

# Sleep Disorder and its Psychological Impact on Retired Elders: A Systematic Review

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## Abstract

**Background:** The retired population is projected to grow dramatically in the next decade. In Organization for Economic Cooperation and Development (OECD) countries, the average number of “retirees” per 100 workers is estimated to increase from 42 in 2018 to over 58 in 2050. Previous studies indicate that retirement tends to lead to an increase in decline in mental health and sleep quality. This systematic review aims to examine the prevalence of sleep disturbance and its psychological outcomes among retired elders and to investigate the related variables.

**Method:** This study followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. A comprehensive systematic review was employed using six databases (PubMed, Scopus, PscyNet Cochrane, CINAHL and Web of Science) to identify manuscripts published before August 2019. Two independent reviewers employed the Joanna Briggs Institute model to determine the quality of studies.

**Result:** Twelve articles (n=6567) were included in the review. The prevalence of sleep disturbance in retired elders ranged from 27% to 82%. The average scores of the psychological outcomes were as follows: 5.72 for anxiety, which was categorized as moderate, 3.94 to 4.21 for depression, and 6.23 for loneliness, which was classified as high. The variables associated with the psychological outcomes and sleep disturbance were gender, health problems, problem with partner in marriage and lack of activity.

**Conclusion:** The impact of retirement on the elderly may lead to sleep disturbance and negative psychological outcomes. Social activities after retirement such as household chores with partners or reliable friends can help maintain a good relationship with one’s partner; subsequently, sleep disturbance and psychological problems can be avoided.

**Keywords:** Psychological Outcome, Retired Elders, Sleep Disturbance, Systematic Review

## 1. Introduction

The elderly population is growing rapidly around the world. It is estimated that this number will continue to increase to around 8.5 billion in 2030 (10%), 9.7 billion in 2050 (26%), and 10.9 billion in 2100 (42%) (Nations, 2019). This rise would certainly have significant medical, economic and psychosocial implications. Many countries agree that population aging is one of the most serious issues today, because while global aging is a positive result of medical, social and economic progress in eradicating disease, it also presents extraordinary challenges (Chang et al., 2019). The

rise of the aging population in retirement overloads social insurance companies and necessitates a proper accessible social support system. It will affect economic growth, trade, migration, and disease patterns and prevalence (Maestas et al., 2016). It is crucial to understand that there are around seven million elderly people who need long-term care for their daily needs and activities, and nearly three million people have developmental disabilities and mental disorders that require substantial assistance (Acemoglu & Restrepo, 2017). The world must immediately take action in creating policies that consider new demographic interests (Maestas et al., 2016).

## 2. Literature review

Everyone gets older, but not all who get older go through a retirement phase. As the number of aging population rises, so do retirement rates, In 1970, men in OECD countries spent 11 years on average

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in retirement while women spent 15. These numbers increased to 17.8 and 22.5 years respectively in 2018 (OECD, 2019). The most prevalent sleep problem among the elderly is insomnia. The estimated prevalence of difficulty in maintaining and initiating sleep is around 30% (Miner & Kryger, 2017). Several studies have shown that 27% experience sleep disturbance at night and 29% experience daytime sleepiness (Becker et al., 2018; Monk & Buysse, 2014). In Iran and America, the prevalence of sleep disturbance is between 50% to 80% for retired elders (Malakouti et al., 2009; Turner et al., 2016). This means that they require a special social support system to help with several problems that come up due to retirement issues, such as sleep disturbance. While it does not always occur during adulthood, there is evidence that sleep disorder is correlated with age and is a part of the aging process. (Dorffner et al., 2015). Individuals who have retired for health reasons have more sleep problems after retirement than before retirement (Olds et al., 2018).

Depression was the most frequent mental illness in older adults. Depression in the elderly is made up of a group of disorders that are influenced by many closely related individual and contextual factors. The prevalence of mental illnesses among the elderly is 33%, depression (12%) and anxiety (11%) being the most prevalent conditions (McCombe et al., 2018). Nevertheless, the relation between employment status and depression in senior is not the only reason for financial stress. In fact, other causes of the impacts of retirement on the wellbeing of older adults have actually been proposed. This includes: improvements in social networks, community alienation, self-esteem weakened, and lack of self-worth and empowerment. (Fernández-Niño et al., 2018).

Sleep disorders appear to affect emotions, contributing in most situations to increased negative emotions and sleep disturbances and resulting in a negative mental state and lack of satisfaction in life. Previous studies have also suggested that sleep disturbances usually affect physical, mental, and emotional functions (Fernández-Niño et al., 2018; Olds et al., 2018). Nearly half the retirees who sleep at home and two-thirds of those who live in nursing homes suffer from sleep disruption (Biddle et al., 2017). As sleep disturbances become more prevalent with age, clinicians need to become familiar with natural sleep changes due to age, and identify sleep disturbance that may be affecting this population (Turner et al., 2016). Stress and anxiety can induce sleepless nights, leading to a number of other

issues, such as limited physical functions and depression, which has physiological impacts (Ballesio & Lombardo, 2016; Rahman & Lin, 2020).

