2011

Relationships between self-rated health, quality of life and sleep duration in middle aged and elderly Australians

Christopher A. Magee
University of Wollongong, cmagee@uow.edu.au

Peter Caputi
University of Wollongong, pcaputi@uow.edu.au

Don Iverson

Relationships between self-rated health, quality of life and sleep duration in middle aged and elderly Australians

Abstract

Objective: To determine whether sleep duration is associated with self-rated health and quality of life in adults residing in New South Wales, Australia. Methods: Cross-sectional data from the 45 and Up Study were used. Sleep duration, self-rated health, quality of life and other health-related variables were assessed using a self-report questionnaire. Multi-nomial logistic regression models were used to examine whether sleep duration predicted self-rated health and quality of life. Results: The sample included 63,408 adults aged 45–95 years. After controlling for a range of covariates, (OR = 1.49, 95% CI 1.31–1.70), 6 h sleep (OR = 1.28, 95% CI 1.17–1.38) and P 9 h sleep (OR = 1.56, 95% CI 1.46–1.67) were associated with poorer self-rated health. Similarly, (OR = 1.80, 95% CI 1.57–2.07), 6 h sleep (OR = 1.36, 95% CI 1.24–1.49) and P 9 h sleep (OR = 1.41, 95% CI 1.30–1.53) were associated with poorer quality of life. Conclusion: Short and long sleep were significantly associated with poor self-rated health and lower quality of life in this large sample of middle aged and older Australian adults. While cross-sectional, these results add weight to recent data emphasising the importance of adequate sleep in physical and mental health.

Disciplines

Arts and Humanities | Life Sciences | Medicine and Health Sciences | Social and Behavioral Sciences

Publication Details

Magee, C. A., Caputi, P. & Iverson, D. C. (2011). Relationships between self-rated health, quality of life and sleep duration in middle aged and elderly Australians. Sleep Medicine, 12 (4), 346-350.

Article Title: Relationships between Self-Rated Health, Quality of Life and Sleep Duration in Middle Aged and Elderly Australians

Authors: Christopher A Magee[1*]; Peter Caputi[1] and Don C Iverson[2]

[1] School of Psychology, University of Wollongong, NSW 2522, Australia.

[2] Illawarra Health and Medical Research Institute, University of Wollongong, NSW 2522, Australia.

*Corresponding Author: Dr Christopher Magee. School of Psychology, University of Wollongong, NSW 2522, Australia. Email: cmagee@uow.edu.au; Ph: + 61 2 4221 3716; Fax: +61 2 4221 4163

Key Words: Sleep duration, self-rated health, quality of life, ageing, epidemiology.

ABSTRACT

Objective: To determine whether sleep duration is associated with self-rated health and quality of life in adults residing in New South Wales, Australia. **Methods**: Cross-sectional data from the 45 and Up Study were used. Sleep duration, self-rated health, quality of life and other health-related variables were assessed using a self-report questionnaire. Multi-nomial logistic regression models were used to examine whether sleep duration predicted self-rated health and quality of life. **Results**: The sample included 63,408 adults aged 45–95 years. After controlling for a range of covariates,

<6 h sleep (OR = 1.49, 95% CI 1.31–1.70), 6 h sleep (OR = 1.28, 95% CI 1.17–1.38) and P 9 h sleep (OR = 1.56, 95% CI 1.46–1.67) were associated with poorer self-rated health. Similarly, <6 h sleep (OR = 1.80, 95% CI 1.57–2.07), 6 h sleep (OR = 1.36, 95% CI 1.24–1.49) and P 9 h sleep (OR = 1.41, 95% CI 1.30–1.53) were associated with poorer quality of life. **Conclusion**: Short and long sleep were significantly associated with poor self-rated health and lower quality of life in this large sample of middle aged and older Australian adults. While cross-sectional, these results add weight to recent data emphasising the importance of adequate sleep in physical and mental health.

1. INTRODUCTION

Single-item measures of self-rated health (SRH) have been shown to reliably predict health service utilisation, nursing home admissions, disability and overall mortality risk in Australia and other countries [1], [2], [3], [4], [5] and [6]. Compared to more objective measures of health status, SRH provides a convenient and inexpensive method of assessing an individual's health across multiple domains (e.g., psychological, behavioural, social and environmental) and provides an important and valid indicator of an individual's health status and associated health outcomes [1] and [7]. Quality of life (QOL) is a construct related to SRH and is also important as it specifically assesses how an individual feels about their health status and other non-medical aspects of their lives [8].

