Sleep Among Long-Term Care Residents in China: A Narrative Review of Literature

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Abstract

The objective of this study is to synthesize and evaluate the current body of sleep research among long-term care (LTC) residents in China and provide insights for future research. Systematic searches identified 15 studies that examined sleep in LTC residents in China. Sleep disturbances and poor sleep quality were prevalent in Chinese LTC residents. Eight cross-sectional studies reported that demographics, comorbidities, lifestyle, and environment were associated with sleep quality in Chinese LTC residents. Seven intervention studies, including exercise, traditional Chinese medicine, light therapy, and behavioral interventions resulted in improved sleep quality. Only subjective sleep measures were used in all 15 studies. Some methodological issues were identified in studies, especially those conducted in Mainland China. Sleep research in LTC residents in China is still at the beginning stages. Future studies should consider more rigorous designs and objective sleep measures, and develop target interventions based on factors associated with sleep disturbances.

Keywords

sleep; long-term care; China

Background

The aging population in China has been growing rapidly over the past two decades. At the end of 2012, the population aged 65 years and older reached 127 million, accounting for 9.4% of the total Chinese population (National Health and Family Planning Commission, 2013). The increasing aging statistics and the Chinese nuclear family structure call for a shift in elder care from traditional family care at home to institutions (Chen, 2015; Chu & Chi, 2008). The Chinese government has increased financial and policy support to promote the

construction of senior housing, residential institutions for the aged, and nursing homes (Feng, Liu, Guan, & Mor, 2012). The use of long-term care (LTC) service has boomed in China in recent years, yet the health issues of older adults living in LTC settings have not been well studied (Wang, Hou, Xu, & Zhang, 2011).

Sleep is an essential aspect of health promotion in older adults (Townsend-Roccichelli, Sanford, & VandeWaa, 2010). Sleep architecture changes with advanced age, resulting in a decrease in deep, restorative sleep and sleep duration, and an increase in light sleep (Rodriguez, Dzierzewski, & Alessi, 2015). Sleep disturbances, such as difficulty initiating sleep, sleep fragmentation, and early morning awakenings, are more commonly reported in older adults than their younger counterparts and may result in consequences such as poor perceived sleep quality and excessive daytime sleepiness (Gleason & McCall, 2015; Rodriguez et al., 2015). Sleep quality reflects a subjective perception and experience of sleep and excessive daytime sleepiness refers to difficulty maintaining wakefulness (Harvey, Stinson, Whitaker, Moskovitz, & Virk, 2008; Young, 2004). Although sleep architecture changes with age, one study reported that sleep disturbances in older adults were more dependent on physical, environmental, and health factors than on age-dependent sleep changes (Martin, Sforza, Barthelemy, Thomas-Anterion, & Roche, 2014). Therefore, it is imperative to address sleep disturbances in older adults and not simply view them as a normal consequence of aging.

Multiple factors can contribute to sleep disturbances, and sleep disturbances often co-occur with physical and psychological disorders in older adults (Rodriguez et al., 2015). Physical and cognitive decline, multiple comorbidities, psychosocial status, and sedentary lifestyle are a few factors that may negatively affect sleep (Gong, Chen, Yao, Yin, & Han, 2012; Li, Chang, & Porock, 2015; Valenza et al., 2013). Furthermore, sleep disturbances and poor sleep quality are associated with multiple negative health consequences, including increased risk of falls, neurodegenerative disease, and decreased functional status (Helbig et al., 2013; Isaia et al., 2011). Sleep disturbances are even more common in LTC residents and are often attributed to a high burden of comorbidities, lifestyle, and environmental factors (Lorenz, Harris, & Richards, 2011). For example, older adults living in LTC settings often have decreased physical activity, limited social interaction, minimal daylight exposure, and poor sleep hygiene (Li, Chang, & Porock, 2015).

Despite the high prevalence and negative effects of sleep disturbances on health, only a few studies examined sleep in LTC residents in China. The purpose of this review is to synthesize and evaluate the current body of sleep research in older adults living in LTC settings in China. Specifically, this review will (a) provide an understanding of sleep in LTC residents in China, including the prevalence of sleep disturbances and poor sleep quality and factors associated with poor sleep quality, and (b) examine effects of existing interventions on sleep disturbances and sleep quality in LTC residents in China.

Method

Search strategies were used to examine all sleep-related research on LTC residents in China, including Mainland China, Taiwan, and Hong Kong. MEDLINE, EMBASE, Wan Fang, and

China National Knowledge Infrastructure (CNKI) databases were searched using variations of the following keywords (in English and Chinese): *sleep*, *insomnia*, *sleepiness*, *nursing home*, *LTC*, *assisted living*, *institutionalized*, *elders*, *older adults*, *residents*, *elderly*, *China*, and *Chinese*. Research articles that met the following inclusion criteria were included: (a) reported sleep disturbances or sleep quality, factors associated with sleep, or effects of sleep-promoting interventions in LTC residents in China; (b) written in Chinese or English; (c) published from 2000 to January 2016 (LTC institutions in China started to emerge in early 2000); and (d) conducted in Mainland China, Taiwan, and Hong Kong. Exclusion criteria were (a) case reports, (b) letters, and (c) articles without full text.

All potential articles were retrieved using database searches and hand searching (see Figure 1). The authors assessed the titles and abstracts of all articles for relevance based on the inclusion and exclusion criteria. The full texts of relevant studies were obtained and evaluated independently by two authors, and discrepancies were discussed.

Basic information including author, publication year, location, sample demographics, and sleep measures were extracted from all reviewed articles. In addition, we extracted the results on prevalence of sleep disturbances and sleep quality and all possible determinants of sleep quality from each cross-sectional study. The prevalence of overall poor sleep quality and each type of sleep disturbance (short or long nocturnal sleep duration, difficulty initiating and maintaining sleep, early morning awakening, long sleep latency, low sleep efficiency, sleep medication use, and daytime dysfunction) were synthesized and compared across cross-sectional studies. Possible factors associated with sleep quality were categorized into nonsignificant or significant factors based on the type of statistical analysis (bivariate/multiple regression) and synthesized across the studies. For intervention studies, we extracted information on study design, details of intervention, and study results on sleep outcomes. The effects of the interventions were synthesized based on the study design and type of intervention provided. We summarized the strengths and limitations of each study according to all data extracted (see Tables 1 and 2).