Numerous research papers document sleep disorders and their psychological impacts worldwide, but none have ever presented the result in the form of a systematic review showing the prevalent and associated factors in retired elders. This systematic review aims to examine the prevalence of sleep disturbance and the psychological outcomes of retirement among elders and investigate the related factors.

### 3. Materials and methods

Systematic reviews were conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The protocol for this systematic review was registered in the International Prospective Registry of Systematic Reviews (PROSPERO). (Register Number CRD42020154689)

#### Search strategy

The data were collected from 6 electronic databases: PubMed (1984 to 2019), PsycNet (2010 to 2019), Scopus (1991 to 2019), Cochrane (2014), CINAHL (2001-2018) and Web of Science (2009 to 2018). The search term keywords used to attain the potential paper were: retirement, retired, retire, in retirement, elderly, aged, aging, old age, age-old, geriatric senior, old people, sleep, sleepiness, sleep disturbance, psychological outcome or psychiatry or mental health outcome, depression or anxiety or insomnia. The detailed information on the strategies for the search term can be found in Supplementary material (Appendix 1). Language and years of publication were not limited during the initial search. The full text references were examined and relevant cited publications that suit to the objective of the study were also investigated.

#### Study selection

Certain criteria that followed the research objectives of this study had to be met before a study was included in the unit analysis. Firstly, the studies must be in English, they must be quantitative in design (cohort, cross-sectional, case-control study), and they must have been peer reviewed. Editorials, systematic reviews, literature reviews, proceeding letters, conference abstracts, and non-peer reviewed journals were excluded. Secondly, the participants must have been retired elders with a minimum total population of 70% (Fincham, 2008) and with more than 60 years of age

(Nations, 2017; WHO, 2012). Thirdly, the results of the study must have been psychological, such as psychiatric or mental health problems, depression, anxiety, or insomnia.

#### 4. Methodology

##### Data extraction and synthesis

All studies included in the qualitative synthesis were reviewed by two independent reviewers with the same knowledge background. The reviews were based on titles and abstracts from the papers (Ferry & Vita). These reviewers also reviewed the full text of the studies to select eligible papers for final analysis (Ferry & Vita). A third reviewer was consulted when needed (Kuan-Han). Discrepancies were resolved through discussions. The information provided has been derived from the selected studies: authors, years of publication, countries of study, study designs, sample size, sex assigned at birth, ages, outcome measures, prevalence of findings, related factors, and retired status. All the data were documented with the Microsoft Excel program.

##### Quality assessment

The researcher used the critical checklist developed by the Joanna Briggs Institute (JBI) to evaluate the quality of each analyzed sample. which was adjusted to the study design. There were 11 items for the cohort sample, 10 for the case control study, 8 for cross-sectional studies, and JBI critical evaluation checklists ("Reviewer's Manual. Australia: The Joanna Briggs Institute," 2014). Any dissent was resolved by discussion between reviewers.

##### Statistical methods

The data was processed with the program Statistical Package for the Social Sciences (SPSS 23). In order to evaluate agreements between the two reviewers on the selection of studies and quality evaluation phase, Cohen's Kappa statistics and percentage agreement were measured. A Kappa result of 0.0 suggests no agreement, 0.01–0.20 suggests none to mild agreement, 0.21–0.40 suggests fair agreement, 0.41–0.60 suggests moderate agreement, 0.61–0.80 suggests significant agreement, and 0.81–1.00 suggests an almost perfect agreement (Giannantonio, 2008).

##### Study selection

Based on the 6 electronic databases, 487 articles from the initial screening were reduced to 424 after duplicates were removed; 21 articles were designated for the full text assessment, and out of

these, 12 studies were deemed eligible to be included in this study. Detailed information about the review process is shown in Figure 1. The agreement between two independent reviewers for screening titles and abstracts (Kappa 0.923, agreement percentage 99.8%), full text screening (Kappa 0.63, agreement percentage 95.2%), and quality assessment were all substantial (Kappa 0.661, agreement percentage 90.2%). As for the analysis of the Joana Brings Institute critical evaluation checklist, the consistency of the systematic reviews was evaluated.

##### Study characteristics

The summary of the included studies is presented in Table 1. They were all published between the years 2000 and 2018, and came from various study settings; 8 studies were conducted in America (Belogolovsky et al., 2012), (Chen et al., 2016; Chen et al., 2015; Gooneratne et al., 2003), (Monk et al., 2013; Monk et al., 2011), (Monk et al., 2012; Turner et al., 2016), 1 study was conducted in Portugal (Becker et al., 2018), 1 study was conducted in Iran (Malakouti et al., 2009), 1 study was conducted in Australia (Olds et al., 2018), 1 study was conducted in Israel (Zisberg et al., 2010). 3 study designs were conducted with cohort study (Belogolovsky et al., 2012; Zisberg et al., 2010), (Turner et al., 2016), (Olds et al., 2018), 1 study design was conducted with case control, (Gooneratne et al., 2003), 8 study designs were conducted with Cross-sectional studies, (Becker et al., 2018), (Malakouti et al., 2009), (Chen et al., 2016; Chen et al., 2015; Monk et al., 2011), (Monk et al., 2012), (Monk et al., 2013), (Zisberg et al., 2010).

