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Research Paper

Sleep Duration and Patterns in Chinese Older Adults: a Comprehensive Meta-analysis

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Abstract

This meta-analysis examined the mean sleep duration and patterns in Chinese older adult population. A literature search was systematically conducted covering major English (PubMed, Embase and PsycINFO) and Chinese (Chinese National Knowledge Infrastructure (CNKI), WanFang and SinoMed) databases. Data in studies with the mean and standard deviation of sleep duration and/or the proportion of short and long sleep durations in Chinese older adults were extracted and pooled using random-effects models. Subgroup analyses were conducted according to gender, region, area, survey time and sample size. A total of 36 studies with 150,616 subjects were included for analyses. The pooled mean sleep duration of 21 studies with available data was 6.82 hours/day (95% CI: 6.59–7.05 hours/day). The estimated proportions of sleep duration <5 hours/day, <6 hours/day, <7 hours/day were 18.8% (95% CI: 1.7%–35.9%), 26.7% (95% CI: 19.7%–33.7%) and 42.3% (95% CI: 34.8%–49.8%), respectively. The pooled proportions for long sleepers were 22.6% (95% CI: 13.9%–31.4%) (>8 hours/day) and 17.6% (95% CI: 12.4%–22.9%) (>9 hours/day). Given the adverse effects of unhealthy sleep patterns, health professionals should pay more attention to sleep patterns in this population in China.

Key words: Sleep duration, old adult, meta-analysis, China.

Introduction

Sleep pattern is closely associated with health and well-being. Emergent evidence indicates that both insufficient and excessive sleep durations are linked with poor physical and mental health [1-6]. In addition, a U-shaped relationship between sleep duration and mortality was found in many studies [7, 8]. Understanding the distribution of sleep duration and sleep patterns in a population is essential for health professionals to examine the sleep-related health problems and implement effective measures to improve unhealthy sleep habits.

Population aging has been a growing health challenge worldwide, especially in developing countries, such as China [9, 10]. The Chinese Ministry of Civil Affairs reported that the number of elderly persons aged 60 years and above have reached 222 million in China, accounting for 16.1% of the whole population at the end of 2015 [11]. Sleep problems

including short and long sleep durations have been common in older adult population globally [1-6, 12]. In China, sleep patterns have been found to vary greatly across different studies [13-15]. One major reason is lack of gold standard criterion of short and long sleep duration. The recent recommendation made by the National Sleep Foundation suggested that different sleep durations are appropriate for different age groups [16]. Older people aged 65 years and above were recommended to sleep 7-8 hours per day; less than 5 or more than 9 hours per day are not recommended [16].

To the best of our knowledge, there have been no meta-analysis or systemic review of the sleep duration and patterns among older adults in China. The objective of this study was to summarize the data from observational studies and then estimate the mean sleep duration and proportion of short and long sleepers in Chinese older adult population.

Methods

Search strategy

This meta-analysis was performed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. Two reviewers (LL and RWW) identified studies independently from PubMed, Embase, PsycINFO, Chinese National Knowledge Infrastructure(CNKI), WanFang, SinoMed from inception until September 10, 2016, using the search terms as follows: (sleep time OR sleep duration OR sleep habit OR sleep pattern OR insomnia OR sleep problem OR sleep disturbance OR sleep disorder OR sleep quality OR sleep symptom) AND (epidemiology OR cross-sectional study OR prevalence OR rate) AND (older adults OR elderly OR aged OR aging) AND (China OR Chinese). Additional studies were searched manually from the references of the selected publications.

Study selection

Studies that met the following criteria were included: a) cross-sectional or cohort studies conducted in China; b) sleep duration expressed as mean and standard deviation (SD) or as the proportion of short (<5 hours/day, <6 hours/day, or <7 hours/day) and long (>8 hours/day or >9 hours/day) sleep duration in adults aged ≥60 years according to the recommendation by the Chinese Ministry of Health; c) sample size ≥100; d) availability in full text in Chinese or English. For cohort studies, only the baseline data were extracted for analyses.