Results

Overview of the Studies

Fifteen articles met the inclusion criteria for this review. Ten studies were conducted in Mainland China (written in Chinese) and five in Taiwan (written in English). Eight studies used a cross-sectional design (Table 1) and reported subjective sleep quality of LTC residents in China as well as factors associated with sleep (Table 1; Chen, Zhang, Zhao, & Dong, 2014; Fang & Lin, 2010; Li, Wang, & Yin, 2012; Lin, Lu, & Ma, 2012; Shi, 2009; Tsai, Wong, & Ku, 2008; Yao et al., 2012; Zhang, Yang, & Zeng, 2008), and seven studies evaluated the effects of interventions on sleep outcomes in LTC residents (Table 2).

Across the 15 studies, participant's mean age ranged from 74 to 80 years. The majority of the participants were widows (52.7%-75.5%) with low levels of education (51.0%-84.0%). Participants' cognitive status was mentioned in four studies, but not described in detail. For example, one cross-sectional study excluded residents with severe cognitive impairment; however, the number of participants with mild or moderate cognitive impairment was not

reported (Tsai et al., 2008). One intervention study specified that 12% of the participants had dementia (Sun, Sung, Huang, Cheng, & Lin, 2010), and two intervention studies described that all participants were cognitively intact (Chen et al., 2010; Chen, Huang, Cheng, Li, & Chang, 2015).

Measurement

All 15 studies measured sleep disturbances and sleep quality subjectively, using questionnaires such as the Chinese/Taiwanese version of Pittsburgh Sleep Quality Index (PSQI), Athens Insomnia Scale (AIS), and researcher-designed sleep questionnaires. Eleven studies used PSQI, one study applied both PSQI and AIS (Sun et al., 2010), and the other three studies used researcher-designed sleep questionnaires (Fang & Lin, 2010; Song, 2009; Wu, Sung, Lee, & Smith, 2015). No detailed information was presented on the researcher-designed sleep questionnaires, and therefore, the psychometric properties of these tools are unknown (Fang & Lin, 2010; Song, 2009; Wu et al., 2015).

The PSQI is a 19-item self-report measure of sleep quality and sleep disturbances over the past month. The PSQI captures seven domains including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, the use of sleep medications, and daytime dysfunction. Each domain is rated from 0 to 3, and the total score ranges from 0 to 21, with higher scores representing worse sleep quality (Chen et al., 2010). The PSQI has been extensively used in populations across the world. It is a valid and reliable tool with reported Cronbach's α of .84, sensitivity of 98.3%, and specificity of 90.2% in the Chinese population (Liu et al., 1996). A global score greater than 7 has been found to be associated with clinically significant sleep disorders in Mainland China. The Chinese Version PSQI was tested and a cut point of greater than 5 was determined to discriminate poor from good sleepers in Taiwanese (Tsai et al., 2005). The Chinese Version PSQI has been widely used in Taiwan (Chen et al., 2015; Lu, Lin, Chen, Tsang, & Su, 2013). To be consistent with the cut point greater than 5, some recent studies in Mainland China also adopted global score greater than 5 as the cutoff to define good and poor sleepers (Li et al., 2012; Luo et al., 2013). In this review, greater than 7 was used as the cutoff value for all studies in Mainland China and a cutoff of greater than 5 was adopted by studies in Taiwan.

The AIS is an eight-item self-report measure of insomnia, which assesses people's nocturnal sleep (sleep latency, early morning awakening, nighttime awakenings, sleep duration, overall sleep quality) and daytime dysfunction (Sun, Chiou, & Lin, 2011). Conceptually, AIS overlaps with PSQI in certain domains such as sleep duration, overall sleep quality, and daytime function. The AIS, however, focuses more on insomnia symptoms, such as nocturnal awakening and early morning awakenings, and fails to assess for sleep medication use (Okajima, Nakajima, Kobayashi, & Inoue, 2013). Each item can be scored 0 to 3, and the total score ranges between 0 and 24. Higher scores represent worse insomnia severity, and a score of greater than or equal to 6 indicates insomnia (Soldatos, Dikeos, & Paparrigopoulos, 2000). One interventional study in this review used AIS in conjunction with PSQI to screen for insomnia and measure insomnia severity. This study reported that the AIS score was strongly correlated with the PSQI ($r = .75$, $p < 0.001$; Sun et al., 2010).

Cross-Sectional Studies (Table 1)

Prevalence of sleep disturbances and poor sleep quality—Sleep disturbances were reported in all eight cross-sectional studies. Six studies assessed residents' sleep disturbances and sleep quality using PSQI and its seven subscales. The prevalence of poor sleep quality ranged from 33% to 73% in six studies. Three studies (Chen et al., 2014; Li et al., 2012; Shi, 2009) reported the prevalence of each PSQI subscale with combined ranges of the following: prolonged sleep latency 33.6% to 48.9%, poor sleep efficiency 20.6% to 61.6%, sleep disturbances 13.1% to 42.4%, sleep medication use 4.4% to 34.7%, and daytime dysfunction 18.6% to 42.4%. The means of PSQI were reported in four studies and ranged between 6.99 and 11.47 (Chen et al., 2014; Yao et al., 2012; Shi, 2009; Zhang et al., 2008). Other sleep disturbances reported in studies include long nocturnal sleep duration (>9 hr/night; 69.1%), difficulty falling asleep after awakening (50%), difficulty initiating and maintaining sleep (59.8%), and early morning awakening (32%; Fang & Lin, 2010; Lin et al., 2012).

Factors associated with sleep disturbances and sleep quality—Residents' demographic characteristics, physical and psychosocial status, life habits, and living environment were associated with sleep disturbances or sleep quality in all studies except one (Fang & Lin, 2010). The global PSQI score was used to represent residents' sleep quality in the seven studies.