##### Participant Characteristic

There were a total of 6567 participants, including 2859 men and 3708 women (Becker et al., 2018; Belogolovsky et al., 2012; Chen et al., 2016; Chen et al., 2015; Gooneratne. et al., 2003; Malakouti et al., 2009; Monk et al., 2013; Monk et al., 2011; Monk et al., 2012; Olds et al., 2016; Turner et al., 2016; Zisberg et al., 2010). Their ages had an average between 60 and 90 years old (Becker et al., 2018; Belogolovsky et al., 2012; Chen et al., 2016; Chen et al., 2015; Gooneratne. et al., 2003; Malakouti et al., 2009; Monk et al., 2013; Monk et al., 2011; Monk et al., 2012; Olds et al., 2016; Turner et al., 2016; Zisberg et al., 2010). Participants were predominantly women and were all retired elders.

## 5. Result and Discussion

### Sleep disturbance and psychological outcome measures

Varying methods of measurement for sleep disturbance and psychological outcomes were used across all 14 studies. Eight studies had quantifiable data on prevalence of sleep disorder measured with the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989). In at least two components, a global PSQI score greater than 5 suggests severe difficulty or moderate difficulty in more than three components.

Two studies presented data on sleep latency and sleep onset using the Sleep Timing Questionnaire (STQ). The STQ is a checklist designed to collect similar information to what the week-long sleep diary method provides (Monk et al., 2003).

One study had data on prevalent sleepiness measured by the Epworth Sleepiness Scale (ESS) and the Functional Outcomes of Sleep Questionnaire (FOSQ). The FOSQ is a self-contained questionnaire intended to quantify the effects of daytime sleepiness on a person's ability to function (Chasens et al., 2009).

One research had data generated by the National Social Health and Aging Project on records of insomnia symptoms and updated by the Diagnostic and Statistical Manual of Mental Disorders and International Classification of Diseases (Chen et al., 2016). One study used the Composite Scale of Morningness (CSM) (Monk et al., 2011), a tool used to measure a person's circadian rhythm (morningness) (Randler, 2009).

Other instruments were used to assess psychological impacts. Two studies used the Sleep Quality Depression Anxiety Stress Scale (DASS) to gather data on prevalent depression and the sleep quality of older adults (Osman et al., 2012). This scale consists of three scales (anxiety, stress, and depression) with seven items. The highest scores correspond to the depressive emotional state on the depression scale (Martins et al., 2019). One study assessing psychological anxiety with the Hospital Anxiety and Depression Scale (HADS) reported a higher level of anxiety. A shortened version of the Center for Epidemiologic Studies Depression Scale (CESD-10) was included in the HADS. The CESD-10 score varied from 0 to 30 and was a frequently used method to detect major depression in the elderly. (Chen et al., 2015; Irwin et al., 1999).

### Prevalence of sleep disturbance and psychological outcome

Malakoti et al. found that 86% of participants

suffered from poor sleep quality and about 29% get less naps. 72% of those who experience sleep disturbances also have chronic diseases (Malakoti et al., 2009). In 2011, another study by Monk reported that about half of the retired senior subjects had sleep problems, with men having better sleep than women. It was also found that a person's chronotype and regularity of sleep time had no effect on sleep quality. Former night shift workers had lower sleep quality, (with a score of 5.6) and lower sleep efficiency (90.2%) compared to former day shift workers (Monk et al., 2013). In 2012 Monk also assessed retired elders' sleep durations. 25% reported being unable to sleep for more than 6.7 hours per day, having trouble with sleeping at night, and daytime sleepiness. They had a median PSQI score of 5, leading to the conclusion that participants not doing night shift work in the last 12 months had improved their sleep quality. In 2016, Turner's research found that more Fifty-one percent of the study participants complained of poor sleep quality. and trouble sleeping, 57% of which having had or at least one of the following three sleep disorders: sleep apnea (44%), syndrome of restless leg (25%), and rapid eye movement sleep behavior disorder (7%). Older African-American subjects with lower education levels had the worst sleep quality compared to other study participants (Becker et al. 2018). 63% of the elderly subjects were able to get sufficient sleep (7-8 hours/day) to avoid stress while 27% experienced sleep disturbance. 56% of Goonerate et al.'s elderly subjects suffered from excessive daytime sleepiness (EDS) every day (Gooneratne. et al., 2003).