Studies on special populations (e.g., army, retired people, empty nesters, people with major medical conditions) or specific settings (e.g., hospitals or nursing homes) and those using convenience sampling or without details on sampling process were excluded.

Two reviewers (LL and RWW) screened titles and abstracts of the initial search results independently. If there were more than one article based on the same study, only the one with the largest sample size and complete information was included for analysis.

Data extraction and quality assessment

Two reviewers (LL and RWW) conducted the data extraction independently. Disagreements emerged in the procedures were resolved by a discussion with a third reviewer (WSB). The following information was extracted and tabulated: study setting, sampling method, sample size, characteristics of the participants, and sleep duration with quantitative data. If there was more than one arm using different cut-offs of sleep duration in one study, then these arms were analyzed separately. The quality of included studies was assessed using the 22-item Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [17]. In this meta-analysis, studies with a score of >11 were rated as "good quality" [18].

Statistical analysis

The pooled mean of sleep duration, proportion of short and long sleep durations, and their 95% confidence intervals (CI) were calculated using random-effects models. The bedtime, sleep latency, time to go to bed and to get up were also pooled. Heterogeneity between studies was measured by I^2 statistic; I^2>50% was considered as high heterogeneity [19]. Subgroup analyses were performed to explore possible sources of heterogeneity according to age groups (60~/70~/≥80 years old; for sleep duration only), gender, area (rural/urban), region (east, central and west parts of China according to the Chinese economic zone division), sample size and survey time (dichotomized using median splitting method). If there were more than 10 studies, meta-regression models were used to detect heterogeneity for continuous variables [20]. Funnel plots, Begg's test [21] and Egger's regression model [22] were used to evaluate publication bias. Sensitivity analysis was carried out by removing each study individually to evaluate the consistency of the results. Comprehensive Meta-Analysis software version 2 (Biostat Inc., Englewood, New Jersey, USA) was used to perform the subgroup analyses and STATA version 12.0 (Stata Corporation, College Station, Texas, USA) was used to conduct other analyses. Significance level was set at 0.05 (two-tailed).

Results

Studies selection results and basic characteristics

A total of 6,598 potential papers were identified, of which 36 papers published in English (n=10) and Chinese (n=26) with 150,616 subjects met the selection criteria and were included for analyses (Figure 1). A total of 21 studies reported mean and SD of sleep duration, 22 studies reported the proportion of short sleepers (15 studies reported the data of sleeping <6 hours/day and 11 studies reported the data of sleep <7 hours/day) and 17 studies reported the proportion of long sleepers (10 studies reported the data of sleeping >8 hours/day and 9 studies reported the data of sleep >9 hours/day). One study provided data of Han and Korean Chinese separately, therefore we extracted and analyzed the data as two arms [23]. Comprehensive characteristics of the eligible studies are shown in Table 1.

Quality assessment and publication bias

The mean STROBE score of the studies was 18, ranging from 14 to 21. All studies were classified as good quality. Supplemental Figure 1 shows the funnel plot of the 21 studies with mean and SD of sleep duration, the Begg's (Z=-1.15, P=0.264) and Egger's tests (t=-0.44, 95%CI: -19.1-12.5, P=0.667) did not reveal any publication bias. Similarly, no publication bias was found in other meta-analyses (Table 2).

Sleep duration of Chinese elderly

The meta-analysis revealed that the mean sleep duration was 6.82 hours/day (95% CI: 6.59–7.05 hours/day) (Figure 2). The proportion of short and long sleepers are presented in Table 2. The proportion of short sleepers was 18.8% (95% CI: 1.7%–35.9%), 26.7% (95% CI: 19.7%–33.7%) and 42.3% (95% CI: 34.8%–49.8%), when defined as less than 5 hours/day, 6 hours/day and 7 hours/day, respectively. In contrast, the proportion of long sleepers was 22.6% (95% CI: 13.9%–31.4%) and 17.6% (95% CI: 12.4%–22.9%), when defined as more than 8 hours/day and 9 hours/day, respectively.