Demographic characteristics—The associations of age, gender, occupation, marital status, and income with sleep quality were evaluated in six studies. After controlling for covariates, widower (odds ratios [ORs] ranged from 1.54 to 3.18, ps .04) and low level of education (ORs ranged from 0.50 to 0.78, $ps < .05$) were significantly associated with poor sleep quality (PSQI global score; Tsai et al., 2008; Zhang et al., 2008). Occupation was not associated with sleep quality (Chen et al., 2014; Zhang et al., 2008). The associations of age, gender, and income with sleep quality were inconsistent across studies. One (Zhang et al., 2008) out of five studies that examined the associations between age and sleep quality found that increased age (OR = 1.45; $p = .02$) was significantly associated with poor sleep quality. In the bivariate analyses, males had better sleep quality than females in two (Lin et al., 2012; Shi, 2009) of four studies that examine gender differences in sleep quality. However, these associations were no longer significant in the multivariate analysis (Shi, 2009). Two studies found that adequate income or perceived adequate was associated with better sleep quality in bivariate analyses (Shi, 2009; Tsai et al., 2008) and the association remained significant (β = −0.82, $p < .001$) after adjusting for covariates (Shi, 2009).

Physical and psychological conditions—Chronic disease, hypnotic medication use, and psychological conditions were all associated with poor sleep quality in LTC residents in China (Chen et al., 2014; Fang & Lin, 2010; Shi, 2009; Tsai et al., 2008). After adjusting for covariates, having a chronic disease was found to be associated with worse sleep quality (β = 0.705, $p = .002$; Shi, 2009) and increased risk of sleep disturbances (OR = 1.75; $p < .001$; Zhang, Yang, & Zeng, 2008). In addition, good sleepers reported better perceived health status than poor sleepers ($t = −3.31$; $p < .01$; Tsai et al., 2008). Residents with regular hypnotic medication use reported significantly worse sleep quality than those who did not

use hypnotics (βs ranged from 1.01 to 1.77, ps ≤ .031; Chen et al., 2014; Shi, 2009). Psychological symptoms, including anxiety, loneliness, worrying (Chen et al., 2014; Shi, 2009), dissatisfaction with life (Chen et al., 2014; Tsai et al., 2008), and depression (Li, Wang, & Yin, 2012; Yao et al., 2012), were associated with residents' worse sleep quality. Cognitive status was not significantly different between good and poor sleepers (Tsai et al., 2008).

Lifestyle and environmental—Lifestyle factors and environmental factors were associated with residents' sleep quality (Lin et al., 2012; Shi, 2009; Yao et al., 2012). The prevalence of poor sleep quality was significantly less in residents who had good social relationships compared with those who did not ($F = 7.68$; $p = .002$; Yao et al., 2012). In addition, residents who participated more frequently in leisure activities ($F = 3.12$; $p = .04$) and physical exercises ($F = 3.26$; $p = .04$) had better sleep quality than those who did not participate (Shi, 2009). Drinking water ($F = 11.89$; $p = .001$) and excitement before bedtime ($F = 24.54$; $p < .001$) were associated with worse sleep quality, whereas foot bath before bedtime was associated with better sleep quality (F values ranged from 4.52 to 7.53; Shi, 2009; Yao et al., 2012). Comfortable bedroom environment (e.g., temperature, humidity, light, and noise, and bed; Shi, 2009; Yao et al., 2012) and overall better facility environment ($F = 4.53$; $p = .01$; Lin et al., 2012) were associated with better sleep quality.

Intervention Studies (Table 2)

Characteristics of intervention studies—Among the seven sleep intervention studies, there were two randomized controlled trials (RCTs): One was randomized at subject level (Sun et al., 2010), and the other was randomized at facility level (Chen et al., 2015), three pretest–posttest controlled trials (Song, 2009; Wu et al., 2015; Yi & Zhang, 2012), and two single-group pretest–posttest studies (Chen et al., 2013; Song, 2009). In general, the sample sizes of studies were relatively small. Four of the five RCTs and pretest–posttest trials had 25 to 36 residents in each group, and only one study had more than 50 residents in each group (Chen et al., 2015). The two studies without control groups had 25 and 50 residents, respectively (Chen et al., 2013; Song, 2009).

The type and length of the intervention varied among studies: two 6-month exercise interventions (Chen et al., 2010; Chen et al., 2015), one 4-week light therapy (Wu et al., 2015), one 5-week traditional Chinese medicine treatment (Sun et al., 2010), and three behavioral interventions lasted from 4 weeks to a year (Chen et al., 2013; Song, 2009; Yi & Zhang, 2012). Three of the seven total intervention studies collected data at baseline, during the intervention and post-intervention (Chen et al., 2010; Chen et al., 2015; Sun et al., 2010). One of the three studies followed up with participants 2 weeks after the intervention ended (Sun et al., 2010).

Three of the seven studies screened residents' sleep at baseline, and only included residents with sleep disturbances (i.e., insomnia) or poor sleep quality (Chen et al., 2013; Sun et al., 2010; Yi & Zhang, 2012). Having a sleep disturbance or poor sleep quality was not part of the inclusion criteria for the other four studies. Four studies used PSQI as sleep outcome measure (Chen et al., 2010; Chen et al., 2015; Chen et al., 2013; Yi & Zhang, 2012), one

study used PSQI as screening tool and used AIS as the outcome measure for insomnia severity (Sun et al., 2010), whereas the other two studies used researcher-designed questionnaires to measure nocturnal sleep disturbances (Wu et al., 2015) and sleep quality (Song, 2009).