Chen et al. illustrated the psychological well-being among retired elder subjects with the following findings: 10% poor, 8% fair, 32% good, 39% very good, and 21% excellent. Subjects had a HADS mean score of 5.72 (scale ranges from 0 to 21) for anxiety, a CESD mean score of 3.94 for depression, and a loneliness scale of 6.23, which was quite high for this study (maximum score 9) (Chen et al., 2015). Becker et al.'s study reported a mean score of 4.21 for depression after assessing the subjects with the DASS-21, where the maximum point is 21 (Becker et al., 2018). Old et al. also used DASS-21 to research mental health (depression) and found significant difference between pre-retirement and post-retirement ( $p < 0.0001$ ) (Olds et al., 2018).

### Factors associated with sleep disturbance and their psychological impacts

The included studies considered the following

factors as related to sleep disturbance: genetics, race, sex assigned at birth, sleep medications, physical disabilities, mental health, financial stress, marriage problems, past work schedules, and lack of social participation and daily activities (Belogolovsky et al., 2012; Chen et al., 2016; Chen et al., 2015; Gooneratne. et al., 2003; Malakouti et al., 2009; Monk et al., 2011; Monk et al., 2012; Turner et al., 2016). The findings on the related factors due to sleep disturbances were different. Several variables related to sleep disorders due to financial stress and marriage problem were found to be caused by alcohol misuse among men after six years of retirement (T1) ( $\beta=1.77$ ,  $p<0.001$ ;  $\beta=0.47$ ,  $p<0.05$ , respectively). The impact of financial stressors ( $\beta=5.97$ ,  $p<0.001$ ) on sleep-related problems also had significant relations with sex assigned at birth. Elderly women, for example, were more susceptible to developing an addiction to sleeping pills (Belogolovsky et al., 2012). Sleep disorders such as insomnia were more commonly found in married elders who had domestic problems (Chen et al., 2016; Chen et al., 2015). Hispanic seniors were also more likely to suffer from insomnia than white seniors ( $\beta= -0.730$ ,  $p<0.05$ ). Self-related mental health assessments had the following results: excellent ( $\beta=0.755$ ,  $p<0.05$ ), very good ( $\beta=0.408$ ,  $p<0.05$ ), good ( $\beta=0.888$ ,  $p<0.01$ ) and fair ( $\beta 1.034$ ,  $p<0.01$ ) compare excellent mental health, also activities daily living ( $\beta 0.23$ ,  $p<0.05$ ). The more socially involved the elderly subjects were, the better their sleep performances were in ACTi graph. They also involved more frequently in spiritual activities, charitable activities, and structured group meetings as they reported lower rates of wake after sleep onset, less wake bursts, and lack of sleep fragmentation. Similarly, in Zisberg et al.'s study, the regular undertaking of activities such as bathing, eating and dressing for the elderly predicted a decrease in sleep latency ( $r = -0.43$ ,  $p < 0.05$ ), higher sleep efficiency ( $r = 0.74$ ,  $p < 0.001$ ), and improved sleep quality ( $r = -0.67$ ,  $P < 0.001$ ), beyond functional status, comorbidities and age ( $r=0.13$ ,  $p<0.05$ )(Zisberg et al., 2010). Monk et al. noted that morning-types had shorter sleep durations compared to other types and that genetic factors and work shifts histories were related to sleep disorders (Monk et al., 2011; Monk et al., 2012). Former day shift workers who have worked for more than 15 years had lower PSQI scores compared to night shift workers, meaning the latter had sleep quality problems. Turner et al. found that elderly with disabilities were more susceptible to suffering from sleep disturbance ( $r=0.11$ ,  $p<0.001$ ).

Lower sleep quality for insomniacs who find it difficult to start or maintain sleep was correlated with mobility impairment in a logistic regression analysis with the following variables: age, sex assigned at birth, years of education and race ( $OR=1.09$ ,  $95\%CI=1.04-1.15$ ) (Turner et al., 2016). Malakouti et al. reported that health problems such as post-menopausal hormonal changes cause nighttime stress in older women and disturbances in breathing and restless legs in older men (Malakouti et al., 2009). Gooneratne et al. found a strong connection between daytime sleepiness and the rates of complaints of frequent awakenings and frequent tossing/turning ( $r =0.44$ ,  $p<0.001$ ), but after a multivariate analysis only a small number of medical diagnoses were significant ( $p<0.001$ ) (Gooneratne et al., 2003). Several studies have shown that sex assigned at birth has a role in sleep quality. Men are 2.52 times more likely to get good sleep quality than women (Malakouti et al., 2009), Monk et al. reported that female had higher PSQI scores (6.1 vs 4.8;  $p < 0.0001$ ) and significantly higher sleep efficiency scores (89.7% vs. 91.8%;  $p < 0.005$ ) than male. They also found former day shift workers had better sleep quality and sleep efficiency than former night shift workers ( $p<0.05$ ) (Monk et al., 2013).