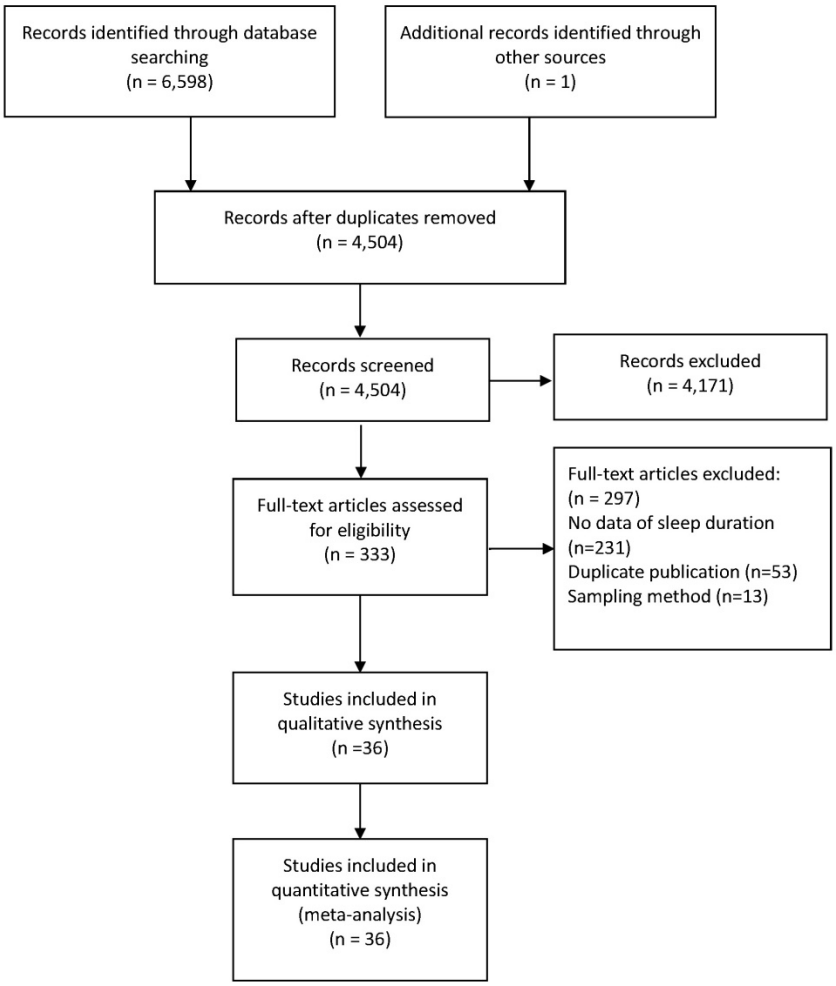

Figure 1. Flowchart of the selection of studies

Table 1. Characteristics of included studies

No.	Author (Publication year, language)	Sampling method	Survey time (year)	Sample size	Age (years)		Urban/ Rural	Female (%)	City/Province	Area	Sleep information	STROBE score
					Mean	SD						
1	Ding X.J. (1997, C)	S, C, R	1992	2779	NR	NR	Mixed	NR	Beijing	East	M, <6, >9	14
2	Chiu H.F.K. *et al.* (1999, E)	S, R	1995	1034	NR	NR	Urban	51.26	Hong Kong	East	M, SD	21
3	Liu L.Q. *et al.* (2001, C)	S, C, R	1997	1805	70.62	5.27	Urban	52.47	Jinan,Wendeng,Liaocheng, Zaozhuang,Binzhou/Shandong	East	M, SD, TB, SL, TG	20
4	Lin D.Y. *et al.* (Han) (2005, C)	R	2004	469	67.7	6.0	Urban	54.37	Yanji/Jilin	Middle	M, SD, TB, TG, BT	16
5	Lin D.Y. *et al.* (Korean) (2005, C)	R	2004	494	68.5	6.2	Urban	67.00	Yanji/Jilin	Middle	M, SD, TB, TG, BT	16
6	Zhang Q.H. *et al.* (2006, C)	M, R	2004	25061	71.2	9.5	Urban	NR	Beijing	East	M, SD, <6,>8, TB, SL, TG, BT	15
7	Lan T.Y. *et al.* (2007, E)	M, PPS	1993	3079	71.28	5.58	NR	43.23	Taiwan	East	<7,>8,>9	19
8	Liu Y. (2007, C)	C, R	2005	2304	74.5,	7.7	Urban	57.94	Shanghai	East	M, SD, TB, SL	20
9	Yao K.W. *et al.* (2008, E)	M, R	NR	187	72.13	4.93	Urban	48.66	Taipei	East	M, SD, SL, BT	20
10	Liu A.L. (2008, C)	R, C	NR	5390	NR	NR	NR	51.54	Zhengzhou,Kaifeng/Henan	Middle	<6, >9	18
11	Xiang Y.T. *et al.* (2009, E)	S, M, PPS	NR	1141	NR	NR	NR	NR	Beijing	East	<7,>8	20
12	Liu H.L. *et al.* (2009, C)	S, C, R, PPS	2006	664	NR	NR	Urban	53.92	Shijiazhuang/Hebei	East	M, SD, TB, SL, TG	18
13	Li J. (2009, C)	R	2006	1006	NR	NR	Mixed	NR	Tianjin	East	M, SD	17
14	Li H. et al. (2009, C)	C, R	2007	4237	NR	NR	NR	56.86	Fuzhou/Fujian	East	<6, >9	15
15	Gu D. *et al.* (2010, E)	R	2005	15638	NR	NR	Mixed	57.23	22 provinces		M, SD, <7,>9	17
16	Li J. (2010, C)	S, C, R	2009	1680	68.44	7.1	Rural	49.94	Anhui	Middle	M, SD, TB, TG	20
17	Xie Z. *et al.* (2010, C)	S, C, R	2009	1040	70.1	7.4	Rural	48.08	Hengyang/Hunan	Middle	M, SD, <5, <6, <7,>8,>9, TB, TG	19
