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Sleep duration and incident and persistent depressive symptoms among a rural ageing population in South Africa

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Abstract

Background: The aim of the study was to assess the relationship between sleep duration and incident depressive symptoms (IDS) and persistent depressive symptoms (PDS) using longitudinal data from South Africa.

Methods: This longitudinal community study enrolled 3891 adults (≥40 years) from the "Health and Ageing in Africa: A Longitudinal Study of an INDEPTH Community in South Africa (HAALSI)". Sleep duration was assessed by self-report at wave 1, and depressive symptoms were assessed using the Center for Epidemiological Studies Depression Scale at wave 1 and 2. Outcomes were incident and persistent depressive symptoms at wave 2. Multivariable logistic regression analysis was conducted to assess the associations between sleep duration at wave 1 and incident, and persistent depressive symptoms.

Results: The prevalence of IDS was 25.6% and PDS 30.8%. The prevalence of very short, short, normal, and long sleep duration at baseline was 3.6%, 10.1%, 60.9% and 25.4%, respectively. In the fully adjusted model, long sleep duration was positively associated with IDS among men (AOR: 1.37, 95% CI: 1.02–1.84), but not among women (AOR: 0.91, 95% CI: 0.67–1.23). No models among both men and women showed a significant association between short sleep and IDS. Long sleep duration was associated with PDS (AOR: 2.04, 95% CI: 1.20–3.48) among men

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Author contribution statement

"Supa Pengpid and Karl Peltzer: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper."

Declaration of Competing Interest

"The authors declare no conflict of interest."

but not among women (AOR: 1.26, 95% CI: 0.76–2.11). Short sleep showed among both sexes no significant associations with PDS.

Conclusion: Long but not short sleep duration was independently associated with IDS and PDS among men but not among women.

Keywords

sleep duration; incident depressive symptoms; persistent depressive symptoms; longitudinal study; South Africa

1. Introduction

Worldwide, depressive symptoms (12.1%), constitute a major public health concern, including in African countries [1,2]. In studies in the general population in South Africa, 9.7% had major depression (life-time) [3], and among ageing adults about a third showed depressive symptoms [4]. Population prevention of depressive disorders in older age, including for example the role of sleep problems, have been suggested [5,6].

Concerning the impact of sleep duration on incident depression, a meta-analysis of seven longitudinal studies from the USA ($n = 6$) and Japan ($n = 1$) found that both "short and long sleep durations were significantly associated with an increased risk of depression in adults" [7]. In a longitudinal study among ageing adults in China, only short but not long sleep was associated with incident depressive symptoms (IDS) and persistent depressive symptoms (PDS) [8,9]. It is unclear, if short or long sleep is associated with IDS and PDS symptoms in Africa. Hence, this study aimed to assess the association between sleep duration and IDS and PDS in a longitudinal study in South Africa.

2. Materials and methods

2.1. Sample and procedure

We analyzed longitudinal data from two consecutive waves ($N = 5059$, ≥40 years, response rate 85.9%, in 2014–2015, and $N = 4176$, response rate 94% in 2018–2019) of the "Health and Ageing in Africa: A Longitudinal Study of an INDEPTH Community in South Africa (HAALSI)" [10]. From wave 1 to wave 2, 595 (12%) had died, 254 (5%) declined participation, and 34 (<1%) were not found [11]. The study protocol was approved by the "University of the Witwatersrand Human Research Ethics Committee (ref. M141159), the Harvard T.H. Chan School of Public Health, Office of Human Research Administration (ref. C13–1608–02), and the Mpumalanga Provincial Research and Ethics Committee" [10].

2.2. Measures

2.2.1. Outcome variable—Depressive symptoms (scores ≥3) were assessed with the "Center for Epidemiological Studies-Depression Scale eight-item scale (CES-D 8)" (alpha 0.66) [12] and CES-D 20 modified to CES-D 8 [13], (alpha 0.79).

2.2.2. Exposure variable—*Sleep duration* was sourced from the item, "Over the past four weeks, how many hours do you think you actually slept each day?" [14]. We followed

the recommendations of the National Sleep Foundation, “7 to 9 hours for young adults and adults, and 7 to 8 hours of sleep for older adults” [15].

2.2.3. Covariates—*Sociodemographic information* included country of birth, age, education, age, marital status, and a quintile of asset-based household wealth.

Current tobacco use was defined as current smokeless and/or current tobacco smoking [10].

Alcohol dependence was assessed with the 4-item CAGE scale [16] (alpha 0.82).

Body Mass Index (BMI) was measured and categorized based on WHO criteria [17].

Hypertension was measured and defined based on National Committee criteria [18].