The associated variables included in the analysis of psychological outcomes were sex assigned at birth, health status, psychological wellbeing, physical health problems, lack of physical activity, loneliness, negative relationships with spouses, problems with waking up in the morning, and morning fatigue (Becker et al., 2018; Chen et al., 2015; Olds et al., 2018). Becker et al. found that sleep quality accounted for 23% of the psychological aspect of the quality of life of the elderly in Portugal. Depressive scores were substantially different between males and females, with women having a higher score than men (4.63 vs 3.06,  $p=0.020$ ). Moderately healthy individuals also had higher depression scores than healthy individuals (5.09 vs 3.26  $p=0.008$ ) (Becker et al., 2018). In addition to problems with waking up in the night and in the morning fatigue related to depression, a study by Chen et al. found that a poor marital relationship was associated with depression in the elderly. The results showed an association between one's psychological well-being, depression ( $\beta =0.06$ ,  $p<0.01$ ) and loneliness ( $\beta=0.05$ ,  $p<0.05$ ), and an association between physical health and sleep troubles (self-related health,  $\beta=0.12$ ,  $p<0.05$ ) (Chen et al., 2015). Olds et al. indicate that the subjects' mental wellbeing steadily improved with physical activity, with large

declines in overall depression, anxiety and stress scale (DASS21) scores ( $p=0.006$ ). The scales were broken down as follows: depression ( $p=0.03$ ), anxiety ( $p=0.26$ ), stress ( $p=0.02$ ), and self-esteem ( $p=0.02$ ) (Olds et al., 2018).

The association between sleep disorder factors and psychological outcomes was found in this review. Chen et al. reported a positive relationship between depression and troubles with sleeping (Chen et al., 2015). After retirement, the subjects, mental health significantly increase due to 40% of their working time being replaced by household chores and 20% being replaced by sleep time. Changes in the use of one's time, therefore, were important in relation to changes in depression of stress and self-confidence. (Olds et al., 2018). Becker et al. explained that the quality of sleep, taking into consideration sex assigned at birth and health differences, mediated between depression and the life quality in elderly (Becker et al., 2018).

## 6. Discussion

This systematic study provides a comprehensive review to investigate the prevalence of sleep disturbance and its psychological impacts by identifying the associations between retired individuals and sleep disorders involving samples worldwide. Sleep disturbance is prevalent in 27% to 82% of the retired elder population. Furthermore, their anxiety scores are moderate in average, with a HADS mean score of 5.72. The same can be said for depression, with DASS-21 and CESD scores ranging from 3.94 to 4.21. The loneliness score, however, is even higher in this study. Depression, anxiety, loneliness and stress are factors that negatively impact the psychological outcome of retirement, and depression was found to be the most frequent problem in this study. This study also found that sex assigned at birth, marriage problems, health problems, and lack of physical activity affects sleep disturbance and psychological outcomes among retired elders.

Studies from countries around the world report a prevalence of sleep issues rising from 1.6% to 56.0% in the general population (Koyanagi & Stickley, 2015; Léger et al., 2008). Other studies have shown that in certain countries/populations, sleep problems may increase in age (Alexander et al., 2016; Hoyos et al., 2015). Alexander et al. found that the most frequent diagnoses among veterans in the United States were sleep apnea and insomnia.

Using the DASS-21 and CESD instrument, the present study found that the depression and anxiety scores in retired elders were moderate.

Loneliness scored the highest, as mental health is greatly influenced by changes brought on by retirement. The findings of this systematic review demonstrate a significant relationship between retirement and depression, loneliness, anxiety, and stress (Becker et al., 2018; Chen et al., 2015; Olds et al., 2018). These findings are consistent with a recent study from Mazza et al., who used DASS-21 on Italian subjects during the COVID-19 pandemic. Results indicated that they suffered from moderate stress (5.34) (Mazza et al., 2020). People tend to work for hours either because of a sense of duty or simply because they want to. Various changes in the use of one's time after retirement would have different effects on both mental and physical health. At this time, particular health-related behaviors can change and mediate mental health. Dave et al. argue that lack of mobility and routine activities lead to a 5-6% increase in disease conditions, and a 6-9% decline of mental health over an average of six years post-retirement. The effects are likely to operate through lifestyle changes, including decreased physical activity and social interactions (Dave et al., 2006).

Sleep disturbance is associated with genetics, race, sex assigned at birth, the use of sleep medications, physical disabilities, mental health, financial stress, marriage problems, past work schedules, lack of social participation and daily activities among retired elders. Based on the genetic factors, Monk et al. presented that retired elders with morning orientations (M-type) tend to experience improved sleep quality (Monk et al., 2011). They also confirmed that those who slept earlier due to their sleep time not being constrained by a work schedule had better sleep quality (Monk et al., 2011).

Sex assigned at birth is a strong independent predictor of sleep disturbance. In this systematic review study, older women were more likely to experience sleep disturbance. One reason was that hormonal changes tend affect their psychological conditions, especially during menopause. In New Zealand, the results from the Health Work and Retirement survey indicated that female caregivers tended have poor sleep as a result of their work (Gibson et al., 2015). Difficulty in falling asleep, sustaining sleep, and returning to sleep were found to be more prevalent in women than in men (Marqui e et al., 2012; Sandlund et al., 2016).

