Sleep and Depression in Older Adults: A Narrative Review

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Abstract

Purpose of Review The sleep-depression association has been recognized for decades. Efforts to clarify this association continue at an increasing pace. This review summarizes recent research on the sleep-depression association in older adults.

Recent Findings Research over the past 4 years has utilized cross-sectional, longitudinal, cohort, and intervention designs to examine these associations.

Summary Short (< 7 h) and long (> 8–9 h) sleep durations and insomnia symptoms are risk factors for depression in older adults. Similarly, short sleep, long sleep, insomnia symptoms, and depression are all risk factors for poorer health in late life, including increased risk of cognitive decline, falls, and poorer quality-of-life. Intervention studies have produced mixed findings, with some studies suggesting that sleep interventions may be potentially effective in improving both insomnia and mood symptoms. Intervention studies incorporating both behavioral and physiological measures of sleep, and larger and diverse samples may enhance the field's understanding of the complex interplay between sleep and mood in older adults.

Keywords Sleep duration · Insomnia · Older adults · Depression · Depressive symptoms

Introduction

Older adulthood (generally defined as those aged 65 and older) is a unique developmental period, as the particular combination of circumstances and contexts in older adulthood involves distinct benefits and challenges. Older adults are more likely to have at least one chronic disease than other age groups and often have comorbidities in other aspects of health such as mental health problems, cognitive decline, and sleep disturbance [1, 2]. Largely due to these health challenges, older adults are much more likely to utilize healthcare services, with the cost of health care and the amount of healthcare utilization increasing as people age [1]. Moreover, the population of older adults is projected to sharply increase over the next several decades, with some calling it a "silver tsunami." As such, research

investigating the health and well-being of older adults is becoming increasingly salient as society prepares to meet the increased demands of this growing population.

Sleep plays an essential role in an individual's health and well-being. Poor sleep is associated with increased risks of cardiovascular disease, hypertension, diabetes, depression, anxiety, and all-cause mortality [3–8]. Changes in sleep, including in quantity and quality, occur throughout the lifespan as individuals age. For example, the National Sleep Foundation recommends that teenagers get 8–10 h of sleep, young and middle-aged adults get 7–9 h of sleep, and older adults get 7–8 h of sleep [9]. Yet, short sleep is a prevalent problem, especially for older adults. One national survey in the USA reported that 24% of adults aged 65 and older were not getting at least 7 h of sleep per night [10]. Moreover, a nationally representative poll on healthy aging reported that 54% of older adults believe that poor sleep is a normal part of aging [11]. Older adults who have short sleep duration are more likely to report pain, frailty, cognitive decline, and lower quality of life [12–16]. Furthermore, 67.7% of older adults report difficulties falling asleep or waking up too early, with 46% reporting difficulties falling asleep at least 1–2 nights per week [17]. Insomnia symptoms in older adults are often more severe, chronic, and impairing than in younger samples. Insomnia in late life has been

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associated with health conditions such as pain, prostate cancer, heart disease, impaired cognition, obesity, and depression [18–21]. Sleep problems and depression are highly comorbid, generally, and in older adults as well, highlighting an important area of investigation.

Depression, a mental disorder characterized by low mood and anhedonia, has been identified as one of the most underfunded and pressing health issues [22–24]. Estimates of the global prevalence of depression in older adults range from 13 to 28% [25, 26]. Depression is seemingly less common among community dwelling older adults; however, this may be due to underdiagnosis [27] and changing clinical presentation [28–33]. Moreover, depression may be more chronic in older adults, as one study observed that 36% of young adults with an initial diagnosis of depression had a diagnosis 2 years later, while 51% of older adults with an initial diagnosis of depression had the diagnosis persist for 2 years [34]. Subclinical depressive symptoms are also common and impactful in late life [35].