Dyslipidemia was defined as: “total cholesterol > 6.21 mmol/L, HDL-C < 1.19 mmol/L, LDL-C > 4.1 mmol/L, triglycerides >2.25 mmol/L, or ever diagnosed or medication use for high cholesterol” [10].

Diabetes was “classified with fasting glucose (defined as > 8 hours) > 7mmol/L (126 mg/dL), ever diagnosed or medication use for diabetes” [10].

Physical activity was assessed and categorized with the “General Physical Activity Questionnaire (GPAQ)” [19,20].

Sedentary behaviour included the item “time usually spend sitting or reclining on a typical day?” (Hours/min) from the GPAQ [19], and grouped into “<4 hours, 4 to <8 hours and 8 or more hours per day” [21].

2.3. Data analysis

A total of 5059 individuals (≥40 years) participated in wave 1, and of these 4176 were followed at wave 2. Our analytic sample included participants who provided data on depressive symptoms at wave 2, giving a final sample of 3891. These sample restrictions were imposed as information of sleep duration and all other variables assessed in this analysis were obtained from wave 1. Descriptive statistics are used to tabulate persons with IDS and PDS Univariable and multivariable logistic regression was applied to assess the association between sleep duration at wave 1 and IDS and PDS. IDS were assessed among those without depressive symptoms at wave 1 and referred to new cases of depressive symptoms at wave 2. PDS were measured only among those who had depressive symptoms at wave 1 and were defined as having depressive symptoms at wave 2. The first multivariable logistic regression model included sociodemographic variables (marital, migration and wealth status, age, and education) as covariates, the second model adjusted for Model 1 variables, plus body mass index and substance use, and the third model adjusted for Model 1 and 2 items, plus sedentary behaviour, physical activity, dyslipidemia, hypertension, and diabetes. $p < 0.05$ was considered as significant. “Inverse probability weights were applied to account for attrition and mortality at follow-up” [22]. StataSE 15.0 (College Station, TX, USA) was used for statistical procedures.

3. Results

3.1. Sample characteristics

The mean age of the analytical sample (N = 3891) was 61.0 years (SD = 12.4 years), and 43.9% were males. By country of birth, 69.6% of participants were born in South Africa and 30.4% in Mozambique or other countries, 53.1% were married or cohabiting, 43.3% had no formal education, and 39.3% had a low wealth status. At wave 1 and wave 2598 (15.5%) and 1030 (26.5%) of participants had depressive symptoms, respectively. The prevalence of IDS was 25.6% and PDS 30.8% (see Table 1).

The prevalence of very short, short, normal, and long sleep duration at baseline was 3.6%, 10.1%, 60.9% and 25.4%, respectively (see Table 2).

3.2. Correlations of sleep duration with incident depressive symptoms

In the fully adjusted model, long sleep duration was positively associated with IDS among men (AOR: 1.37, 95% CI: 1.02–1.84), but not among women (AOR: 0.91, 95% CI: 0.67–1.23). No models among men and women showed a significant association between short sleep and IDS (see Table 3).

3.3. Associations between sleep duration and persistent depressive symptoms

Table 4 shows, based on the longitudinal analysis, associations between sleep duration and PDS.

Long sleep duration was associated with PDS (AOR: 2.04, 95% CI: 1.20–3.48) among men but not among women (AOR: 1.26, 95% CI: 0.76–2.11). Short sleep showed among both men and women no significant association with PDS (see Table 4).

4. Discussion

We found that compared to the recommended sleep duration, long sleep duration was positively associated with IDS and PDS four years later, among male and not female ageing adults in South Africa. No association was found between short sleep duration and IDS and PDS. Contrary to these findings, results from a study among ageing adults in another middle-income country, China, found that short and not long sleep increased the odds of IDS and PDS [8,9]. Compared to a review of seven studies that showed short and long sleep was significantly associated with IDS [7], we only found this association between long sleep and IDS among men and not among women.

The proportion of short sleep was low (13.1%) and that of long sleep high (27.5%, or 40% ≥9 h [23] in this study, which may potentially explain why we only found an effect of long sleep and not short sleep on depressive symptoms. Although in this study, the proportion of short and long sleep was similar to an older study among ageing adults in South Africa, 11.4% and 43.5% (≥9 h), respectively [24], studies in other middle-income countries showed that the proportion of short sleep was higher (20.3% in China and 29.3% in India) and that of long sleep lower (25.9% in China and 14.9% in India) [25].

The possible reasons for the link between sleep duration and depression are still needing further investigations [8]. However, some evidence seems to suggest that short or long sleep increase levels of inflammation linking sleep duration with depressive symptoms [26,27]. Regarding the gender differences in our results, in a study among adolescents, it was found that following sleep deprivation, females were more sensitive than males to develop depressive symptoms [28]. However, our study among ageing adults in South Africa found that males and not females with long sleep duration had IDS and PDS. Long sleep duration among middle-aged and older adult men in South Africa could be in itself an atypical symptom of depression or could be a correlate of low physical activity leading to increased depressive symptoms [29].