18	Wang W. *et al.* (2011, C)	R, C	NR	145	63.91	2.94	Urban	55.17	Beijing	East	<6, >8	17
19	He M.H. (2011, C)	R, C	2010-2011	1200	65.6	6.7	Rural	36.25	Hong'an/Hubei	Middle	M, SD	15
20	Chen Z.Y. (2011, C)	S, R	NR	312	69.1	NR	Rural	58.65	Western Hunan	Middle	<6, >9	17
21	Wu C.Y. *et al.* (2012, E)	R	2001	100	74.7	5.3	Urban	55.00	Taipei	East	<5, <7	20
22	Wang Q. *et al.* (2012, C)	R, S, C	2011	404	71.18	6.61	Urban	63.12	Xi'an/Shannxi	West	M, SD	19
23	Li S.X. *et al.* (2012, C)	R, C	2008-2009	753	67.9	7.05	Urban	51.13	Tangshan/Hebei	East	<5, <6, <7	18
24	Luo J. (2013, E)	C	NR	1086	72.2	8.3	Urban	57.27	Shanghai	East	M, SD, <6, <7,>8, SL, BT	20
25	Zhu Y.J. *et al.* (2013, C)	M, S, R, C	2012	4115	65.89	4.95	Mixed	51.01	Jilin	Middle	<6	18
26	Yue J. *et al.* (2013, C)	S	2011-2012	758	72.25	8.25	NR	43.93	Xi'an/Shannxi	West	<6, >8	18
27	Liu J.F. *et al.* (2014, C)	M, R, S	2012-2013	5470	74.56	6.73	Urban	47.04	Changsha/Hunan	Middle	M, SD	20
28	Zhang Y. *et al.* (2014, C)	C	2012	1500	70.24	8.44	Urban	49.33	Tangshan/Hebei	East	<5, <6, <7	19
29	Zhao J.X. *et al.* (2014, C)	R	2010	358	NR	NR	Urban	45.81	Guangzhou/Guangdong	East	>8	18
30	Yu S. *et al.* (2015, E)	M, S, R, C	2012-2013	1717	71.18	4.97	Rural	49.45	Liaoning	Middle	M, SD	20
31	Wang X.J. *et al.* (2015, C)	S, R	NR	526	70.24	NR	Rural	52.28	Shan county, Cao county/Shandong	East	<6	17
32	Wang K.Y. *et al.* (2015, C)	S, C, R	2013	4002	73.34	6.01	Rural	51.42	Yichang/Hubei	Middle	M, SD, <7,>9	20
33	Liu H. *et al.* (2016, E)	M, S, PPS	2011-2012	5616	NR	NR	NR	47.19	28 provinces		M, SD, <6, <7,>8	20
34	Zhi T.F. *et al.* (2016, E)	S, R	2014	1756	75.3	3.9	Rural	53.30	Rugao/Jiangsu	East	<6, >8	19
35	Lv Q.J. *et al.* (2016, C)	C, R	NR	820	70.7	5.9	Urban	52.32	Pingdingshan/Henan	Middle	<5,>9	21
36	Qi S.G. *et al.* (2016, C)	M, S, C, R	2013	51774	NR	NR	Mixed	54.81	31provinces, Xinjiang Production and Construction Corps		M, SD, <7	19
37	Zhong X.X. *et al.* (2016, C)	S, C, R	2014	196	70.2	7.3	Rural	52.55	Ma'anshan/Anhui	Middle	M, SD	17