Although sleep problems were long thought to be an epiphenomenon of depression (e.g., sleep disturbance being part of the diagnostic criteria of major depressive disorder), it is now widely recognized that sleep and mood have a bi-directional association [36]. In older adults, those who have comorbid insomnia and depression have been observed to have a higher prevalence of Alzheimer's disease and related dementias, as well as greater limitations on activities of daily living (ADLs), than those with either insomnia or depression [37, 38, 12, 39, 40]. Due to the high comorbidity between sleep problems and depression, underlying factors, such as shared neural pathways or altered brain structure and activity, may elucidate important aspects about the nature of this association. For example, it has been observed that depression can be associated with abnormalities and dysregulation in brain areas that overlap with those observed in the pathophysiology of insomnia [22, 41]. Given the impacts that sleep problems and depression symptoms can have on the well-being of older adults, elucidating the nature and underlying factors of the bi-directional association between sleep problems and depression remains a pressing research priority for the field [42].

This review aims to synthesize and report on current research findings (i.e., last 1–4 years) regarding the link between sleep duration and depression and the link between insomnia and depression in older adults. A review of recent literature was conducted using PubMed, including only articles that were published from 2019 to 2023. Articles were included if at least 95% of the sample comprised adults aged 60 years or older and if the study included measurement of depression and sleep duration or insomnia as variables of interest. The review is organized by first providing a summary of findings regarding sleep duration and depression and then summarizing findings regarding insomnia and depression.

Refer to Table 1 for a summary of studies focused on sleep duration and depression. Refer to Table 2 for a summary of studies focused on insomnia and depression.

Sleep Duration and Depression

Sleep duration is one of the most recognizable characteristics of sleep and is associated with various aspects of an individual's health and well-being [3, 4]. For example, individuals with depression often experience sleep disturbances such as hypersomnia or insomnia. Recent research has highlighted that short (less than 6–7 h) and long (more than 8–9 h) sleep durations are risk factors for depression and increased depression symptoms in older adults. For example, one recent meta-analysis, and a recent study in Taiwanese older adults, observed a u-shaped association between nighttime sleep duration and risk of depression, such that the lowest risk was at 7 h of sleep and higher risks were at both short and long sleep durations [43, 44]. Hu and colleagues found that short and long sleep durations were associated with increased depression symptoms which were then associated with poorer quality of life in older adults [12•]. The u-shaped association between sleep duration and depression symptoms may, in part, be reflective of individual differences. Zuidersma and colleagues did a series of 8 single subject studies that tracked sleep and depression symptoms over 63 consecutive days in older adults and found that individuals displayed unique patterns of associations between sleep duration and subsequent depression symptoms. For example, for some older adults, long sleep duration was related to depression symptoms; however, in other older adults, short sleep duration was associated with increased depression symptoms. Interestingly, changes in depression symptoms were not predictive of subsequent changes in sleep duration for any of the participants [45]. One potential explanation for these disparate results may be that different combinations of depression symptoms can lead to either more or less sleep. For example, ruminative thinking and psychomotor agitation may lead to less sleep while increased fatigue and low mood may lead to more sleep.

Sleep Duration, Depression, and Other Clinical Factors

Short or long sleep duration combined with depression can potentially lead to an individual feeling more fatigued and less motivated during the day, which can heighten adverse health consequences. Several recent studies investigated changes in sleep duration and depression symptoms during the transition from pre- to peri-pandemic in older adults. Mishra and colleagues observed that depression symptoms significantly increased during the initial phases of the COVID-19 pandemic and that this increase was associated with a decline in both time in bed and physical activity [46]. The increase in

Table 1 Studies investigating sleep duration and depression in older adults (n = 18)