4.1. Study limitations

Depressive symptoms were in this study only assessed with a screening questionnaire, while a diagnostic psychiatric evaluation is preferred. Some data, including sleep duration, were assessed by self-report and not verified by actigraphy or polysomnography, which may have led to an overestimation of the duration of sleep. We were not able to show reasons for short or long sleep duration and how this may be related to social or personality characteristics.

4.2. Conclusions

Long and not short sleep durations were positively associated with IDS and PDS among men, but not among women in South Africa.

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Data availability statement

"The data used in this study is publicly available at the Harvard Center for Population and Development Studies (HCPDS) program website (www.haalsi.org)."

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Table 1

Sample characteristics by incident and persistent depressive symptoms, Agincourt, South Africa, 2014–2019.

Baseline variables		Sample	Incident depressive symptoms	Persistent depressive symptoms
		N (%)	N (%)	N (%)
Age (in years)	40–49	742 (19.2)	166 (24.4)	20 (24.8)
	50–59	1110 (28.7)	230 (23.8)	47 (29.0)
	60–69	1018 (26.3)	225 (26.1)	48 (27.9)
	70–79	681 (17.6)	138 (24.8)	45 (36.0)
	80 or more	313 (8.1)	70 (28.0)	22 (29.6)
Sex	Female	2184 (56.1)	457 (25.6)	107 (29.2)
	Male	1707 (43.9)	360 (24.3)	77 (29.9)
Country of birth	Mozambique/other	1179 (30.4)	264 (25.7)	52 (29.2)
	South Africa	1698 (69.6)	569 (24.7)	131 (29.9)
Education	None	1681 (43.3)	372 (26.2)	98 (35.3)
	1–7 years	1279 (32.9)	263 (24.5)	64 (27.0)
	8–11	441 (11.4)	90 (22.6)	12 (19.0)
	12 or more	481 (12.4)	106 (23.9)	10 (21.5)
Marital status	Married/cohabiting	2066 (53.1)	426 (23.1)	84 (31.4)
	Not married	1823 (46.9)	408 (27.1)	100 (28.6)
Wealth index	Low	1531 (39.3)	342 (26.8)	80 (30.6)
	Middle	763 (19.6)	150 (22.8)	38 (30.1)
	High	1597 (41.0)	343 (24.3)	66 (29.0)
Alcohol dependence	No	3838 (98.7)	826 (25.1)	178 (29.4)
	Yes	52 (1.3)	9 (20.3)	6 (60.0)
Current tobacco use	No	3316 (85.3)	695 (24.2)	155 (30.3)
	Yes	572 (14.7)	140 (29.5)	29 (27.9)
Body mass index	Normal	1316 (35.2)	288 (24.6)	58 (32.2)
	Under	165 (4.4)	38 (29.9)	14 (37.7)
	Overweight	1091 (29.2)	215 (23.3)	51 (28.0)
	Obesity	1168 (31.2)	261 (26.0)	53 (29.1)
Hypertension	No	1616 (42.2)	354 (25.3)	63 (26.3)
	Yes	2215 (57.8)	464 (24.6)	117 (31.6)
Diabetes	No	3225 (89.1)	695 (24.8)	143 (30.0)
	Yes	395 (10.9)	86 (27.9)	31 (33.8)
Dyslipidaemia	No	1881 (56.6)	406 (24.6)	84 (29.8)
	Yes	1444 (43.4)	323 (27.2)	77 (30.7)
Physical activity	Low	1588 (41.1)	331 (25.5)	102 (31.9)
	Moderate	910 (23.5)	202 (24.8)	34 (22.8)
	High	1368 (35.4)	300 (24.7)	63 (29.9)
Sedentary behaviour	Low	2111 (57.2)	464 (25.4)	103 (28.7)
	Moderate	1261 (34.2)	272 (24.7)	63 (31.1)

Baseline variables		Sample	Incident depressive symptoms	Persistent depressive symptoms
		N (%)	N (%)	N (%)
	High	317 (8.6)	54 (23.7)	26 (29.5)

Table 2

Sleep duration by incident and persistent depressive symptoms, Agincourt, South Africa, 2014–2019.