NR=Not Reported; SD= Standard deviation; C; Chinese, E: English.

Sleep Information: M=mean of Sleep duration; SD=standard deviation; <5 refers to the percentage of participants with a sleep duration<5 hours/day, <6 refers to that <6 hours/day, <7 refers to that <7 hours/day,

>8 refers to that >8 hours/day and >9 refers to that >9 hours/day; TB=time to go to bed, SL=sleep latency, TG=time to get up, BT=bed time.

Sampling Method: C=Cluster sampling; M=Multistage sampling; R=Random sampling; S=Stratified sampling; PPS=sampling with probability proportional to size.

Table 2. Proportion of sleep duration with different cut-off values

Cut-off of sleep duration (Number of studies)	Proportion (%)	95%CI (%)		Events	Sample size	I^2(%)	*P*	Publication bias	
								P (Egger's Test)	*P* (Begg's Test)
<5 hours/day (5)	18.8	1.7	35.9	823	4213	99.7	<0.001	0.150	0.462
<6 hours/day (15)	26.7	19.7	33.7	16742	55074	99.7	<0.001	0.821	0.553
<7 hours/day (11)	42.3	34.8	49.8	28118	85729	99.8	<0.001	0.219	0.436
>8 hours/day (10)	22.6	13.9	31.4	8660	40040	99.7	<0.001	0.604	0.474
>9 hours/day (9)	17.6	12.4	22.9	6260	37297	99.3	<0.001	0.221	1.000