Author, year	Sample	Methods/study design	Measures	Outcomes/findings
Amerio et al. (2023) [47]	Representative of Lombardy region in Italy, 4400 older adults (65+) (42.5% response rate)	Telephone-based survey, Nov 17–30 2020, assessed symptoms during COVID-19 (November 2020) and asked about symptoms during 2019	Depression: PHQ-2 Sleep: 2 items from PSQI for sleep quality and quantity	Prevalence of depression symptoms increased from 7.8 to 16.5% while prevalence of low sleep duration (<6 h) increased from 35.2 to 39.5%. Decreases in physical activity were associated with worsening sleep duration and depressive symptoms
Chen et al. (2019) [13]	Older adults (65+), using two samples (one Japanese and one from Singapore), with over 2888 in Japan and 2111 in Singapore	Cross-sectional clinical interviews	Depression: CES-D Sleep: Clinical interview, asked about duration, restlessness, and non-restorative sleep	Short sleep duration predicted pain, multiple pain locations, and pain-related disability occurring 3 years later, while controlling for depression
Hu et al. (2022) [12•]	52,551 older adults (60+) from UK Biobank study	UK Biobank is a large prospective cohort study	Depression: PHQ-2 Sleep: Self-report Sleep duration Other measures: European Quality of Life-5	U-shaped association between sleep duration and HRQoL (≤5 and ≥10) were associated with poorer quality of life). Depression was associated with poorer quality of life. Depression mediated the association between sleep duration and HRQoL. Physical activities moderated the mediating effect of depression, such that those with higher physical activities had better quality of life
Hudon et al. (2020) [15•]	Median initial age of participants in studies was 73	Meta-analysis: included 18 studies	Measures were dependent on individual studies	Depression and sleep duration (long and short) were most consistent and robust predictors of subsequent cognitive decline, with depression being a consistent predictor of Alzheimer's disease
Li et al. (2023) [43]	Middle-aged and older adults from 6 studies	Meta-analysis and dose–response analysis	Measures were dependent on individual studies	U-shaped curve between sleep duration and risk of depression, with lowest risk of depression at 7 h. In non-Asians, it was only short sleep duration that was associated with increased risk of depression while in Asian populations it was both short and long sleep duration
Lin et al. (2021) [44]	1068 older Taiwanese adults	Telephone survey	Depression: CES-D Sleep: Sleep duration from PSQI	Non-linear associations between sleep duration and depression, <4 h per night was highest risk for depression

Table 1 (continued)

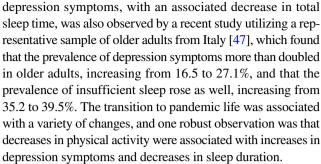| Author, year	Sample	Methods/study design	Measures	Outcomes/findings
Liu et al. (2021) [14•]	5026 Chinese older adults (60+)	Prospective, cohort longitudinal study	Depression: CES-D Sleep: Self-report sleep duration Other measures: frailty	Transitioning from robust to prefrail/frail was associated with higher depression and short sleep duration accelerated this association. Transitioning from prefrail to frail was associated with higher depression and short sleep duration
Liu et al. (2023) [33]	9789 Chinese older adults (60+)	Used fourth round of data from longitudinal study which is the study same as above	Depression: CES-D Sleep: Self-report sleep duration Other measures: Number of chronic diseases	Adults with at least one chronic condition were more likely to have depression than those without any conditions and this held after controlling for various variables, including sleep Short sleep duration was associated with higher prevalence of depression
Luo et al. (2022) [29]	49,317 Chinese adults from 8 health centers in 6 provinces (mean age was 67)	Cross-sectional survey between January 2015 and December 2020	Depression: PHQ-9 Sleep: Self-report sleep duration Other measures: Sedentary time	Sedentary behaviors for > 6 h was a risk factor for depressive symptoms. Sleep duration < 7 h was a risk factor for depression
Lyu et al. (2023) [40]	15 studies with 6,391 participants aged 60 +	Systematic review and meta-analysis	Measures were dependent on individual studies	Prevalence of cognitive frailty was 11%. Age (75+), short sleep (<5 h), and depression were risk factors of cognitive frailty. Regular exercise was a protective factor against frailty
Mishra et al. (2021) [46]	10 older adults (75 +)	Assessed 3-month pre pandemic to 6-month post pandemic with a pendant-wearable system	Depression: CES-D Sleep: time in bed, measured through wearable pendant	Depression symptoms significantly worsened, time spent standing and walking decreased, while time spent sitting increased. Increased depression was associated with increased sitting time and shorter sleep duration and less physical activity
Morgan and Hartescu (2019) [50]	1002 randomly sampled older adults (65 +)	face to face interviews in 1985, deaths recorded in 2012 census	Depression: Symptoms of Anxiety and Depression scale Sleep: Self-report sleep duration and time in bed	Sleep duration had a u-shaped association with functional capacity. Long sleep duration (> 9 h) and hypnotic use were associated with increased mortality although this became non-significant when adjusting for frailty. Low physical activity was associated with increased mortality