Chronic health conditions and mental health problems are strong predictors of SRH and QOL, but other psychosocial, behavioural, sociodemographic and health-related factors have also been shown to be important [7] and [9]. In recent years, a number of studies have indicated that sleep duration could be an important predictor of an individual's health status. For example, short sleep (i.e., ≤ 6 hours sleep a night) has been associated with poor mood, an increased risk of accidents, chronic health conditions (e.g., obesity, cardiovascular disease and diabetes), and elevated mortality risk [10], [11], [12], [13], [14], [15] and [16]. These findings are concerning given that short sleep is a common characteristic of modern society, reported by between 15% and 30% of adults living in Australia, the US, Europe and Asia [12], [17], [18], [19] and [20].

Some recent studies have found that short sleep is associated with poorer SRH and QOL in young and middle aged adults. For example, in a sample of 17,465 university students aged 17–30 years across 24 countries, Steptoe et al. [21] found that individuals reporting <7 h sleep a night were more likely to have poorer SRH. Faubel et al. [22] examined 3834 Spanish adults aged ≥ 60 years and observed that ≤ 5 hours sleep was also associated with poorer health-related QOL. Yokoyama et al. [23] reported a linear association between sleep duration and subjective well being in 1769 Japanese adults aged 70 years and above after

adjusting for potential confounding variables. In contrast, Jean-Louis et al. [24] found no evidence of an association between quality of well being and sleep duration, but this could have been the result of a relatively small sample (n = 273).

In the present study, we sought to further understand the nature of the association between sleep duration and SRH in a large Australian sample of middle aged and elderly adults. This involved controlling for a number of potential confounding variables (e.g., mental health, chronic health conditions) and examining whether the association between sleep duration and SRH varied with age. This latter point is important given that SRH declines with age, and structure and quality of sleep change considerably in older adulthood [25], [26] and [27]. Thus it is possible that the association between sleep and SRH varies with age, but to our knowledge this has not yet been examined. A secondary aim of this study was to examine whether sleep duration was also an independent predictor of QOL.

2. METHODS

2.1Participants

This paper examined data collected through the 45 and Up Study, which is a large-scale health survey of adults aged 45 years and over who reside in New South Wales, Australia. The objective of the 45 and Up Study is to collect data from a large heterogeneous sample of Australian adults, and participants are not necessarily representative of the Australian population; detailed information regarding the methods of the 45 and Up Study is described elsewhere [28]. The present paper included participants who were recruited as part of the baseline phase of the 45 and Up Study, which was conducted between 2006 and 2008. The 45 and Up Study was approved by the University of New South Wales Human Research Ethics Committee. Ethics approval to use these data in the present paper was obtained from the University of Wollongong Human Research Ethics Committee.

2.2 Materials

All data were derived from the self-report questionnaire, except for place of residence which was determined using a standard index of geographic location in Australia [29]. Sleep duration was assessed using the question "About how many hours in each 24 h day do you usually spend sleeping (including at night and naps)?" with responses coded as <6 h, 6 h (≥ 6 h, < 7 h), 7 – 8 h (≥ 7 h, < 9 h) and ≥ 9 h. These categories are consistent with a number of studies demonstrating that 7–8 h sleep a night is associated with the lowest risk of morbidity and mortality [10], [11], [12], [13], [14] and [15].

Self-rated health was determined from the question "In general, how would you rate your overall health?" Participants responded on a five-point Likert scale; the response categories were "excellent", "very good", "good", "fair" and "poor". For the purposes of the present analyses we combined these to form two categories: good SRH (i.e., excellent/very good/good) and poor SRH (i.e., poor/fair). Quality of life was determined from the question "In general, how would you rate your overall quality of life?" The response categories were the same as for SRH and we combined these into good QOL (i.e., excellent/very good/good) and poor QOL (i.e., poor/fair).

