and sleep restriction changes the ratio in the direction of greater hunger.{Spiegel, 2004} These studies have now been replicated in a range of studies presented this month at the main academic conference for sleep research.

Implications for Committee

We know from our own studies that 18.4% of people aged 30-60 in NSW reported sleeping, on average, less than 6.5 hours per night.{Bartlett, 2008 #1264} . Increasing 24 hour workplaces, service industries and media means pressure on sleep length. Internet and mobile telephony and the expectation of availability also compound the problem. Longer work travel times results in reduced sleep length (Basner, 2007). Based on the

findings reported above improving sleep length and quality in children and adults would have major benefits in ameliorating the current “diabesity epidemic”.

Sleep Apnea and Obesity

Obstructive sleep apnea is characterised by snoring and repetitive upper airway obstruction during sleep which causes repeated falls in blood oxygen level and also fragments sleep. The major daytime effects are sleepiness, poor work performance and impaired motor vehicle driving.

Obesity is the major risk factor for sleep apnea.{Bearpark, 1995; Young, 2002} so as obesity rises so too will the prevalence of sleep apnea. Almost all studies of community-dwelling adults world-wide have found a strong association between the presence of sleep apnea and various measures of obesity that have included body mass index, waist girth, and sometimes neck circumference.{Young, 2002} In addition longitudinal study has shown that gaining weight is a risk factor for developing sleep apnea and conversely losing weight is associated with the regression of the disorder.{summarised in Yee 2007} Clinical trials of pharmacotherapy induced weight loss, such as one by our CCRE group{Yee, 2007}, confirm that obesity is a treatable cause of sleep apnea.

It is a serious and common condition {Bearpark, 1995} which also causes substantial excess morbidity and mortality.{Basner, 2007} with strong associations with increased hypertension, other cardiovascular disease and stroke. We have recently found that moderate-severe sleep apnea increases the risk of death by about 5-fold per year in the Australian community.{Marshall, 2008} independent of obesity. This has been replicated recently in two US populations, the Wisconsin Sleep Cohort and the Sleep Heart Health Study.

It is important to emphasise sleep apnea appears to have effects on mortality *independent of co-existing obesity*. Therefore this is likely to be a highly important cause of health risk in the 50% of obese patients who will have sleep apnea. Sleep apnea also causes

significant psycho-social morbidity in the obese. For example, in obese women, the presence of snoring and sleepiness increases the divorce risk seven-fold. There is also evidence that sleep apnea will promote obesity by a range of metabolic mechanisms but also by disrupting sleep promoting altered appetite regulation and reduced activity secondary to daytime sleepiness.

It is also important to recognise that sleep apnea in obese children is strongly associated with metabolic impairment and increased blood pressure (Capdevila,2008).

Regardless, as the prevalence of obesity rises the prevalence of sleep apnea will also rise. Thus, part of the estimated additional costs to the Australian economy of the obesity epidemic will actually be directly caused by sleep apnea. The community-wide prevalence of sleep apnea can probably be reduced via societal obesity reduction. But in addition part of the costs to society and the health care system of the obesity epidemic could also be controlled via effective treatments for sleep apnea such as continuous positive airway pressure.

RECOMMENDATIONS:

1. **We would advocate promoting the concept of increasing sleep length not only to reduce daytime sleepiness but to reduce risks of developing obesity or diabetes.** It is true that there are no studies that show sleep lengthening will prevent obesity or diabetes. *However* the strength of the epidemiological association between short sleep and “diabesity” and the importance of obtaining adequate sleep to prevent sleepiness and accidents, would make such a policy self-evident. Lengthening sleep hours in those who have sleep loss requires a combination of health promotion and societal change. Health promotion programs should emphasise the need to get adequate sleep (at least 7.5 hours per day or longer in children). School health courses would be an appropriate target and schools should be discouraged from starting too early in the morning. Societal change to promote longer sleep in those who have sleep loss is more complex but

requires recognition of the problem in those that design work systems, industrial awards and urban design.

2. Implementation of Screening for Sleep Apnea in Patients with Obesity and Financial Support for Sleep Apnea Diagnosis and Treatment.

Currently the Medicare Services Advisory Committee is evaluating new item numbers for screening studies for sleep apnea. It is important that this process is short and that adequate funding within the health budget is provided for these services. In addition, unlike the PBS and medications, costs for treatment for sleep apnea are not reimbursed by any Commonwealth scheme. Some partial reimbursement is available to those belonging to private health funds. Also, there is some provision by State Health Departments for financially disadvantaged patients but the budgets are limited, treatment is often delayed and there is often great geographical variation in resource provision. In countries such as the UK, France and Sweden, such equipment is provided by government under strict evidence based guidelines related to disease severity and effectiveness of therapy. We would strongly advocate the implementation of a similar national system to prevent inequity in provision of therapy.