Effects of interventions on sleep—In general, the interventions showed beneficial effects on sleep in LTC residents in China. In the first of the two studies testing an exercise intervention in Taiwan, a 6-month silver Yoga program was implemented by residents who were mildly dependent in activities of daily livings (ADLs; Chen et al., 2010). After the 6-month Yoga intervention, participants in the intervention group had significantly better overall sleep quality ($F = 19.91$; $p = .001$), less sleep disturbances ($F = 16.12$; $p = .001$), and higher habitual sleep efficiency ($F = 8.81$; $p = .005$) compared with the control group. In the second study, a 6-month elastic band exercise intervention was implemented in wheelchair-bound residents who were heavily or moderately dependent in ADLs. Participants in the intervention group had longer sleep duration ($F = 11.09$; $p = .001$) and better habitual sleep efficiency ($F = 7.46$; $p = .007$) than the control group at 3 months, and these results were maintained at the end of the 6 months (Chen et al., 2015). Therefore, these two exercise interventions improved residents' overall sleep quality and sleep efficiency (Chen et al., 2010; Chen et al., 2015).

The 4-week light exposure intervention failed to reduce sleep disruption in the intervention group compared with the control group (Wu et al., 2015). As sleep disruption was the only sleep measure in the study, the effects of this light intervention on other sleep parameters (i.e., sleep duration) are unknown. One RCT utilized 5-week traditional Chinese medicine treatment (Acupressure on Shenmen points) to decrease residents' sleep disturbances (i.e., insomnia; Sun et al., 2010). The severity of participants' insomnia significantly decreased in the intervention group both during ([Weeks 2-5] βs ranged from −18.28 to 16.38, all ps < .001) and at post-intervention ([Week 6] β= −11.40, p < .001; [Week 7] β = −4.84, p < .001) and was significantly lower than the control group. However, insomnia severity bounced back to baseline status at 2 weeks after completion of the intervention (Sun et al., 2010).

Multi-component behavioral interventions using education for healthy sleep, daytime physical and social engagement, self-relaxation, and bedtime foot bath were used in three studies in the Mainland China and increased the participants' overall sleep quality (F values ranged from 12.98 to 29.48; ps < .001), sleep efficiency (F values ranged from 4.97 to 8.9; ps < .04), and daytime function (F values ranged from 24.90 to 36.20; ps < .001; Chen et al., 2013; Song, 2009; Yi & Zhang, 2012).

Discussion

Sleep is a critical but overlooked health outcome in older adults' health care management, especially for those living in institutions. Although there is a fair amount of sleep research in China during the last two decades, sleep in LTC residents had not been well studied in China. We only found 15 studies that met our relatively broad inclusion criteria, sleep research in LTC residents in China. The heterogeneity of the study designs, statistical approaches, and types of interventions across studies makes the comparison of results

difficult. Nevertheless, this literature review can provide a first overview on the existing body of sleep research in LTC residents in China and offer helpful directions for future studies.

There were some variations in the prevalence of poor sleep quality and sleep disturbances reported in the reviewed studies, despite the fact that demographic characteristics (age, gender, education, and marital status [widower]) were similar in these studies. These variations could be related to clinical characteristics of samples (e.g., some may have higher incidence of comorbidities associated with insomnia) and/or differences in the cutoff scores of the PSQI applied across studies. The variation may also be partially due to the varied economic status in different regions in China and participants' cognitive function. Overall, more than 40% residents in five of the six cross-sectional studies reported poor sleep quality. One epidemiological study reported that the prevalence of sleep disturbances in community-dwelling Chinese older adults was 33.7% (Niu et al., 2016). We were not able to find any large-scale epidemiological study that examined the prevalence of sleep disturbances in Chinese LTC residents. Taken together, these results suggest that sleep disturbances are more prevalent in institutionalized Chinese older adults than those living in the community.

Our review revealed that multiple factors were associated with sleep disturbances and poor sleep quality in LTC residents in China. These factors include widower, low level of education, comorbidities, psychological symptoms (e.g., anxiety, depression, and loneliness), lack of physical and social activities, bedtime habits (e.g., drinking water, bedtime excitement, etc.), and bedroom and institutional environment. The lack of association between occupation and sleep quality may be explained by the fact that participants were no longer working at the time of data collection. Our findings are consistent with the results from studies conducted in LTC residents in the United States (Ancoli-Israel, Ayalon, & Salzman, 2008; Li, Grandner, Chang, Jungquist, & Porock, 2015; Martin & Ancoli-Israel, 2008).

Chinese culture may be a unique factor that affects residents' sleep in LTC settings in China. Chinese older adults are usually reluctant to transit into LTC from home, because taking care of older adults is an obligation of their adult children (filial piety) in China and moving to an LTC setting means they do not have children or their children do not have filial piety. These culture-related negative thoughts of living in LTC may affect sleep.

There are some methodological limitations in the reviewed cross-sectional studies that may have affected the results and warrant further discussion. First, the description of study methods and results was very brief and often vague (Chen et al., 2014; Fang & Lin, 2010; Li, Wang, & Yin, 2012; Lin et al., 2012; Yao et al., 2012). Second, the statistical approaches may not have been sufficient to answer the research questions. For example, bivariate analyses were used without adjusting for any possible confounders, such as, age, gender, body mass index (BMI), physical and psychological conditions, and medication use (Lin et al., 2012; Yao et al., 2012), and associations between sleep and possible factors were claimed based on results from univariate descriptive statistics, rather than appropriate statistical methods better suited to examine associations between variables (Fang & Lin, 2010), despite adequate sample sizes. In addition, cognitive impairment and dementia are

well-established factors associated with sleep disturbances (Yaffe, Falvey, & Hoang, 2014), yet seven of the eight cross-sectional studies did not provide information on participants' cognitive function. We recommend that at a minimum, cognitive function needs to be assessed to determine participants' capacity to complete subjective study instruments, such as PSQI.

Furthermore, sleep disturbances and sleep quality were assessed mostly using the Chinese version of the PSQI. Different cut points for poor sleep quality were used in studies conducted in different regions in China (Mainland vs. Taiwan). The inconsistent use of and scoring of subjective sleep measures raise doubts on the validity of the data and make the results difficult to interpret. No objectively measured sleep parameters were assessed in any of the studies included in this review. Actigraphy has been widely utilized as an objective sleep measure in the larger body of sleep research conducted in LTC settings in the United States and other countries (Li, Grandner, et al., 2015; Martin, Marler, Harker, Josephson, & Alessi, 2007; Ouslander et al., 2006; Richards et al., 2011). Future research should consider adding actigraphy to comprehensively assess sleep by capturing both subjective sleep quality and objective sleep parameters in LTC residents in China. In addition, the cut point of PSQI needs to be more mainstream and should not vary by region.