Marital status is another factor associated with sleep disorder. In this study, it was found that married elders were more likely to have trouble sleeping than unmarried elders. Data from the Study of Health Aging and Retirement in Europe

revealed that marriage issues and widowhood were correlated with sleep issues (van de Straat & Bracke, 2015). An eight-year longitudinal research stated that the improvement in the marital relations were positively associated with sleep quality in older adults (Lee et al., 2017). Another similar study revealed bidirectional relationships between marital consistency and sleep disruptions (Yang et al., 2013).

Mental health can be very sensitive to changes after retirement. In this systematic review study, it was found that lack of physical activities and having a negative relationship with one's partner are factors associated with psychological outcomes in the retired elders. Schuch et al. reported that the lack of physical activity was a risk factor for the onset of depression in the general population. Furthermore, they highlighted that even just a small amount of physical activity such as walking 150 minutes per week could decrease the incidence of future depressive episodes (for example,) (Schuch et al., 2018). Besides the lack of psychical activity, negative relationships between married couples may lead to mental health problems. Whisman et al. and Wang et al. emphasized the significant effects in the positive relationship between marital distress and depressive symptoms. (Wang et al., 2014; Whisman & Uebelacker, 2009). Some elders have successfully transitioned to retirement by having good social supports from partners and using their time appropriately (Becker et al., 2018; Chen et al., 2015; Olds et al., 2018).

### 7. Implication

Retired elders were gradually suffered with the burden of several diseases. Among the most prevalent conditions in this aging population, sleep disorders and psychological symptoms have major impact in the quality of life, functional capacity and social relationship. Clinical trials regarding interventions in sleep disorders and psychological symptoms as a target in the retired elders are missing. Development of an early intervention and comprehensive geriatric assessment over sleep disturbances and psychological symptoms in the retired elderly are warranted.

### 8. Limitation

This study had several limitations. First, the risk of language bias and publication bias was high as only peer-reviewed journals and studies published in English were included. Second, since all included studies were observational or long-term follow-ups, the methodological consistency of the included studies was considered moderate. Third, drawing

definitive conclusions in a causal effect between variables was difficult because most of the studies employed the cross-sectional approach. Fourth, all assessment tools to evaluate the research outcome applied self-rated questionnaires; therefore, the results were epidemiological rather than clinical. For future research, it is suggested to use clinical assessment tools instead of subjective questionnaires to examine the sleep disorders and psychiatric disorders. Cohort study design is recommended to explore the causal relationships between retirement status and sleep disorders and psychiatric disorders for future investigation.

### 9. Conclusion

The results show that the prevalence of sleep disorder in this population is quite high and that the psychological outcome scores tend to be moderate, especially with depression and loneliness. Retirement can affect the elderly's sleep, which in turn has negative psychological impacts, influencing social participation, daily activities, and social activities, involvement in group activities with members of a religious group or a society, and daily activities such as household chores, physical activities, and self-care. But these activities also promote better sleep quality and can prevent psychological problems. Engaging in social activities with trusted people such as partners after retirement aids in maintaining a good relationship with one's partner and can help deal with problems of stress, anxiety, and depression.

### Conflicts of Interest

The authors declare no possible conflict of interest relevant to the study, authorship, and/or publication of this paper.