Table 1 (continued)

Author, year	Sample	Methods/study design	Measures	Outcomes/findings
Ren et al. (2021) [52]	9692 older adults (65+) from Chinese longitudinal study (2011–2015)	Used parametric g-formula (statistical method) to evaluate risk of falls depending on hypothetical interventions	Depression: CES-D; Sleep: Self-report sleep duration; Other measures: Risk of falls	Hypothetically increasing sleep duration or decreasing depression symptoms was associated with significantly lower risk of falls. Hypothetical multicomponent interventions decreased risk of falls more than single component interventions
Seo and Son (2022) [49]	168 Korean older adults with heart failure (65+)	Cross-sectional survey	Depression: PHQ-9; Sleep: Self-reported sleep duration	Sleeping for more than 8 h and having depression was associated with a greater risk of cognitive frailty compared to those who only slept more than 8 h, or those who only had depression. Short sleep duration was not associated with cognitive frailty
Winer et al. (2021) [48•]	4417 individuals aged 65 to 85 years	Cross-sectional, participants underwent an PET scan, had complete apolipoprotein E (APOE) genotype data, and did a neuropsychological assessment	Depression: GDS; Sleep: self-reported sleep duration; Other measures: Amyloid-beta plaque burden	Both short and long sleep durations were associated with worse outcomes for older adults, such as greater Aβ burden, greater depressive symptoms, higher body mass index, and cognitive decline
Zaidel et al. (2021) [39]	4201 adults ages 65+ years with diagnosed back pain, osteoarthritis, and/or rheumatoid arthritis, and at least 1 year of continuous medical and drug plan enrollment	Cross-sectional survey made by UnitedHealthcare and distributed in May and June 2018	Depression: PHQ-2; Sleep: Sleep quality and duration questions from PSQI; Other measures: Perceived stress, Resilience	More than half of the older adults with chronic pain reported at least 1 sleep problem. Sleep quality and duration were associated most strongly with psychological and psychosocial factors. Strongest predictors of poor sleep quality and short sleep duration included medium and high levels of perceived stress and depression
Zhang et al. (2023) [51]	4819 respondents 60+	China Health and Retirement Longitudinal Study (CHARLS), parametric g-formula was used to estimate 7-year cumulative cognitive impairment risks among older Chinese adults	Depression: CES-D; Sleep: Self-report sleep duration; Other measures: social activity, physical activity, intellectual activity	Hypothetical interventions on depression, sleep duration, and intellectual activity reduced cognitive impairment risks

Table 1 (continued)

Author, year	Sample	Methods/study design	Measures	Outcomes/findings
Zuidersma et al. (2022) [45]	8 psychiatric patients, 60+, major depressive disorder, dementia or mild cognitive impairment	Idiographic single-subject study design. Each participant completed 63 assessments of depression, sleep, and cognitive functioning using a diary and actigraphy	Depression: PHQ-8 Sleep: Duration assessed with daily diaries and actigraphy	Longer sleep duration in one participant was associated with more depressive symptoms in subsequent days. For two participants, changes in sleep led to more or less depressive symptoms. Changes in depressive symptoms were not associated with subsequent changes in sleep

GDS Geriatric Depression Scale, *CES-D* Center for Epidemiological Studies Depression Scale, *PHQ-2* Patient Health Questionnaire-2, *PHQ-9* Patient Health Questionnaire-9, *HRQoL* Health-related Quality of Life, *PSQI* Pittsburgh Sleep Quality Index

depression symptoms, with an associated decrease in total sleep time, was also observed by a recent study utilizing a representative sample of older adults from Italy [47], which found that the prevalence of depression symptoms more than doubled in older adults, increasing from 16.5 to 27.1%, and that the prevalence of insufficient sleep rose as well, increasing from 35.2 to 39.5%. The transition to pandemic life was associated with a variety of changes, and one robust observation was that decreases in physical activity were associated with increases in depression symptoms and decreases in sleep duration.