All seven intervention studies used nonpharmacological interventions. Overall, the reviewed exercise, traditional Chinese acupressure, and behavioral interventions showed beneficial effects on residents' sleep. The 4-week light therapy study failed to show differences between intervention and control groups.

The study designs, interventions, and durations of intervention varied greatly between studies. Overall, the sample sizes of these studies were relatively small and may not have been sufficiently powered to detect changes. In addition, four studies did not screen sleep disturbances or report the proportion of good sleepers at baseline, which may confound the study results (Chen et al., 2010; Chen et al., 2015; Song, 2009; Wu et al., 2015). In general, the four studies conducted in Taiwan had more rigorous study designs than the three studies from Mainland China. The methods and results were clearly described in the studies from Taiwan, with stronger designs (e.g., RCT and clustered RCT), longer intervention periods, mid-intervention assessment, and post-intervention follow-up. Among the three Mainland China studies, two of the studies used a single-group design (Chen et al., 2013; Song, 2009) whereas the other used a pretest–posttest with control group design. All participants were recruited from one single LTC facility, and the studies lacked an in-depth description of the intervention and statistical analyses (Yi & Zhang, 2012).

Improving sleep hygiene, stimulus control therapy, sleep restriction, relaxation training, and cognitive behavioral therapy for insomnia (CBT-I) in older adults are among the most widely used nonpharmacological therapies to improve sleep (Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008). Other therapies include exercise, light therapy, and environmental modifications, as found in this review. In community-dwelling older adults, there is evidence to suggest that exercise may be an effective way to improve sleep (Varrasse, Li, & Gooneratne, 2015). A combination of approaches may be best to improve sleep in LTC residents. First, determining the cause(s) of the sleep disturbance(s) is an important step to

be able to alleviate the disturbance and negative consequences. Modifying the daytime and nighttime environment will promote sleep in LTC residents. Environmental modifications include keeping the nighttime environment dark, quiet, and at a comfortable temperature; keeping the daytime environment bright; increasing physical activity; and maintaining a consistent mealtime schedule (Neikrug & Ancoli-Israel, 2010). Martin and colleagues (2007) found that increasing daytime activities, maintaining a routine bedtime, and a reducing nighttime noise and light all decreased daytime sleepiness in nursing home residents. Nonpharmacological treatments have advantages over pharmacological treatment as they can be effective at improving sleep in both the short and long terms with no serious consequences (Morin, Colecchi, Stone, Sood, & Brink, 1999).

Sleep research in LTC residents in China seems to be in its infancy. Future intervention studies in LTC China need to have more rigorous designs, larger sample sizes, and sufficient statistical approach, and to determine dose response. Increasing data collection time periods will help increase power and clustered randomization should be considered if randomization at the individual level is not feasible. As we know there are promising nonpharmacological treatments for sleep disturbances in LTC residents, these methodological suggestions may guide future studies.

There are a few limitations of this review. First, the 15 heterogeneous articles reviewed may be a small number of studies to represent sleep disturbances and sleep quality in LTC residents in China. However, our search criteria were broad, and these articles represent the state of the science of sleep in LTC residents in China. Second, our extraction and synthesis of material is subjective, but was discussed among multiple authors. The strength of this review is that we provide the first overview of current body of sleep research in the growing LTC population in China and suggest directions for future research.

Conclusion

This review presents the current body of sleep research in LTC residents in China and provides suggestions for future research. Sleep disturbances and poor sleep quality are prevalent in LTC residents in China. There are physical, psychosocial, and environmental factors that are associated with sleep disturbances and poor sleep quality. The nonpharmacological sleep interventions were beneficial for residents' sleep. However, the sleep research in LTC residents in China is still at the beginning stages, especially in Mainland China. Future studies should consider more rigorous designs and adding objective sleep measures (e.g., actigraphy).

Acknowledgments

Biographies

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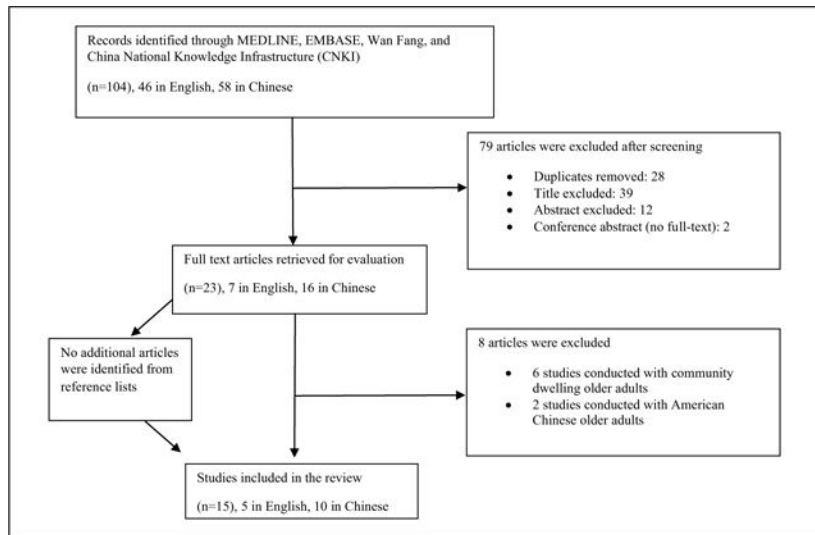
Figure 1.
Process of article identification and selection.

Table 1

Characteristics of Cross-Sectional Studies.