Baseline variables		Sample	Incident depressive symptoms	Persistent depressive symptoms
		N (%)	N (%)	N (%)
Sleep duration-All	<6 h	131 (3.6)	28 (25.0)	5 (22.9)
	6 h	366 (10.1)	85 (27.3)	12 (21.9)
	7–9 (45–64 yrs), 7–8 (65+)	2211 (60.9)	483 (24.8)	92 (29.7)
	≥10 (45–64 yrs), ≥9 (65+)	920 (25.4)	204 (26.9)	58 (32.5)
Sleep duration-Male	<6 h	70 (4.3)	18 (23.2)	4 (24.0)
	6 h	158 (9.8)	54 (25.4)	5 (22.6)
	7–9 (45–64 yrs), 7–8 (65+)	949 (58.7)	284 (23.2)	34 (27.6)
	≥ 10 (45–64 yrs), ≥9 (65+)	440 (27.2)	167 (29.9)	29 (38.2)
Sleep duration-Female	<6 h	61 (3.0)	21 (27.3)	1 (11.1)
	6 h	208 (10.3)	69 (28.2)	7 (20.9)
	7–9 (45–64 yrs), 7–8 (65+)	1262 (62.7)	396 (27.2)	58 (31.5)
	≥ 10 (45–64 yrs), ≥9 (65+)	482 (23.9)	134 (25.7)	29 (27.7)

Table 3

Association between sleep duration and incident depressive symptoms, Agincourt, South Africa, 2014–2019.

Variable	Unadjusted model	Model 1	Model 2	Model 3
	Odds Ratio (95% CI)	Odds Ratio (95% CI)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Male				
Sleep duration				
Very short	0.99 (0.55, 1.77)	0.92 (0.50, 1.70)	0.95 (0.51, 1.75)	0.92 (0.48, 1.76)
Short	1.09 (0.75, 1.60)	1.09 (0.74, 1.60)	1.10 (0.74, 1.64)	0.85 (0.53, 1.37)
Normal	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Long	1.39 (1.09, 1.78) **	1.34 (1.03, 1.74) *	1.36 (1.04, 1.78) *	1.37 (1.02, 1.84) *
Female				
Sleep duration				
Very short	1.10 (0.63, 1.91)	0.91 (0.50, 1.65)	0.80 (0.43, 1.48)	0.52 (0.24, 1.10)
Short	1.07 (0.77, 1.49)	1.07 (0.76, 1.50)	1.03 (0.73, 1.45)	1.20 (0.83, 1.73)
Normal	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Long	0.92 (0.71, 1.18)	0.88 (0.67, 1.14)	0.86 (0.66, 1.13)	0.91 (0.67, 1.23)

Short sleep duration: Very short: <6 h; Short: 6 h; Normal sleep duration:7–9 h age 45–64, and 7–8 h age ≥ 65 years; Long sleep duration: ≥10 h age 45–64, and ≥ 9 h age ≥ 65 years; Model 1: Adjusted for sociodemographic variables (marital, migration and wealth status, age, and education). Model 2: Adjusted for Model 1 variables, plus body mass index and substance use; Model 3: Adjusted for Model 1 and 2 items, plus sedentary behaviour, physical activity, dyslipidemia, hypertension, and diabetes.

** $p < 0.01$

* $p < 0.05$.

Table 4

Association between persistent depressive symptoms, Agincourt, South Africa, 2014–2019.

Variable	Unadjusted model	Model 1	Model 2	Model 3
	Odds Ratio (95% CI)	Odds Ratio (95% CI)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Male				
Sleep duration				
Very short	1.63 (0.63, 4.16)	1.26 (0.43, 3.71)	1.33 (0.45, 3.91)	1.80 (0.59, 5.47)
Short	0.83 (0.35, 1.97)	0.85 (0.36, 2.04)	0.70 (0.27, 1.86)	0.70 (0.23, 2.16)
Normal	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Long	1.96 (1.26, 3.05)***	1.62 (1.02, 2.59) *	1.76 (1.09, 2.82) *	2.04 (1.20, 3.48) **
Female				
Sleep duration				
Very short	0.31 (0.05, 2.10)	0.30 (0.04, 2.07)	0.33 (0.05, 2.25)	0.43 (0.06, 3.01)
Short	0.69 (0.33, 1.46)	0.65 (0.31, 1.38)	0.61 (0.27, 1.78)	0.58 (0.23, 1.46)
Normal	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Long	1.33 (0.88, 2.02)	1.07 (0.69, 1.66)	1.16 (0.75, 1.82)	1.26 (0.76, 2.11)

Short sleep duration: Very short: <6 h; Short: 6 h; Normal sleep duration:7–9 h age 45–64, and 7–8 h age ≥ 65 years; Long sleep duration: ≥10 h age 45–64, and ≥ 9 h age ≥ 65 years; Model 1: Adjusted for sociodemographic variables (marital, migration and wealth status, age, and education). Model 2: Adjusted for Model 1 variables, plus body mass index and substance use; Model 3: Adjusted for Model 1 and 2 items, plus sedentary behaviour, physical activity, dyslipidemia, hypertension, and diabetes.

** $p < 0.01$

* $p < 0.05$.