Several recent studies have highlighted clinical characteristics that are associated with both sleep duration and depression. For example, a meta-analysis demonstrated that depression and sleep duration (long and short) were consistent and robust predictors of subsequent cognitive decline [15•]. This finding was further clarified by a cross-sectional study of 4417 older adults that found that both short and long sleep durations were associated with increased depression symptoms, sharper cognitive decline, and increased amyloid-β burden [48•]. In another meta-analysis that pooled over 6000 participants, depression symptoms and short sleep duration were risk factors of cognitive frailty, while a separate study observed that long sleep duration and depression symptoms were also associated with cognitive frailty [40, 49]. A longitudinal, prospective cohort study done in 5026 Chinese older adults observed that short sleep duration accelerated the transition to frailty in older adults [14•]. Moreover, a study that utilized a random sample of older adults observed that both short and long sleep duration were associated with decreased functional capacity [50]. Two studies, using a statistical method to model probabilities, reported that independent hypothetical increases in sleep duration and decreases in depression symptoms were associated with significantly lower risks of falls and long-term risk of cognitive impairment [51, 52]. Moreover, these studies indicated that the effects of hypothetical interventions could be additive, such that multicomponent interventions targeting both sleep and depression could be more effective than just treating one or the other. Overall, these results suggest that treatments aimed at improving sleep duration and depression may have potential to improve other clinical characteristics, such as falls and cognitive impairment. However, more studies need to be conducted to directly test this hypothesis.

Insomnia and Depression

One of the diagnostic criteria for depression is sleep disturbance, specifically experiencing symptoms of hypersomnia or insomnia. Insomnia and depression are highly comorbid in older adults and across the lifespan. One epidemiologic study in individuals aged 16–74, estimated that 40.5% of individuals with depression meet criteria for a DSM-IV insomnia

Table 2 Studies investigating insomnia and depression in older adults (n = 34)

Author, year	Sample	Methods/study design	Measures	Outcomes/findings
Bazargan et al. (2019) [61]	Convenience sample of 398 African American older adults (65 +) from low SES area of LA	Survey	Depression: GDS Sleep: ISI	ISI total score was predicted by GDS scores, GDS predicted ISI factor 2 (items 5–7) but not factor 1 (items 1–4)
Bentham and Eaves (2022) [76]	11 studies included, only 2 focused on depression	Systematic review identifying CBT interventions in OA	Measures were dependent on the studies	CBT-I by itself and with components specifically for depression both led to significant decreases in depression and insomnia
Bolstad and Nadorff (2020) [62]	133 Older adults (65 +) from Mturk, half had income <35 K	Amazon MTurk online survey	Depression: GDS Sleep: ISI, used first three items to determine type of insomnia	Maintenance insomnia was the only type associated with depression while controlling for anxiety
Chao et al. (2022) [31]	2829 adults (95% of sample was greater than 60)	Prospective, observational study (did one visit pre March 2020, and one visit from July to December 2020)	Depression: PHQ-8 Sleep: Women's health initiative insomnia rating scale	There was a significant increase in depressive symptoms, significant decrease in insomnia symptoms but the prevalence of insomnia did not decrease (with insomnia being the most common condition). The increase in depression symptoms was not associated with insomnia
Chen and Saito (2021) [32•]	2006 wave of Health and Retirement study (recruited 50 + but 95% of sample was 60 +)	HRS used multistage probability sampling design	Depression: CES-D Sleep: Measured insomnia subtypes with a single question for each subtype	Onset insomnia was associated with depression onset on 2- and 4-year follow-up, maintenance insomnia was not associated with onset of depression at follow up, waking up too early was associated with onset at 2 years. Non-restorative sleep was associated with depression onset at all follow-up periods
Danhauer et al. (2022) [79]	Community-dwelling older adults (60 +), had 125 randomized to each treatment group	Randomized to 2 groups, one which did telephone CBT-I and in-person yoga	Depression: PROMIS-29 for depression Sleep: ISI	Significant decreases in insomnia and depression in both groups at week 11 and after 6 months
Falgàs et al. (2021) [60]	120 healthy older adults (65 +)	Convenience sample. Conducted a neurological evaluation, neuropsych assessment, clinical interview, and 3 T MRI scan	Depression: GDS Sleep: ISI Other measures: Berlin Sleep Questionnaire (for sleep apnea)	When adjusting by GDS, right ventral orbitofrontal and temporo-parietal junction, left insula were significantly correlated with insomnia symptoms. When adjusting for multiple comparisons, the results were no longer significant