A number of additional variables were measured and included as covariates in the analyses. Age was assessed as a continuous variable and was split into the following categories: 45–54 years, 55–64 years, 65–74 years, 75–84 years, 85–95 years. Additional demographic variables such as sex, place of residence, country of birth, education level, and marital status were also measured and included in the analyses. Work hours were coded as "does not work", "1–34 h/week", "35–40 h/week" and ">40 h/week". Participants also indicated how much alcohol they consumed on average each week (coded as "0 drinks", "1–7 drinks", "8–14 drinks" and '≥ 15 drinks') and whether they smoked cigarettes (coded as "non-smoker", "former smoker"

and “current smoker”). Body mass index (BMI) was determined from self-reported height and weight; participants were categorised as lean (BMI: 18.5–24.9), overweight (BMI: 25.0–29.9) or obese (BMI: ≥ 30). Participants also completed the Kessler Psychological Distress Scale [30], which consists of 10 items (each scored from 1 to 5) that assess Emotional Disturbances. Participants’ scores on this scale were coded as low emotional disturbances (<16), moderate emotional disturbances (16–21) and high/very high emotional disturbances (22–50) [31]. Participants also indicated whether they had ever been diagnosed with cancer, heart disease, diabetes, or stroke; these variables were coded as “yes” or “no”.

2.3 Statistical Analysis

The relationship between sleep duration and SRH was examined using multinomial logistic regression models. This was preferred over binary logistic regression as more detailed information regarding categorical covariates can be obtained without dummy coding. In the unadjusted analyses, sleep duration was entered as the only predictor of SRH. In the adjusted analyses, sleep duration was entered alongside socio-demographic factors (age, sex, country of birth, education level, marital status, work hours, place of residence), health-related behaviours (alcohol consumption and smoking status), chronic health conditions (obesity, cancer, heart disease, diabetes and stroke) and emotional disturbances (as assessed by the Kessler Psychological Distress Scale).

This analytic approach was performed on the entire sample and then separately in each of the five age categories. This same process was used for modelling QOL. The results are reported as odds ratios (OR) and 95% confidence intervals (CI), with a p value <.05 considered statistically significant.

3. RESULTS

3.1 Descriptive Statistics

The sample comprised 63,408 participants aged 45–95 years for whom complete data on all variables were available. As shown in Table 1, most participants were aged 45–64 years, but there were sufficient numbers in the older age categories for the analyses to be performed. A total of 15.6% of individuals reported short sleep (i.e., ≤ 6 hours sleep) and 17.2% reported long sleep (≥ 9 hours sleep). The majority of participants also reported good SRH (88.6%) and good QOL (91.7%).

Table 1. Socio-demographic and health characteristics of participants.

	<6 h	**6 h**	**7–8 h**	**9 h**	**Total**	***P*-value**
	(*n* = 1984; 3.1%)	**(*n* = 7930; 12.5%)**	**(*n* = 42,565; 67.1%)**	**(*n* = 10,929; 17.2%)**	**(*n* = 63,408)**	
Sex						<.001
Male	908 (45.8)	3972 (50.1)	21,130 (49.6)	5954 (54.5)	31,964 (50.4)	
Female	1076 (54.2)	3958 (49.9)	21,435 (50.4)	4975 (45.5)	31,444 (49.6)	
Age category						<.001
45–54 years	655 (33.0)	3023 (38.1)	15,925 (37.4)	2581 (23.6)	22,185 (35.0)	
55–64 years	657 (33.1)	2872 (36.2)	15,454 (36.3)	3275 (30.0)	22,258 (35.1)	
65–74 years	382 (19.3)	1288 (16.2)	7280 (17.1)	2679 (24.5)	11,629 (18.3)	
75–84 years	234 (11.8)	620 (7.8)	3379 (7.9)	1956 (17.9)	6189 (9.8)	
85–95 years	56 (2.8)	126 (1.6)	527 (1.2)	438 (4.0)	1147 (1.8)	
Marital status						<.001
Single	577 (29.1)	2035 (25.7)	8678 (20.4)	2277 (20.8)	13,567	