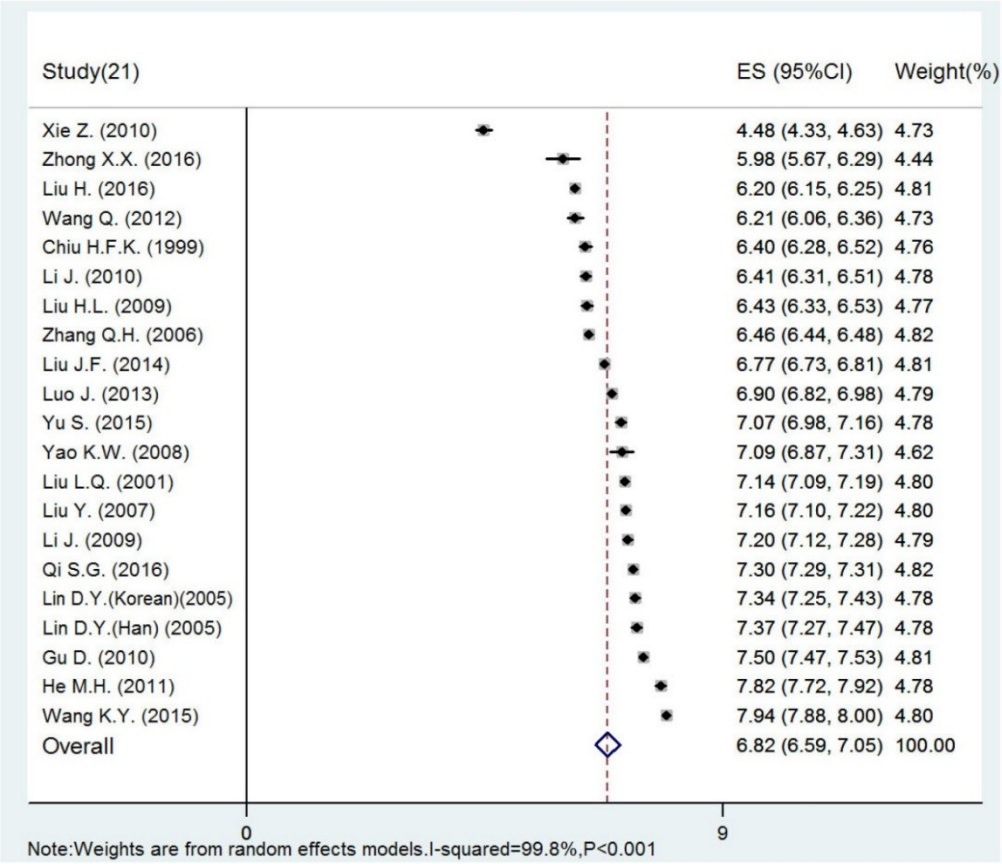

Figure 2. Forest plot of the mean sleep duration

The results of subgroup analyses using mean sleep duration, the proportion of long (>9 hours/day) and short sleep (<6 hours/day) are shown in Table 3. The results using other cut-offs for sleep duration are shown in Table S2. The proportion of short sleepers (<6 hours/day) was 38.3% (95% CI: 20.7%-59.6%) in rural areas, while it was 17.0% (95% CI: 8.6%–30.8%) in urban areas, but the difference did not reach a significance level. Meta-regression analyses revealed that sample size and survey time did not have significant impact on the results (*P*>0.05).

Sleep habits

The pooled time to go to bed of 8 studies with 33,517 subjects was 09:03 pm (95% CI: 08:48 pm–09:18 pm). The pooled mean sleep latency of 6 studies with 31,107 subjects was 30.66 minutes (95% CI: 20.32 minutes - 41.00 minutes). The mean time to get up of 7 studies with 31,213 subjects was 05:24 am (95% CI: 04:58 am – 05:50 am) and the mean bedtime was 7.82 hours (95% CI: 7.43 hours – 8.21 hours) (Table S1).

The time to go to bed for older adults in the east area was later than in the middle area (09:23 pm, 95% CI: 09:06 pm - 09:41 pm vs. 08:43 pm, 95% CI: 08:27 pm - 09:00 pm), but the former group had longer bedtime than the latter group (8.10 hours, 95% CI: 7.87 hours - 8.33 hours vs. 7.41 hours, 95% CI: 7.13 hours - 7.70 hours). Subgroup analyses of sleep habits are shown in the Table S3.

Sensitivity analyses

After removing each study sequentially, the results from remained studies were still consistent with the primary results.