Table 2 (continued)

Author, year	Sample	Methods/study design	Measures	Outcomes/findings
Gallo et al. (2020) [63•]	599 adults (60+) meeting criteria for MDD or clinically significant minor depression in primary care settings	Multisite, collaborative primary care study with 12-month follow-up	Depression: HAM-D without sleep items Sleep: HAM-D sleep items (difficulty falling asleep, waking up during the night, difficulty waking up in the morning) Other measures: Scale for suicidal ideation	Patients with worsening sleep disturbance were significantly more likely (OR = 28.6) to have MDD or clinically significant minor depression and suicidal ideation and were less likely to be in remission at follow-up. Patients with persistent sleep disturbance showed similar pattern as those who had worsened sleep disturbance, but they were attenuated (association with SI was not significant)
Hill Almeida et al. (2022) [8]	Random sample of 5547 men aged 70–89 years	Prospective cohort study of a community sample, followed for up to 17 years	Depression: GDS, PHQ-9 Sleep: Asked yes/no about the following: taking a long time to get to sleep, lying awake most of the night, worry keeping participant awake, waking up early hours, sleeping badly	Insomnia symptoms were associated with increased incidence of depression and mortality These results stayed significant even when adjusting for age, sex, education, smoking, and frailty
Irwin et al. (2022) [77]	291 older adults (60+) from community with insomnia disorder and no MDD	Randomized to 2 months of CBT-i or Sleep Education Therapy (SET)	Depression: Incident MDD diagnosed by interview and DSM-5 criteria Sleep: Diagnosis of insomnia disorder	CBT-I group was associated with significantly less likelihood of incident depression
Ji and Fu (2021) [65]	2068 older adults (65+) from multiple sites in communities	Multistep sampling method to recruit participants with sleep complaints. Had participants complete a clinical interview	Depression: CES-D Sleep: ISI (used 3 factor solution)	Onset age of insomnia was not a significant indicator of depression, while nighttime symptoms of insomnia and depression were risk factors for cognitive decline
Kazan et al. (2023) [64]	20 older adults (60+)	Prospective, cross-lagged, panel design with 12 weeks of follow-up	Depression: Montgomery-Asberg depression scale Sleep: ISI Other measures: physical activity	Higher depressive symptom burden was a significant predictor of greater insomnia, increased stress, and less physical activity, the following week
Kennair et al. (2022) [74]	Representative sample of a municipality in Norway (Trondheim), 1069 older adults 60+	Self-report survey	Depression: PHQ-ADS Sleep: ISI	About 15% of sample had at least mild symptoms of depression/anxiety, while 18% reported insomnia symptoms. Depression and insomnia were associated with poorer quality of life, especially when having higher symptoms of each
Kunicki et al. (2023) [37]	373,897 veterans admitted to a sample of 129 VA medical centers with primary diagnosis of heart failure. Mean age of sample was 72	Secondary data analyses of mortality and diagnoses from medical records	Depression: Depressive episodes from MDD or Bipolar 1 diagnosis Sleep: Insomnia diagnosis Other measures: Alzheimer's and related dementias diagnoses	Those with comorbid insomnia and depression had a higher prevalence of Alzheimer's and related dementias

Table 2 (continued)