	<6 h	6 h	7–8 h	9 h	Total	*P*-value
	(*n* = 1984; 3.1%)	(*n* = 7930; 12.5%)	(*n* = 42,565; 67.1%)	(*n* = 10,929; 17.2%)	(*n* = 63,408)	
					(21.4)	
Married/de facto	1407 (70.9)	5895 (74.3)	33,887 (79.6)	8652 (79.2)	49,841 (78.6)	
Country of birth						<.001
Australia	1413 (71.2)	5770 (72.8)	31,969 (75.1)	8429 (77.1)	47,581 (75.0)	
Overseas	571 (28.8)	2160 (27.2)	10,596 (24.9)	2500 (22.9)	15,827 (25.0)	
Place of residence						<.001
Remote	33 (1.7)	130 (1.6)	791 (1.9)	229 (2.1)	1183 (1.9)	
Regional	1029 (51.9)	3967 (50.0)	22,606 (53.1)	6552 (60.0)	34,154 (53.9)	
Major city	922 (46.5)	3833 (48.3)	19,168 (45.0)	4148 (38.0)	28,071 (44.3)	
Education						<.001
<High school	353 (17.8)	814 (10.3)	3204 (7.5)	1437 (13.1)	5808 (9.2)	
High school	682 (34.4)	2386 (30.1)	12,537 (29.5)	3494 (32.0)	19,099 (30.1)	
Trade/diploma	598 (30.1)	2611 (32.9)	14,226 (33.4)	3765 (34.4)	21,200 (33.4)	
University degree	351 (17.7)	2119 (26.7)	12,598 (29.6)	2233 (20.4)	17,301 (27.3)	
Self-rated health						<.001
Good self-rated	1525 (76.9)	6851 (86.4)	38,938 (91.5)	8851 (81.0)	56,165	

	<6 h	6 h	7–8 h	9 h	Total	*P*-value
	(*n* = 1984; 3.1%)	(*n* = 7930; 12.5%)	(*n* = 42,565; 67.1%)	(*n* = 10,929; 17.2%)	(*n* = 63,408)	
health					(88.6)	
Poor self-rated health	459 (23.1)	1079 (13.6)	3627 (8.5)	2078 (19.0)	7243 (11.4)	
Quality of life						<.001
Good quality of life	1569 (79.1)	7081 (89.3)	40,018 (94.0)	9453 (86.5)	58,121 (91.7)	
Poor quality of life	415 (20.9)	849 (10.7)	2547 (6.0)	1476 (13.5)	5287 (8.3)	
Emotional disturbance[a]						<.001
Low (<16)	1169 (58.9)	5605 (70.7)	34,090 (80.1)	7959 (72.8)	48,823 (77.0)	
Moderate (16–21)	444 (22.4)	1561 (19.7)	6334 (14.9)	1931 (17.7)	10,270 (16.2)	
High (≥22)	371 (18.7)	764 (9.6)	2141 (5.0)	1039 (9.5)	4315 (6.8)	

[a] Emotional disturbance assessed using the Kessler Psychological Distress Scale.

3.2 Sleep Duration, SRH and QOL

Table 2 shows the unadjusted and adjusted results for the models examining the relationship between sleep duration and SRH for the total sample and for each of the age groups. In the total sample, compared to 7–8 h sleep, those reporting <6 h sleep (OR = 1.49, 95% CI 1.31–1.70), 6 h sleep (OR = 1.28, 95% CI 1.17–1.38) and ≥ 9 h sleep (OR = 1.56, 95% CI 1.46–1.67) were more likely to report poor SRH. Similarly, <6 h sleep (OR = 1.80, 95% CI 1.57–2.07), 6 h sleep (OR = 1.36, 95% CI 1.24–1.49) and ≥ 9 h sleep (OR=1.41, 95% CI 1.30-1.53) were associated with poorer QOL (see Table 3).

Table 2. Odds ratios for sleep duration predicting SRH for the total sample and by age group.

	Unadjusted		Adjusted[a]	
	OR	**95% CI**	**AOR**	**95% CI**
Total sample				
<6 h sleep	3.23*	2.90, 3.61	1.49*	1.31, 1.70
6 h sleep	1.69*	1.57, 1.82	1.28*	1.17, 1.38
7–8 h sleep	Referent		Referent	
≥ 9 sleep	2.52*	2.38, 2.67	1.56*	1.46, 1.67
45–54 years				
<6 h sleep	3.52*	2.89, 4.28	1.30*	1.02, 1.64
6 h sleep	1.73*	1.53, 1.97	1.16*	1.01, 1.33
7–8 h sleep	Referent		Referent	
≥ 9 sleep	2.78*	2.47, 3.13	1.79*	1.56, 2.06
55–64 years				
<6 h sleep	3.80*	3.15, 4.59	1.72*	1.37, 2.17
6 h sleep	1.74*	1.53, 1.97	1.35*	1.17, 1.56
7–8 h sleep	Referent		Referent	
≥9 sleep	2.55*	2.29, 2.84	1.59*	1.40, 1.81
65–74 years				
<6 h sleep	2.85*	2.21, 3.67	1.64*	1.21, 2.21
6 h sleep	1.78*	1.50, 2.12	1.41*	1.16, 1.71
7–8 h sleep	Referent		Referent	
≥ 9 sleep	2.01*	1.77, 2.29	1.51*	1.30, 1.75