3. Increasing research support for study of impact of sleep health on obesity.

There are a range of research questions that remain unanswered including understanding biological mechanisms of how sleep loss promotes obesity and diabetes and the exact role of sleep lengthening in reversing risk. In addition there are a range of research issues related to barriers to health promotion and barriers to chronic care in sleep apnea. We would advocate that if the committee recommends any specific funding initiatives for obesity research that this includes research on the impact of sleep health on obesity and its health outcomes.

References

- Agras WS, Hammer LD, McNicholas F, Kraemer HC. Risk factors for childhood overweight: A prospective study from birth to 9.5 years. *J Pediatrics* 2004; 145: 20-5.
- Basner M, Fomberstein KM, Razavi FM, Banks S, William JH, Rosa RR, Dinges DF. American time use survey: sleep time and its relationship to waking activities. *Sleep*. 2007 Sep 1;30(9):1085-95
- Basner RC. Continuous positive airway pressure for obstructive sleep apnea. *N Engl J Med*. 2007 Apr 26;356(17):1751-8. Review
- Bearpark H, Elliott L, Grunstein R, Cullen S, Schneider H, Althaus W, Sullivan C. Snoring and sleep apnea. A population study in Australian men. *Am J Respir Crit Care Med*. 1995 May;151(5):1459-65.
- Marshall N, Wong K, Liu P, Cullen S, Knuiman M, Grunstein R. Mortality in Sleep Apnea. results from Busselton Study. *Sleep* (in press)
- Capdevila OS, Kheirandish-Gozal L, Dayyat E, Gozal D. Pediatric obstructive sleep apnea: complications, management, and long-term outcomes. *Proc Am Thorac Soc*. 2008 Feb 15;5(2):274-82
- Cappuccio FP, Taggart FM, Kandala NB, Currie A, Peile E, Stranges S, Miller MA. Meta-analysis of short sleep duration and obesity in children and adults. *Sleep*. 2008;31(5):619-26.
- Chen X, Beydoun MA, Wang Y. Is sleep duration associated with childhood obesity? A systematic review and meta-analysis. *Obesity (Silver Spring)*. 2008 Feb;16(2):265-74.
- Dieu HTT, Dibley MJ, Sibbritt D, Hanh TTM. Prevalence of overweight and obesity in preschool children and associated socio-demographic factors in Ho Chi Minh City, Vietnam. *Int J Pediatric Obes* 2007; 2: 40 - 50
- Gangwisch JE, Malaspina D, Boden-Albala B, Heymsfield SB. Inadequate sleep as a risk factor for obesity: Analyses of the NHANES I. *Sleep* 2005; 28: 1289-96.
- Gottlieb DJ, Punjabi NM, Newman AB, Resnick HE, Redline S, Baldwin CM, et al. Association of sleep time with diabetes mellitus and impaired glucose tolerance. *Arch Intern Med* 2005; 165: 863-7.

- Hasler G, Buysse D, Klaghofer R, Gamma A, Ajdacic V, Eich D, et al. The association between short sleep duration and obesity in young adults. *Sleep* 2004; 24: 661-6.
- Knutson KL, Spiegel K, Penev P, Van Cauter E. The metabolic consequences of sleep deprivation. *Sleep Med Rev* 2007; 11: 163-78
- Patel SR, Malhotra A, White DP, Gottlieb DJ, Hu FB. Association between reduced sleep and weight gain in women. *Am J Epidemiol* 2006; 164: 947-54.
- Patel SR, Hu FB. Short sleep duration and weight gain: a systematic review. *Obesity (Silver Spring)*. 2008 Mar;16(3):643-53
- Pearson H. Medicine: Sleep it off. *Nature* 2006; 443: 261-3
- Reilly JJ, Armstrong J, Dorosty AR, Emmett PM, Ness A, Rogers I, et al. Early life risk factors for obesity in childhood: Cohort study. *BMJ* 2005; 330: 1357.
- Snell EK, Adam EK, Duncan GJ. Sleep and the body mass index and overweight status of children and adolescents. *Child Development* 2007; 78: 309-23.
- Spiegel K, Tasali E, Penev P, Cauter EV. Brief communication: Sleep curtailment in healthy young men is associated with decreased leptin levels, elevated ghrelin levels, and increased hunger and appetite. *Ann Intern Med* 2004; 141: 846-50.
- Taheri S, Lin L, Austin D, Young T, Mignot E. Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PLoS Med* 2004; 1: e62.
- Yee BJ, Phillips CL, Banerjee D, Caterson I, Hedner JA, Grunstein RR. The effect of sibutramine-assisted weight loss in men with obstructive sleep apnoea. *Int J Obes (Lond)*. 2007 Jan;31(1):161-8
- Young T, Peppard PE, Gottlieb DJ. Epidemiology of obstructive sleep apnea: a population health perspective. *Am J Respir Crit Care Med*. 2002 May 1;165(9):1217-39