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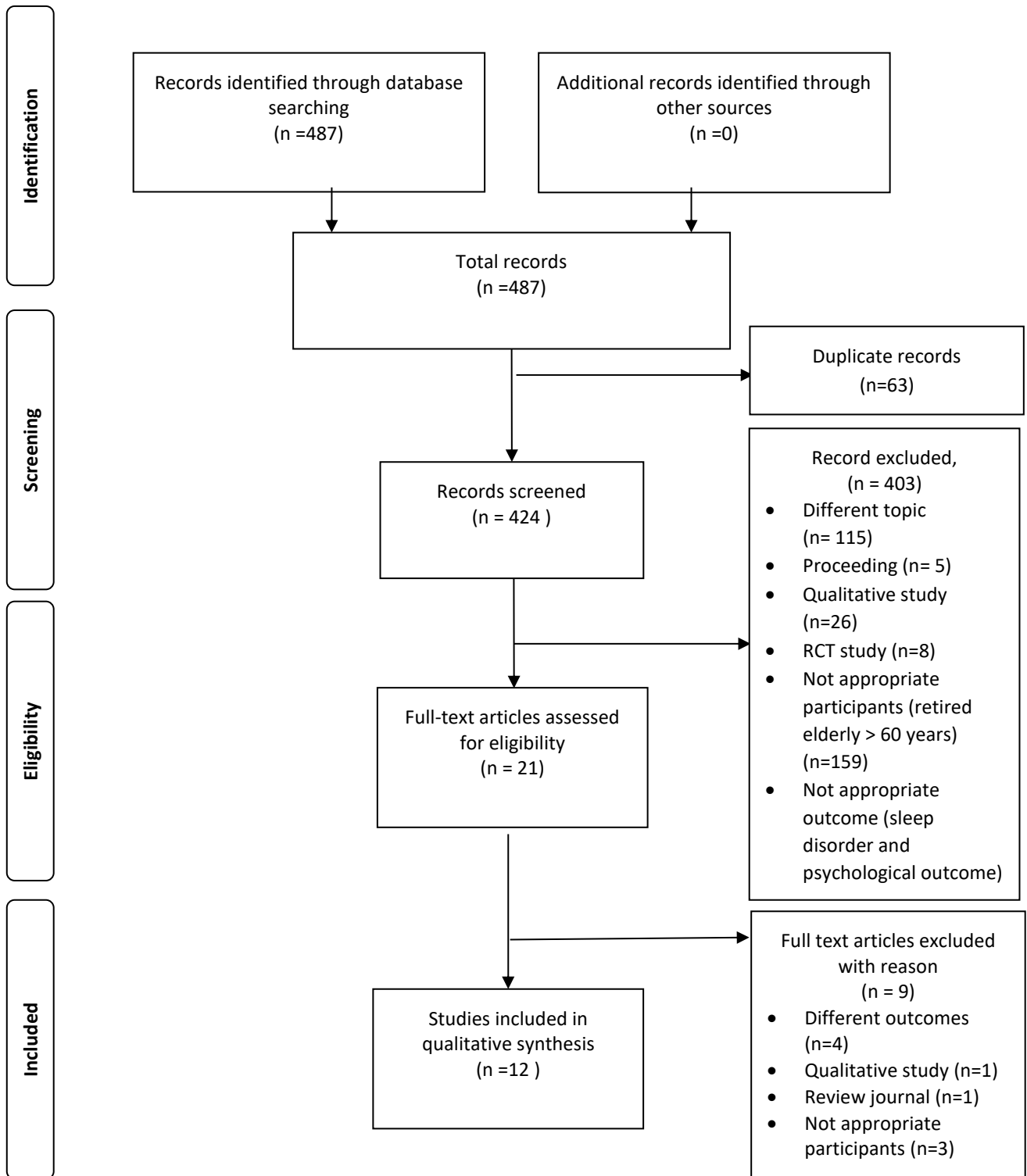


Figure 1. PRISMA Flow diagram

Table 1. Summary of included studies

Author, year	Country	Study design	Sample size	Gender	Age	Outcome Measures	Findings	
							Prevalence of sleep disturbance	Related Factors
Belogolovsky, et al., 2012	America	Longitudinal	After six years of retirement (T1) 221 men and 71 women		Over 60 years old	PSQI	63% have sufficient sleep (7-8 hours/day) to avoid stress The remaining 27% experienced sleep disturbances	For regression, financial and marital stressors after six years of retirement (T1) (respectively $\beta=0.77$ , significant level 1%; $\beta=0.47$ , significant level 5%) had positive resulted in sleep related problems. Measurement timeline for T2 is 18 months after (T1). Sleep quality at T2 hospital was affected positively but not significantly by the abuse of alcohol. ( $\beta =0.06$ ), therefore violating mediation's key assumption. It was concluded that there is a link between financial challenges and marital concerns. Only financial stressors affect sleep-related problems, with $\beta=5.97$ and $p<0.001$ , as significantly moderated by sex assigned at birth.
Becker, et al., 2018	Portugal	Cross-sectional, t-	187		Over 60 years old	PSQI DASS 21		There were significant discrepancies in depression scores between different sexes assigned at birth and health statuses. Women had a higher mean score than men (4.63 vs 3.06, $p=0.02$ ) and moderately healthy subjects had a higher mean score than healthy subjects (5.09 vs 3.26, $p=0.008$ ).
Chen, et al., 2016	America	Cross-sectional	780		60-85 years old	NSHAP		When comparing Hispanic seniors with white seniors ( $\beta =-0.730$ , significant level 5%), their self-related mental health assessments had the following results: excellent ( $\beta=0.755$ , significant level 5%), very good ( $\beta=0.408$ , significant level 5%), good ( $\beta=0.888$ , significant level 1%) and fair ( $\beta=1.034$ , significant level 1%). They also compared functional health ( $\beta 0.23$ , significant level 5%).
Chen, et al. 2015	America	Cross-sectional	727		62-90 years old	HADSC and CESD		The association between age and trouble sleeping ( $\beta=0.02$ $p<0.05$ ) and the association between physical health and trouble sleeping (self-related health) ( $\beta=0.12$ $p<0.05$ ) were all variables mediated by the household environment health and the subjects' physical conditions. Association between psychological wellbeing and trouble sleeping; CESD score $\beta=0.06$ significant level 1%, loneliness $\beta=0.05$ significant level 5%.