	Unadjusted		Adjusted[a]	
	OR	**95% CI**	**AOR**	**95% CI**
75–84 years				
<6 h sleep	2.06*	1.52, 2.78	1.41	0.99, 1.99
6 h sleep	1.45*	1.17, 1.79	1.17	0.92, 1.48
7–8 h sleep	Referent		Referent	
≥ 9 sleep	1.70*	1.48, 1.95	1.35*	1.16, 1.58
85–95 years				
<6 h sleep	1.05	0.56, 1.99	0.68	0.33, 1.41
6 h sleep	1.41	0.92, 2.16	1.25	0.78, 2.02
7–8 h sleep	Referent		Referent	
≥ 9 sleep	1.48*	1.12, 1.96	1.22	0.89, 1.68

[a] Results are adjusted for age, sex, place of residence (i.e. rural, regional, major city), country of birth, education level, marital status, smoking status, work status, alcohol consumption, BMI, emotional disturbances (determined by the Kessler 10 scale) and self-reported chronic disease status.

* $p < .05$.

Table 3. Odds ratios for sleep duration predicting QOL for the total sample and by age group.

	Unadjusted		Adjusted[a]	
	OR	**95% CI**	**AOR**	**95% CI**
Total sample				
<6 h sleep	4.15*	3.70, 4.66	1.80*	1.57, 2.07
6 h sleep	1.88*	1.74, 2.04	1.36*	1.24, 1.49
7–8 h sleep	Referent		Referent	

	Unadjusted		Adjusted[a]	
	OR	**95% CI**	**AOR**	**95% CI**
≥ 9 sleep	2.45*	2.29, 2.63	1.41*	1.30, 1.53
45–54 years				
<6 h sleep	4.98*	4.06, 6.11	1.69*	1.32, 2.18
6 h sleep	2.13*	1.85, 2.45	1.40*	1.19, 1.64
7–8 h sleep	Referent		Referent	
≥ 9 sleep	2.75*	2.40, 3.16	1.46*	1.23, 1.72
55–64 years				
<6 h sleep	4.66*	3.83, 5.68	1.94*	1.53, 2.50
6 h sleep	1.87*	1.63, 2.15	1.30*	1.15, 1.59
7–8 h sleep	Referent		Referent	
≥ 9 sleep	2.35*	2.07, 2.66	1.33*	1.15, 1.55
65–74 years				
<6 h sleep	3.43*	2.60, 4.52	1.84*	1.33, 2.56
6 h sleep	1.73*	1.41, 2.12	1.28*	1.02, 1.61
7–8 h sleep	Referent		Referent	
≥ 9 sleep	1.95*	1.67, 2.27	1.44*	1.21, 1.71
75–84 years				
<6 h sleep	2.78*	2.02, 3.82	1.83*	1.27, 2.64
6 h sleep	1.90*	1.51, 2.40	1.55*	1.19, 2.00
7–8 h sleep	Referent		Referent	
≥ 9 sleep	1.80*	1.53, 2.12	1.39*	1.16, 1.66

	Unadjusted		Adjusted[a]	
	OR	**95% CI**	**AOR**	**95% CI**
85–95 years				
<6 h sleep	1.13	0.59, 2.18	0.84	0.39, 1.79
6 h sleep	0.88	0.54, 1.44	0.76	0.44, 1.33
7–8 h sleep	Referent		Referent	
≥ 9 sleep	1.37	1.01, 1.84	1.2	0.85, 1.69

[a] Results are adjusted for age, sex, place of residence (i.e. rural, regional, major city), country of birth, education level, marital status, smoking status, work status, alcohol consumption, BMI, emotional disturbances (determined by the Kessler 10 scale) and self-reported chronic disease status.

* $p < .05$.

When the analyses were broken down by age group, a similar pattern of results was observed for most of the age groups but there were some differences. For example, short and long sleep were associated with poorer SRH in the unadjusted and adjusted analyses for participants aged 45–74 years. Short and long sleep were associated with poorer SRH in the 75–84 year age group in the unadjusted analyses, but only long sleep significantly predicted poor SRH in the adjusted analyses. In those aged 85–95 years, long sleep was associated with poor SRH in the unadjusted analyses; neither short nor long sleep was associated with SRH in the adjusted models. A similar pattern was observed for the models predicting QOL. For the younger four age groups (i.e., 45–84 years) short and long sleep were associated with poor QOL in the unadjusted and adjusted models. In the 85–95 year age group, there was no evidence for an association between sleep duration and QOL.