Author, year	Sample	Methods/study design	Measures	Outcomes/findings
Li et al. (2020) [69]	2558 older adults from NHATS	Secondary data analyses of survey data from NHATS	Depression: PHQ-2 Sleep: two questions about difficulty falling asleep and staying asleep Other measures: Number of falls	22.6% of sample reported insomnia symptoms and 9.9% reported depressive symptoms. Depressive symptoms independently predicted falls, but insomnia symptoms did not, and there were no interaction effects
Lin et al. (2022) [54]	1100 Taiwanese older adults (65+)	Cross-sectional survey	Depression: GDS Sleep: PSQI >= 6 for insomnia	Insomnia was associated with depression, and depression was associated with physical and oral frailty in dose–response manner
Liu et al. (2021) [68]	7609 older adults (65+) from NHATS	Cross-sectional analysis of NHATS	Depression: PHQ-2 Sleep: 2 questions asking about insomnia symptoms (difficulty falling asleep and staying asleep) Other measures: frailty	Insomnia symptoms, depression, and pain were all associated with frailty. When including them all in logistic reg model, everything was significant except for difficulty staying asleep. Significant interactions between difficulty falling asleep and depression were found
Liu et al. (2019) [75]	2976 patients with primary diagnosis of osteoarthritis (OA) (60+)	ISI, PHQ-8, Healthcare use extracted from health records for three years	Depression: PHQ-8 Sleep: ISI Other measures: Healthcare use	Pain increased all HCU, depression increased office visits, length of stay, and costs, and insomnia decreased length of stay. Increased severity of insomnia and depression greatly increased utilization
Luyster et al. (2020) [38•]	278 older adults with asthma (60+) from NHANES (2005–2008)	Face-to-face interviews and self-report health measures	Depression: PHQ-9 Sleep: 3 questions for insomnia (difficulty falling asleep, staying asleep, or waking up too early)	Insomnia was not independently associated with ADL limitations, while depression was. Comorbid insomnia and depression were significantly more likely to have ADL limitations than just having insomnia or just having depression
McCurry et al. (2021) [78]	327 older adults (60+) with comorbid insomnia and OA pain	6 20–30 min telephone sessions over 8 weeks getting CBT-I	Depression: PHQ-8 Sleep: ISI	Significant decreases in ISI scores over 2 months in CBT-I group. At 12-month follow-up, 56.3% of CBT-I group remained in remission for insomnia. There was no significance for depression

Table 2 (continued)

Author, year	Sample	Methods/study design	Measures	Outcomes/findings
McLaren et al. (2023) [82]	15 studies with 498 older adults (65 +)	Meta-analysis	Behavioral interventions generally included: stimulus control and sleep restriction, sleep hygiene, and/or psychoeducation	All behavioral interventions improved self-reported aspects of sleep (SOL, WASO) while actigraphic and poly-somnographic outcomes were smaller or no effect. Multicomponent interventions demonstrated improvements in depression
Ramos et al. (2022) [66]	14 articles with people 65 +	Integrative review	Measures were dependent on the individual studies	Insomnia, depression, and frailty were all risk factors for post-operative delirium
Rojo-Wissar et al. (2021) [55]	1049 from Baltimore longitudinal study on aging (60+)	Surveys and interviews	Depression: CES-D. Sleep: Women's health initiative insomnia rating scale. Other measures: NEO-PI-R	Showed that neuroticism was associated with increased insomnia symptoms while conscientiousness was associated with lower insomnia symptoms while adjusting for depression
Rosas et al. (2022) [56]	438 older adults (65 +) with hypertension	Cross-sectional observational study	Depression: GDS. Sleep: 4 questions for insomnia symptoms (difficulty falling asleep, wake up too early, "sleep badly at night")	Those who endorsed more insomnia symptoms (and those who endorsed waking up too early) had higher depressive symptoms
Tanaka et al. (2019) [81]	47 older adults	One 60-min group session of CBT-I, followed by one 45-min individual CBT-I session and 2 follow-up telephone sessions	Depression: GDS. Sleep: PSQI for insomnia symptoms. Other measures:	This study did show that the brief CBT-I was effective in reducing depression symptoms. However, there was not a significant change in PSQI scores
Tsaras et al. (2022) [73]	200 older (60+) from a municipality in Greece	Cross-sectional study	Depression: GDS. Sleep: Athens Insomnia Scale. Other measures: WHO Quality of Life Scale	Prevalence of depression, insomnia, and comorbid insomnia and depression were 28%, 40.5%, and 19%, respectively. Depression and insomnia were negatively correlated with quality of life. Comorbid insomnia and depression was associated with lower physical health, psychological health, and social relationships
Tsaras et al. (2021) [57]	250 older (60+) adults in Greece stratified random sampling	Cross-sectional survey study	Depression: GDS. Sleep: Athens Insomnia Scale	Prevalence of depression was 28.4% and insomnia was 39.2%. Found that insomnia and depression were both significant risk factors for each other
Unsal et al. (2021) [70]	122 (65+) adults (47 insomnia, 75 controls)	Self-report questionnaires and neuropsychological assessments	Depression: GDS. Sleep: ISI, Insomnia diagnosis according to ICSD-3. Other measures: Number of falls	Falls were more common in the insomnia group and they had higher fear of falls. Depression was independently associated with insomnia