Authors* year Location	Sample characteristics	Sleep measure	Outcome: Sleep disturbances and sleep quality			Strengths and limitations
			Type and prevalence	Factors associated with sleep quality		
				Significant	Nonsignificant	
Chen, Zhang, Zhao, & Dong, 2014 Mainland China	151 residents from 4 nursing homes; Age ($M \pm SD$): 79.4 ±7.4; 62.9% female; 51% low level of education; 75.5% widower	PSQI	Overall poor sleep quality (Global PSQI Score > 7): 64.9%; Long sleep latency: 58.9%; Short sleep duration (6 hr): 58.9%; Low sleep efficiency (<75%): 61.6%; Sleep disturbances: 42.4%; Sleep medication use: 18.5%; Daytime dysfunction: 42.4%; M PSQI (SE) = 9.70 (0.376)	*Bivariate analysis (t tests)* Married +; Healthy spouse +; Chronic diseases −; Anxiety and loneliness +; Worrying about future −; Life satisfaction +; Hypnotic use −; *Multiple regression* Environmental factors +; Life satisfaction + (β = −1.0, p = .01); Hypnotic use − (β = 1.01 ; p =.006)	Gender; Age; BMI; Occupation; Income; Length of stay; Facility type	Limitations: 1 Unclear description of methods and results; 2 May lack sufficient statistical power
Yao et al., 2012 Mainland China	409 residents from 8 nursing homes; M age: 79.29; 52.6% aged 80 and above; 70.7% low level of education	PSQI	Overall poor sleep quality (Global PSQI score > 7): 51.6%; M PSQI (SD) 6= 8.24 (4.35)	*Bivariate analysis (chi-square)* Female − (χ^2 = 13.35, p < .001); Depression − (χ^2 = 19.99, p < .001); Social relationship + (χ^2 = 7.68, p = .006); Foot bath before bed + (χ^2 = 7.53, p = .008); Excitement before bed − (χ^2 = 24.54, p < .001)	N/A	Strength: 1 Relatively large sample size; Limitations: 1 No detailed description of methods; 2 Chi-square test was the only analytic approach. Regression analysis should be added to the analysis
Lin, Lu, & Ma, 2012 Mainland China	97 residents from 4 nursing homes; M age: 74.5, range (60-88)	PSQI; Sleep status questionnaires	Difficulty fall asleep after awakening: 50%; Frequent awakening and early morning awakening: 32%; M PSQI: not reported	*Bivariate analysis (ANOVA)* Female − (F = 6.15; p < .01); Age − (F = 5.18; p < .01); Environment + (living environment): (F = 4.53; p < .01)	N/A	Limitations: 1 Unclear description of methods and results; 2 Unclear description of how PSQI was used in the study; 3 Did not control for possible confounders

Outcome: Sleep disturbances and sleep quality

Authors* year Location	Sample characteristics	Sleep measure	Type and prevalence	Factors associated with sleep quality		Strengths and limitations
				Significant	**Nonsignificant**	
Li, Wang, & Yin, 2012 Mainland China	107 residents from one nursing home; Age ($M \pm SD$): 82.5 ± 6.9; range (68–98); 60.7% female; 64.4% widower	PSQI	Overall poor sleep quality (Global PSQI score > 7): 32.7%; Long sleep latency: 33.64%; Short sleep duration (≤6 hr): 30.0%; Low sleep efficiency (<75%): 20.6%; Sleep disturbances: 13.1%; Sleep medication use: 34.7%; Daytime dysfunction: 18.6%; *M* PSQI: not reported	*Bivariate analysis: (Spearman correlation)* Depression – (r = .405; p < .01)	N/A	Limitations: 1 Unclear description of methods and results; 2 Did not control for possible confounder
Fang, & Lin, 2010 Mainland China	97 nursing home residents in three communities; Age > 60; 57.7% aged 80 and above	Self-designed sleep evaluation questionnaire	Difficulty initiating and maintaining sleep: 59.8%; Long nocturnal sleep duration (>9 hr): 69.1%; *M* PSQI: not reported	Not reported	N/A	Limitations: 1 Insufficient statistical analysis; 2 No detailed information of the self-designed sleep evaluation questionnaire; 3 Unclear description of methods and results
Shi, 2009 Mainland China	179 nursing home residents Age ($M \pm SD$): 79.8 ± 0.5; 45.3% female; 70.9% low level of education; 62.5% widower	PSQI	Overall poor sleep quality (Global PSQI score > 7): 41.8%; Long sleep latency: 45.8%; Short sleep duration (≤6 hr): 23.5%; Low sleep efficiency (<75%): 21.2%; Sleep disturbances: 16.2%; Sleep medication use: 4.4%; Daytime dysfunction: 27.3%; *M* PSQI (*SD*) = 6.99 (0.26)	*Bivariate analysis (ANOVA)* Female –; Income (more than 800 RMB) +; Chronic diseases –; Hypnotic use –; Exercise frequency +; Anxiety/Worrying –; Social involvement +; Loneliness –; Drinking water before bedtime –; Chatting before bedtime –; Foot bath before bedtime +; Comfortable Environment +; *Multiple regression analysis* Income (more than 800 RMB) +(β = −0.823, p < .001)	Age; BMI; Facility type; Drinking; Smoking; Life satisfaction	Strength: 1 Controlled for multiple confounders; Limitation: 1 Inadequate sample size for the analysis