DISCUSSION

In the present study, short and long sleep were found to be associated with poorer SRH in adults aged 45–74 years; these relationships remained significant after controlling for potential confounding variables. These results suggest a U-shaped association between sleep duration and SRH in middle aged and older adults. In the adjusted analyses, sleep duration was not associated with SRH in those aged 75–95 years old, suggesting that short and long sleep are independently associated with poor SRH in middle aged and elderly adults, but not in the very elderly. A similar pattern of results was obtained for QOL; there was a U-shaped association between sleep duration and QOL, and this was observed in those aged 45–84 years, but not in those aged 85–95 years.

These findings are consistent with some recent studies that have previously examined the associations between sleep duration and a variety of health and QOL related measures [21], [22] and [23]. The largest of these studies was conducted on a sample of 17,465 university students from 24 countries, where short sleep (but not long sleep) was found to be associated with poor SRH [21]. Two studies in elderly samples produced similar results, with individuals reporting short sleep being more likely to have poorer health-related QOL [22] and [23]. Our study extended these findings by examining whether the association between sleep duration and SRH and QOL varied with advancing age in a large sample of Australian adults.

Several explanations for why short sleep was associated with poor SRH and QOL are possible. Short sleep could contribute to poor SRH and QOL by impairing mood and cognitive functioning or because of an increase in fatigue. Short sleep may also lead to a number of adverse physiological changes (e.g., impaired glucose tolerance, inflammation), which increase the risks of chronic conditions such as diabetes, obesity and hypertension [32], [33] and [34]. Short sleep may also be a consequence of poor SRH and QOL. In particular, individuals with a poorer health status could be more likely to experience disturbed and short sleep or may be less accurate in estimating their sleep duration. Given that the present data were cross-

sectional, we are unable to determine whether short sleep contributes to poor SRH/QOL or vice versa. In the context of recent research, however, it is likely that the relationship is bi-directional.

To our knowledge, the association between long sleep duration and SRH and QOL has not been previously reported and the underlying mechanisms are not clear. A number of previous studies have found that long sleep is associated with a number of adverse health outcomes such as depression, obesity and hypertension, as well as elevated mortality [10], [35] and [36]. Such studies have generally concluded that long sleep is a consequence (rather than a cause) of these health conditions [36]. Hence, it may also be possible that long sleep is a result of poor SRH and QOL, not vice versa. Nevertheless, we emphasise that the precise health implications associated with long sleep, not only in the context of self-report measures but disease status as well, remain unclear and warrant further investigation.

The lack of an association between sleep duration and SRH and QOL in the very elderly could reflect a number of age-related processes. For example, health status and sleep quality both decline with age, which may reflect a combination of social and lifestyle factors (e.g., death of a spouse) as well as chronic health conditions (e.g., cancer, depression). Age-related biases in self-reported sleep and health could have affected the results and may also explain the lack of an association in the very elderly [37]. Any combination of these factors could explain the absence of an association between sleep duration and SRH and QOL in the elderly.

To our knowledge, this is the largest study examining the association between sleep, SRH and QOL in middle aged and elderly adults and the first conducted on an Australian sample. The large sample size allowed us to examine whether the association between sleep and SRH and QOL varied with age, whilst controlling for a number of important confounding variables. As noted, however, the present paper utilised cross-sectional data so we are unable to determine the direction of causation between sleep duration and

SRH and QOL. This is important particularly in the case of short sleep which could feasibly cause, or be the result of, poor SRH and QOL. Future studies involving longitudinal data will therefore be important. A further limitation relates to the self-report nature of the data particularly in relation to sleep, SRH and QOL. Self-reported sleep duration corresponds modestly with more objective measurements of sleep involving actigraphy and polysomnography, and there is some evidence that many individuals over-estimate their sleep duration [37], [38] and [39]. This may have led to some misclassification of participants in regard to their sleep duration which may have impacted the results. Furthermore, chronic health conditions were also assessed via a self reported questionnaire which may not provide an accurate or detailed indication of underlying health conditions. We suggest that future studies in this area attempt to incorporate more detailed and objective measures of relevant health conditions such as hypertension, heart disease and stroke, as these may influence the association between sleep duration and SRH/QOL. Finally, although we relied on self-report measures of health and QOL, it is important to note that these are widely used and provide important information about an individual's health status that would not be evident from more objective measures [1] and [7].