Table 3. Subgroup analyses of sleep duration

A. Subgroup analyses of night sleep duration

Subgroups	Categories (Number of studies)	Mean	SE	95%CI		Sample size	I^2(%)	*P*	*Q* (*P*)
Age groups (years)	60~ (4)	6.68	0.41	5.88	7.48	2748	99.4	<0.001	0.33(0.85)
	70~ (4)	6.53	0.41	5.73	7.33	2957	99.5	<0.001	
	≥80 (4)	6.86	0.41	6.05	7.67	1504	98.9	<0.001	
Gender	Female (11)	6.52	0.18	6.12	6.86	6666	99.0	<0.001	1.33(0.25)
	Male (11)	6.81	0.18	6.46	7.15	5823	98.3	<0.001	
Region	Rural (6)	6.63	0.22	6.19	7.07	9835	99.8	<0.001	0.59(0.44)
	Urban (11)	6.84	0.17	6.52	7.17	38978	99.4	<0.001	
Sample size	≤1500 (11)	6.66	0.17	6.33	6.99	7780	99.5	<0.001	1.90(0.17)
	>1500 (10)	7.00	0.17	6.65	7.34	115067	99.9	<0.001	
Area	East (11)	6.94	0.20	6.55	7.33	50502	99.8	<0.001	1.31(0.52)
	Middle (8)	6.77	0.22	6.33	7.21	14551	99.7	<0.001	
	West (1)	6.21	0.08	6.06	6.36	404	-	-	
Survey time	1999-2010 (10)	6.75	0.19	6.38	7.12	49515	99.8	<0.001	0.16(0.69)
	2011-2016 (9)	6.86	0.20	6.47	7.26	72059	99.8	<0.001	
Language of publications	Chinese (15)	6.82	0.15	6.52	7.10	97569	99.8	<0.001	0.04(0.85)
	English (6)	6.86	0.24	6.40	7.32	25278	99.7	<0.001	

B. Subgroup analyses of the rate of short sleep duration (<6 hours/day)

Subgroups	Categories (Number of studies)	Proportion (%)	95%CI (%)		Events	Sample size	I^2(%)	*P*	*Q* (*P*)
Region	Rural (4)	38.3	20.7	59.6	1792	3634	99.2	<0.001	3.48(0.06)
	Urban (5)	17.0	8.6	30.8	9176	28545	99.2	<0.001	
Sample size	≤1700 (8)	21.0	14.8	28.9	1517	6120	99.4	<0.001	1.36(0.24)
	>1700 (8)	27.7	19.7	37.5	15225	48954	99.6	<0.001	
Area	East (9)	19.0	12.4	27.9	11335	37843	99.5	<0.001	3.89(0.14)
	Middle (4)	35.9	20.9	54.3	3330	10857	99.7	<0.001	
	West (2)	30.0	12.9	11.9	835	2416	98.8	<0.001	
Survey time	1997-2012 (5)	29.8	18.8	43.9	10762	33870	99.7	<0.001	0.16(0.69)
	2013-2016 (5)	26.3	16.2	39.6	4557	13745	99.4	<0.001	
Language of publications	Chinese (12)	24.9	17.0	32.8	13740	46616	99.5	<0.001	1.30(0.25)
	English (3)	33.8	15.3	52.3	3002	8458	99.5	<0.001	