Gooneratne, et al. 2003	America	76 cases and 38 control	FOSQ and ESS	Over 65 years old	30 men and 84 women	56% EDS daytime sleepiness more every day.	It was concluded that regular awakenings and tossing/turning were correlated with daytime sleepiness. Their frequency scores indicated them having a significant correlation to each other ( $r = 0.44, p < 0.001$ ). Significant effects only came from the total number of diagnosed diseases. significant level 1%, while other variables like sex assigned at birth significant level 10%, medication use significant level 5%, and repeated waking up or turnings were not significant.
Malakouti, et	Iran	390	PSQI and ESS	Over 60 years	199 men and	Sleep disturbance=336 (86.2%) Iranian daytime sleepiness =114 (29.2%)	Logistic regression analysis showed that results from the General Health Questionnaire (GHQ) had the most significant independent correlation with sleep quality by PSQI.
Monk, et al. 2013	America	1113 participant	PSQI	Over 65 years old	634 men and 479		When comparing retired day shift workers (0 years of night shifts) group to the group exposed to 1-15 years of night shifts, the above record worse sleep by 0.94 PSQI units ( $p = 0.005$ , post-hoc turkey-kramer modified $p < 0.004$ ). ANOVA results demonstrated the significant influence of night shift worker exposure, with subjects with exposure for 1-15 years is average daily bedtime 13 min later than 0 years.
Monk, et al. 2011	America	654 retired seniors	CSM, PSQI and STQ	Over 65 years old	363 men and 291 women	About half the samples had sleeping problems	The total mean score and median of PSQI were 5.4(SD=3.5) and 5.0 respectively. M-types or morningness revealed higher subjective quality of sleep (6.0 vs. 4.5; $F 1,649 = 29.59$ ; significant level 1%. Subjects with Stable Bedtime (SB) indicated <i>better</i> subjective quality of sleep (6.0 vs,4.8) ; $F 1,649 = 18.47$ ; significant level 5% effect size = 0.33) with a relatively better sleep quality (92% vs 90%; $F 1,649 = 3.63$ significant level 10%; effect size = 0.15). Subjects with stable rise time (SR) showed better subjective quality of sleep (5.0 vs. 5.9; $F 1,649 = 12.03$ ; $P < 0.001$ ; effect size = 0.27) and better sleep quality (90% vs. 92%; $F 1,649 = 7.29$ ; significant level 1% effect size = 0.21), but a shorter time at sleep (504 min vs. 489 min; $F 1,649 = 7.62$ ; significant level 1% effect size = 0.22). Covariate Former night shift workers indicated a greater PSQI score (5.1 vs. 5.6; significant level 5%) with a relatively lower score on sleep efficiency (91.5% vs. 90.2%; significant level 1%) compared to former day shift staff.
Monk, et al. 2012	America	1166	PSQI and ESS	Over 65 years old	658 men and 508	25% reported less sleep (6.7 hour/day) and having problems with sleeping at night and daytime sleepiness.	The PSQI's median reached 5 with an ESS score of 5, meaning neither sleep disruptions nor excessive daytime sleepiness were particularly pervasive.

Turner, et al. 2016	America Longitudinal	943 226 men and 717 women Over 65 years old	PSQI	51% prevalence of impaired sleep quality via sleep disturbances on 53% of the elder African-American subjects 57% possibility of having sleep disorder with about 17% possibility of experiencing more than one at a time	Sleep quality had a correlation only with mobility disability ( $r=.11, P<.001$ ). Based on age, sex assigned at birth, education length, and race as analyzed through logistic regression analyses, poorer sleep quality was indeed associated with mobility disability (OR 1.09, 95% CI 1.04-1.15).
Olds et al. 2018	Australia Cohort	105 54 men and 51 women Over 60 years old	DASS21	Mental health commonly improves for all the retirement thresholds, since the DASS21 total score, depression, and stress (all $p\leq 0.0001$ ) demonstrated notable reductions; furthermore, well-being and self-esteem also improved (with $p<0.0001$ , and $p = 0.01$ respectively). Relationship between activity composition; total score ( $p=0.006$ ), depression ( $p=0.03$ ), anxiety ( $p=0.26$ ), stress( $p=0.02$ ), and self-esteem ( $p=0.02$ ).	Total PSQI, control variables (comorbidities) accounted for 13% of the variance ( $F_{3,88} = 4.20, P = 0.008$ ); The Scale of Older Adult Routine (SOAR) Basic added an additional 4% (together 17%) of the variance ( $F_{4,88} = 4.41, P = 0.003$ ), and the SOAR Instrumental added an additional 10% (together 23%) of the variance ( $F_{4,88} = 6.34, P < 0.001$ ). Improved regularity of lifestyle was associated with lesser sleep latency ( $r = -0.43, P < 0.05$ ); better Sleep Efficiency ( $r = 0.74, P < 0.001$ ); and a lower total score of PSQI ( $r = -0.67, P < 0.001$ ).
Zisberg, et al. 2010	Israel Cross-sectional	96 27 men and 69 women Over 60 years old	PSQI, Sleep latency, and		