In this study we found that short and long sleep were strongly related to an individual's perceived health status and their overall quality of life. Sleep duration may therefore play an important role in promoting the health and well being of middle aged and older adults. These associations were not evident in the very elderly (i.e., $\geq$ 85 years) probably because of a number of age related factors that impact both sleep and health status. More research is required to delineate the nature of the associations observed in the present study. However, there is now mounting evidence from other countries that short sleep has adverse effects on physical and mental health. We therefore suggest that there is a need for increased public awareness in Australia regarding the importance of adequate sleep. Public health programs in Australia and other countries that promote healthy sleep durations could be important in reducing morbidity associated with short sleep.

Acknowledgements: The 45 and Up Study is managed by The Sax Institute in collaboration with major partner Cancer Council New South Wales; and partners the National Heart Foundation of Australia (NSW Division); NSW Health; beyondblue: the national depression initiative; Ageing, Disability and Home Care, Department of Human Services NSW; and UnitingCare Ageing.

REFERENCES

1. Miilunpalo, S, Vuori, I, Oja, P, et al. Self-rated health status as a health measure: the predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. J Clin Epidemiol 1997; 50:517 – 528.

2. Kaplan, GA, Goldberg, DE, Everson, SA, et al. Perceived Health Status and Morbidity and Mortality: Evidence from the Kuopio Ischaemic Heart Disease Risk Factor Study. Int J Epidemiol 1996; 25:259 - 265.

3. Okamoto, K, Momose, Y, Fujino, A, Osawa, Y. Gender differences in the relationship between self-rated health (SRH) and 6-year mortality risks among the elderly in Japan. Arch Gerontol Geriatr 2008; 47:311 - 317.

4. Lyness, JM, King, DA, Conwell, Y, et al. Self-Rated Health, Depression, and One-Year Health Outcomes in Older Primary Care Patients. J Geriat Psychiat 2004; 12:110 - 113.

5. DeSalvo, KB, Bloser, N, Reynolds, K, et al. Mortality prediction with a single general self-rated health question. J Gen Intern Med 2005; 20:267 - 275.

6. McCallum, J, Shadbolt, B, Wang, D. Self-rated health and survival: a 7-year follow-up study of Australian elderly. Am J Public Health 1994; 84:1100 - 1105.

7. Singh-Manoux, A, Martikainen, P, Ferrie, J, et al. What does self rated health measure? Results from the British Whitehall II and French Gazel cohort studies. J Epidemiol Community Health 2006; 60:364 - 372.

8. Gill, TM, Feinstein, AR. A Critical Appraisal of the Quality of Quality-of-Life Measurements. J Am Med Assoc 1994; 272:619 - 626.

9. Singh-Manoux, A, Dugravot, A, Shipley, MJ, et al. The association between self-rated health and mortality in different socioeconomic groups in the GAZEL cohort study. Int. J. Epidemiol. 2007;36:1222 – 1228

10. Hublin, C, Partinen, M, Koskenvuo, M, Kaprio, J. Sleep and Mortality: A Population-Based 22-Year Follow-Up Study. Sleep 2007; 30:1245 - 1253.

11. Heslop, P, Smith, GD, Metcalfe, C, et al. Sleep duration and mortality: the effect of short or long sleep duration on cardiovascular and all-cause mortality in working men and women. Sleep Med 2003; 3:305 - 314.

12. Tamakoshi, A, Ohno, Y. Self-Reported Sleep Duration as a Predictor of All-Cause Mortality: Results from the JACC Study, Japan. Sleep 2004; 27:51 - 54.

13. Suzuki, E, Yorifuji, T, Ueshima, K, et al. Sleep duration, sleep quality and cardiovascular disease mortality among the elderly: a population-based cohort study. Preventive Medicine 2009;49:135 - 141.

14. Spiegel, K, Knutson, K, Leproult, R, et al. Sleep loss: a novel risk factor for insulin resistance and Type 2 diabetes. J Appl Physiol 2005; 99:2008 - 2019.

15. Yaggi, HK, Araujo, AB, McKinlay, JB. Sleep duration as a risk factor for the development of type 2 diabetes. Diabetes Care 2006; 29:657 – 661.

16. Dinges, DF, Rogers, NL, Baynard, MD. Chronic Sleep Deprivation. In: Kryger MH, Roth T, Dement WC, editors. Principles and Practice of Sleep Medicine. Philadelphia: Elsevier Saunders, 2005. p. 67- 76.