C. Subgroup analyses of the rate of long sleep duration (>9 hours/day)

Subgroups	Categories (Number of studies)	Proportion (%)	95%CI (%)		Events	Sample size	I^2(%)	*P*	*Q* (*P*)
Region	Rural (4)	18.7	13.5	25.2	3745	14013	98.6	<0.001	0.94(0.33)
	Urban (2)	24.1	15.7	35.2	2059	7799	91.7	<0.001	
Sample size	≤3100 (5)	17.9	11.7	26.4	1805	8030	98.8	<0.001	0.51(0.48)
	>3100 (4)	14.3	8.8	22.4	4455	29267	99.5	<0.001	
Area	East (4)	23.3	14.2	35.8	4013	16182	99.3	<0.001	1.64(0.44)
	Middle (6)	15.8	10.2	23.6	3022	16224	99.5	<0.001	
	West (1)	23.3	21.7	25.0	582	2497	-	-	
Survey time	1997-2006 (3)	21.0	12.5	33.0	3917	21496	99.6	<0.001	0.66(0.42)
	2007-2013 (3)	15.6	9.0	25.6	1798	9279	98.9	<0.001	
Language of publications	Chinese (8)	15.7	11.0	20.4	5244	34218	99.0	<0.001	4.36(0.04)
	English (1)	33.0	31.3	34.7	1016	3079	-	-	

Discussion

In this meta-analysis, the pooled data of 21 studies showed that the mean sleep duration in Chinese older adults was 6.82 hours/day. In this group, 26.7% reported sleeping less than 6 hours and 17.6% sleeping more than 9 hours per day. On average, they went to bed at 09:03 pm and got up at 05:24 am. Their mean time spent in bed was 7.82 hours during which they needed 30.66 minutes to fall asleep. In terms of subgroup analysis, a greater proportion of older adults in rural areas had short sleep duration (<6 hours/day) than their urban counterparts.

The mean sleep duration in this meta-analysis (6.82 hours/day) is shorter than the duration (7.5 hours/day) from another large survey of 15,638 older Chinese adults in 22 provinces [13], but is similar to that found in Europe (6.95 hours/day) [24]. A multi-ethnic study on sleep duration showed that the proportions of short sleepers in white, black, Hispanic and Chinese people were 19.3%, 43.4%, 31.5% and 37.1%, respectively [25]. Apart from the use of different definitions of short sleep, other factors, such

as living rhythm, lifestyle, sleeping environment, chronic medical conditions, psychiatric disorders and outdoor activities, are significantly associated with sleep duration in older adults [24, 26].

China has been experiencing rapid urbanization and economic growth in the past decades, which may have a negative impact on the health of older adults [27]. For example, increased consumption of stimulant drinks, such as tea, coffee and energy drinks, increasing nightlife and widespread use of electronic devices often interfere with 'circadian rhythm' including sleep pattern. However, the survey year of the included studies did not show a significant moderating effect on sleep duration in subgroup analysis.

There is compelling evidence that short sleep duration could increase the risk of obesity, coronary heart disease, all-cause mortality, and was an important risk of non-successful aging [1, 5, 28, 29]. In contrast, long sleep duration was positively associated with cardiovascular diseases, stroke and mortality [1, 2, 4, 28]. Moreover, cognition and memory impairment were common in both short and long sleepers [3, 6, 30-32].

Previous studies found that low economic status is associated with greater sleep disturbance and short or long sleep duration [33, 34]. Considering that economic status is higher in the eastern region and urban areas than in the central region and rural areas in China, subgroup analyses were conducted between different areas defined by the Chinese economic zone. We found the proportion of short sleepers (<6 hours/day) in rural area (38.3%) was higher than in urban area (17.0%); the proportion in central region (35.9%) was higher than in the eastern region of China (19.0%), which support the association between economic status and sleep pattern. In addition, we found that Chinese older adults usually go to sleep almost an hour earlier than their counterparts in the USA, while the sleep latency of the Chinese old people were similar to those in the USA and Europe [24, 35].

The results should be interpreted with caution due to several limitations. First, inconsistent criteria were used in assessing the sleep duration across studies [36]. Second, sleep data were self-reported which may lead to recall bias. Third, heterogeneity remained in the subgroup analyses, since heterogeneity cannot be avoided in large meta-analysis of epidemiological surveys [37-39].

In conclusion, short sleep duration is common in Chinese older adults. Given its adverse effects, effective measures should be implemented to improve the sleep patterns in this population.

Supplementary Material

Supplementary figures and tables.
http://www.ijbs.com/v13p0682s1.pdf

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Competing Interests

The authors have declared that no competing interest exists.

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