Outcome: Sleep disturbances and sleep quality

Authors* year Location	Sample characteristics	Sleep measure	Type and prevalence	Factors associated with sleep quality		Strengths and limitations
				Significant	Nonsignificant	
				Chronic diseases – (β = 0.705, p = .002) Hypnotic use – (β = 1.771, p = .031) Worrying – (β = 0.752, p = .044) Exercise frequency + (β = –0.640, p = .004) Drinking water before bedtime – (β = 1.169, p = .011) Comfortable Environment + (β = 1.020, p = .020)		
Zhang, Yang, & Zeng, 2008 Mainland China	80 nursing home residents and 80 community-dwelling elders Age > 65 42.5% aged 80 and above	PSQI	Overall poor sleep quality (global PSQI score > 7): In nursing home residents: 73%; In community-dwelling elders: 40% Nursing home residents had significant higher global score and subscale scores of PSQI than elders living in community M PSQI (SD) = 11.47 (2.33) in nursing home residents versus 7.35 (3.06) community-dwelling older adults.	*Adjusted logistic regression* Age – (OR = 1.45, p = .02) Education + (OR = 0.78, p < .01) Widower – (OR = 1.54, p = .04) Chronic disease – (OR = 1.75, p < .01) Inverted personality – (OR = 3.03, p < .01)	Gender Occupation	Limitation: 1 In the logistic regression analysis, older adults' living places were not considered (nursing home versus community)
Tsai, Wong, & Ku, 2008 Taiwan	196 residents without severe cognitive impairment from 9 nursing homes in Taiwan M age: 79 65.3% low level of education 53.1 % widower	PSQI	Overall poor sleep quality (global PSQI score > 5): 46.4% Only 48.5% of the participants used self-care strategies to manage sleep disturbances M PSQI : not reported	*Bivariate analysis (T test/chi-square test)* Education + Widower – Depression – Life satisfaction + Perceived health status + Perceived income adequacy + Multiple regression Adjusted logistic regression Widower – (OR = 3.18, p < .01, 95% CI = [1.63, 6.20]) Education level + (OR = 0.50, p < .05, 95% CI = [0.27, 0.99])	Age Gender Number of diseases Length of stay Cognitive/ functional status	Strengths: 1 Clear description of methods and results 2 Appropriate statistical approach Limitation: 1 Environmental factors were not considered in the study

Note. PSQI = Pittsburgh Sleep Quality Index; BMI = body mass index; OR = odds ratio; CI = confidence interval.

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The first three authors of articles are listed.

Table 2

Characteristics of Intervention Studies.

Authors* year Location	Study design	Sample characteristics	Intervention	Sleep measures	Outcomes	Strengths and limitations
Chen, Huang, Cheng, Li, & Chang, 2015 Taiwan	A cluster RCT with 114 elders from 10 nursing homes. Intervention group (5 nursing homes, $n = 59$) and control group (5 nursing homes, $n = 55$) Data were collected at baseline (t_0), 3-month (t_1), and the end of 6-month (t_2) intervention	Age ($M \pm SD$): 79.15 ± 7.03 57.9% widower 74.6% low level of education 100% using wheelchairs for mobility, cognitively intact, heavily/moderately dependent on others to perform activities of daily living	Intervention group (six months): Group exercise using wheelchair-bound senior elastic band exercise Program (warm-up, aerobic motion, harmonic stretching) Three 40-min sessions weekly for 6 months (Months 1–3 basic level; Months 4–6 advanced level) Control group: routine daily activity	Overall sleep quality: PSQI global score Sleep efficiency, sleep latency, and sleep duration were measured by PSQI subscales	1. Within group (compare with t_0) *Intervention* Longer sleep duration at t_1 & t_2 ($F = 7.12; p = .002$); Larger sleep efficiency at t_1 ($F = 4.27; p = .025$) *Control* Worse overall sleep quality at t_2 ($F = 5.02; p = .015$).2. Between group (adjusted for t_0): compare with control group, intervention group had longer sleep durations at t_1 ($F = 11.09; p = .001$) & t_2 ($F = 10.07; p = .002$); Larger sleep efficiency at t_1 ($F = 7.46; p = .007$); and better overall sleep quality at t_2 ($F = 4.83; p = .03$)	Strengths: 1 Cluster randomization 2 Relatively long duration of intervention 3 Three data collection times Limitation: 1 Sleep variables at baseline were not reported in detail
Wu, M.Sung, Lee, & Smith, 2015 Taiwan	A quasi-experimental pretest–posttest study with control group (cluster randomization of 4 units within on facility) Intervention group (2 units, $n = 34$) and control group (2 units, $n = 31$) Data were collected at baseline (t_0) and post-intervention (t_1)	Age ($M \pm SD$): intervention: 81.0 ± 9.0 vs. control: 79.0 ± 7.0 >76.5% low level of education > 74% using wheelchair for mobility	Intervention group (4 weeks): Group bright light therapy—sitting as a group in front of a 10,000-lux light box 30 min in the morning 3 times a week for 4 weeks Control group: usual standard care	Sleep disruption at night: self-designed daily sleep recording sheet	1 Less number of sleep disruption at t_1 within intervention ($t = 2.46; p = .02$) 2 No significant differences between two groups at t_1 after controlling for t_0 ($t = -0.19; p = .63$).	Limitations: 1 Relatively small sample size 2 Convenience sample within one facility 3 Short duration of intervention
Chen et al., 2013 Mainland China	Single-group pretest–posttest design 21 residents from one nursing home Data were collected at baseline and after 6-week intervention	Age ($M \pm SD$): 81.95 ± 5.18 57.1% female 57.1% low level of education Poor sleep quality (PSQI global score > 7) No sleep medication use	6-week multicomponent intervention 1 Healthy sleep education: poster and face-to-face instructions; 2 Self-administrated behavioral interventions: short afternoon nap (<30	Overall sleep quality: PSQI global score Subjective sleep quality, sleep efficiency, sleep latency, sleep duration, and daytime function were measured by PSQI subscales	Overall sleep quality ($F = 29.48; p < .001$) and most of the sleep parameters measured by PSQI subscales were significantly improved ($F_{\text{Subjective sleep quality}} = 18.06$, $F_{\text{sleep duration}} = 8.70$, $F_{\text{Sleep efficiency}}$ 4.95, $F_{\text{sleep disturbances}} = 27.98$; $F_{\text{Daytime functioning}} = 24.90$, All $ps < .04$)	Limitations: 1 Small sample size 2 Single-group design