17. Krueger, PM, Friedman, EM. Sleep duration in the United States: A cross-sectional population-based study. Am J Epidemiol 2009; 169:1052 - 1063.

18. Ursin, R, Bjorvatn, B, Holsten, F. Sleep duration. subjective sleep need, and sleep habits of 40- to 45-year-olds in the Hordaland Health Study. Sleep 2005; 28:1260 - 1269.

19. Bartlett, DJ, Marshall, NS, Williams, A, Grunstein, RR. Sleep Health New South Wales: chronic sleep restriction and daytime sleepiness. Intern Med J 2008; 38:24 - 31.

20. Magee, CA, Iverson, DC, Caputi, P. Factors associated with short and long sleep. Prev Med 2009; 49 461 – 467.

21. Steptoe, A, Peacy, V, Wardle, J. Sleep Duration and Health in Young Adults. Arch Intern Med 2006; 166:1689 - 1692.

22. Faubel, R, Lopez-Garcia, E, Guallar-Castillón, P, et al. Sleep Duration and Health-Related Quality of Life among Older Adults: A Population-Based Cohort in Spain. Sleep 2009; 32:1059 - 1068.

23. Yokoyama, E, Saito, Y, Kaneita, Y, et al. Association between subjective well-being and sleep among the elderly in Japan. Sleep Med 2008; 9:157 - 164.

24. Jean-Louis, G, Kripke, DF, Ancoli-Israel, S. Sleep and quality of well-being. Sleep 2000; 23:1115 - 1121.

25. Liang, J, Shaw, BA, Krause, N, et al. How Does Self-Assessed Health Change With Age? A Study of Older Adults in Japan. J Gerontol B Psychol Sci Soc Sci 2005; 60:S224 -232.

26. McCullough, ME, Laurenceau, J-P. Gender and the Natural History of Self-Rated Health: A 59-Year Longitudinal Study. Health Psychol 2004; 23:651 - 655.

27. Someren, EJW. Circadian and sleep disturbances in the elderly. Exp Geront 2000; 35:1229 - 1237.

28. Banks ., Redman S, Jorm L, et al. Cohort Profile: The 45 and Up Study. Int J

Epidemiol 2008; 37:941 – 947.

29. Australian Bureau of Statistics. Australian Standard Geographical Classification (ASGC) July 2008. Australian Bureau of Statistics, Canberra 2008.

30. Kessler, RC, Andrews, G, Colpe, LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med 2002;32:959-976.

31. Australian Bureau of Statistics. Information paper: use of the Kessler Psychological Distress Scale in ABS Health Surveys, Australia, 2001. Australian Bureau of Statistics, Canberra 2003.

32. Magee, CA, Huang, X, Iverson, DC, Caputi, P. Examining the Pathways linking Chronic Sleep Restriction to Obesity. Journal of Obesity 2010; 2010:1 – 10.

33. Spiegel, K, Tasali, E, Leproult, R, Van Cauter, E. Effects of poor and short sleep on glucose metabolism and obesity risk. Nat Rev Endocrinol 2009; 5:253 - 261.

34. Gangwisch, JE, Heymsfield, SB, Boden-Albala, B, et al. Short Sleep Duration as a Risk Factor for Hypertension: Analyses of the First National Health and Nutrition Examination Survey. Hypertension 2006; 47:833 - 839.

35. Stranges, S, Dorn, JM, Shipley, MJ, et al. Correlates of short and long sleep duration: A cross-cultural comparison between the United Kingdom and the United States. Am J Epidemiol 2008; 168:1353 - 1364.

36. Patel, SR, Malhotra, A, Gottlieb, DJ, et al. Correlates of long sleep duration. Sleep 2006; 29:881 - 889.

37. van den Berg, JF, Van Rooij, FJA, Vos, H, et al. Disagreement between subjective and actigraphic measures of sleep duration in a population-based study of elderly persons. J Sleep Res 2008; 17:295 - 302.

38. Lauderdale, DS, Knutson, KL, Yan, LL, et al. Self-reported and measured sleep duration: how similar are they? Epidemiology 2008; 19:838 - 845.

39. Lockley, SW, Skene, DJ, Arendt, J. Comparison between subjective and actigraphic measurement of sleep and sleep rhythms. J Sleep Res 1999; 8:175 - 183.