Authors* year Location	Study design	Sample characteristics	Intervention	Sleep measures	Outcomes	Strengths and limitations
			min) and 20-min exercise for the elderly and bedtime foot bath and massage 3 Weekly meeting between subjects and the research team to review the progress of intervention.			
Yi & Zhang, 2012 Mainland China	A quasi-experimental pretest–posttest study with control group Data were collected at baseline and post-intervention Intervention group (n = 38) and control group (n = 38) from one nursing home	Have insomnia	Intervention group 1 Healthy sleep education: sleep hygiene and factors associated with sleep and how to adapt to nursing home environment. 2 Self-relaxation for 10-15 min before everyday bedtime for 4 weeks. Control group: usual care	Overall sleep quality: PSQI global score Subjective sleep quality, sleep efficiency, sleep latency, sleep duration, sleep disturbances, use of sleep medications, and daytime function were measured by PSQI subscales.	Compared with control group, the overall sleep quality ($F = 24.47$; $p < .001$) and all sleep parameters measured by PSQI subscales ($F_{\text{Subjective sleep quality}} = 15.83$; $F_{\text{sleep latency}} = 11.86$; $F_{\text{Sleep duration}} = 7.13$, $F_{\text{Sleep efficiency}} = 8.90$, $F_{\text{Sleep disturbances}} = 6.64$, $F_{\text{Sleep medication}} = 11.67$; $F_{\text{Daytime functioning}} = 36.20$, All ps . 01) in the intervention group were significantly improved.	Limitations: 1 No demographic characteristics reported 2 Vague description of intervention 3 No clear description of statistical approach and results
Sun, Sung, Huang, Cheng, & Lin, 2010 Taiwan	A RCT 50 elders from two nursing homes were randomly assigned to intervention (n = 25) and control (n = 25) groups Data were collected at baseline and every week for 7 weeks, starting from the first week of intervention until 2 weeks after intervention	Insomnia: Athens Insomnia Scale–Taiwan form (AIS) > 6 and PSQI > 5. 84% with low level of education 12% with dementia diagnosis	Intervention group (4 weeks): HT7 (Shenmen point) acupressure on both wrists with an interval of 5-s pressure followed by 1-s rest for 5 min at bedtime every night Control group: slightly touch on the same position with on pressure	Sleep quality was measured by PSQI Insomnia severity was measured by AIS	During the course of intervention and 2-week after intervention, the AIS score decreased significantly (less severity of insomnia) in intervention group, compared with control group (adjusted for time and group effects; Week 2-5: β ranged from −18.28 to 16.38, all ps < .001 ; 2-week post-intervention; Week 6: β = −11.40, $p < .001$; Week 7: β = −4.84, $p < .001$) During the 2 weeks after intervention, AIS returned to its original status in intervention group (AIS [$M \pm SD$] Week 1 vs. Week 7: 16.60 ± 6.04 vs. 15.72 ±4.01)	Strengths: 1 RCT design 2 Data collected at multiple time points, including follow-up after intervention Limitations: 1 Small sample size 2 Potential for intervention contamination 3 Baseline use of hypnotics, duration of insomnia, and other interventions

Authors* year Location	Study design	Sample characteristics	Intervention	Sleep measures	Outcomes	Strengths and limitations
						were not recorded
						4 AIS was first used in Chinese population, the psychometric proprieties were not known.
Chen, et al., 2010 Taiwan	A quasi-experimental pretest–posttest design with control group. Data were collected at baseline t_0 3-month t_1 and 6-month t_2 of the study 69 residents from 2 assisted living facilities were divided randomly into a yoga exercise ($n = 38$) and control group ($n = 31$), and 55 participants completed the study	Aged ($M \pm SD$): 75.4 ± 6.7 52.7% widower; 81.8% lower level of education Cognitively intact residents who were mild functionally dependent and able to walk without assistance	Intervention (6 months) 70-min group silver yoga exercise practice session, 3 times a week for 6 months (12-13 participants/ group) Control group: usual daily activities	Overall sleep quality: PSQI global score Subjective sleep quality, sleep efficiency, sleep latency, sleep duration, sleep disturbances, use of sleep medications, and daytime function were measured by PSQI subscales	1. Within group *Intervention* Overall sleep quality was significantly improved ($F = 4.13$; $p = .03$) and sleep disturbances ($F = 3.64$; $p = .04$), daytime Dysfunction ($F = 6.68$, $p = .007$) were significantly decreased *Control* Overall sleep quality ($F = 5.93$; $p = .005$) and sleep efficiency decreased ($F = 3.82$; $p = .037$) and sleep disturbances ($F = 7.00$; $p = .002$) increased significantly. 2. Between group (adjusted for t_0) At t_2, intervention group had less sleep disturbances ($F = 16.12$; $p = .001$), daytime dysfunction, higher habitual sleep efficiency ($F = 8.81$; $p = .005$), and overall better sleep quality ($F = 19.91$; $p = .001$) than those of their control group; the intervention group had shorter sleep duration ($F = 8.59$; $p = .005$) than control group	Strengths: 1 Long intervention duration 2 Data collected at three time points Limitations: 1 More than half of the participants exercised regularly before recruitment 2 Participants were not screened for sleep problems before the study
Song, 2009 Mainland China	Single-group pretest–posttest design with 50 residents from one nursing home Data were collected at baseline and after 1-year intervention	Aged 70-90	1-year intervention 1 self-care training for activities of daily living and physical training (at least 30 min daily); 2 resident–staff communication 20 min a week	Overall sleep quality was measured by questions asking sleep latency, sleep duration, awakening, nocturia, and daytime functions	The percentage of elders with good sleep quality increased significantly after the 1-year intervention ($F = 12.98$, $p = .001$) The percentages of elders with not good or very poor sleep quality decreased significantly after the 1-year intervention ($F = 9.25$, $p < .01$)	Strength: 1 Long intervention duration Limitations: 1 Self-defined category of sleep quality

Authors* year Location	Study design	Sample characteristics	Intervention		Sleep measures	Outcomes	Strengths and limitations	
			3	family health guidance: face-to-face or telephone communication 1 to 3 times a month;			**2**	Inadequate statistical analysis
			4	Social activities with family involvement			**3**	Convenience sample and single-group design

Note. PSQI = Pittsburgh Sleep Quality Index; RCT = randomized controlled trial; AIS = Athens Insomnia Scale.

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The first three authors of articles are listed.