Table 2 (continued)

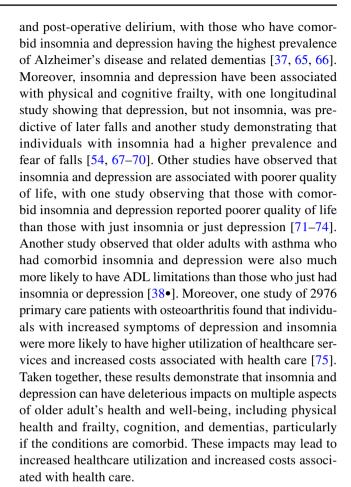| Author, year	Sample	Methods/study design	Measures	Outcomes/findings
Vitiello et al. (2022) [80•]	327 older adults (60+) primary care patients with chronic OA pain and insomnia	RCT with a CBT-I group and education group	Depression: PHQ-8 Sleep: ISI Other measures: Brief pain inventory	Those who improved their sleep or pain in short-term (2 months) were more likely to have improved in their sleep, pain, depression, and fatigue at the 12-month follow-up
Wang et al. (2021) [58]	632 60+ older adult in Chinese older adults	Cross-sectional observational survey	Depression: PHQ-9 Sleep: 3 questions for insomnia (diff falling asleep, maintaining sleep, early wake)	Higher altitude was associated with higher depression. Insomnia is associated with higher likelihood of depression, even when controlling for altitude
Xie et al. (2021) [67]	1585 older adults who lived in community, were 75 years or older and without a clinical diagnosis of dementia	Cross-sectional study, 45-min face-to-face interviews to complete questionnaires	Depression: GDS-15 Sleep: "asked whether they slept well, had insomnia occasionally, or had insomnia every day" Other measures: Frailty and MMSE-Chinese	Depression and sleep problems increased the risk of cognitive frailty
Yang et al. (2021) [71]	871 older adults	Cross-sectional study	Depression: Chinese CES-D Sleep: ISI Other measures: WHO-Quality of Life Brief version	Older adults with depressive symptoms, insomnia symptoms, and comorbid depressive and insomnia symptoms had lower scores in QoL compared to those without
Zhao et al. (2019) [72]	323 older adults living in nursing homes (60+)	Cross-sectional survey	Depression: GDS Sleep: Athens Insomnia Scale Other measures: MMSE, 36-item Short Form Health Survey	Insomnia and depression symptoms were both negatively related to HRQoL. Depression symptoms mediated the relationship between insomnia and HRQoL
Zhong et al. (2022) [59]	791 elderly patients in urban and rural primary care centers in China	Large-scale cross-sectional survey, two-stage consecutive sampling	Depression: GDS Sleep: ISI	219 patients (28.9%) had clinical insomnia (ISI score ≥ 15) during the past 2 weeks. Significantly higher rates of clinical insomnia were associated with hypertension, heart disease, COPD, arthritis, and depressive symptoms

ISI Insomnia Severity Index, *GDS* Geriatric Depression Scale, *CES-D* Center for Epidemiological Studies Depression Scale, *PHQ-9* Patient Health Questionnaire-9, *MMSE* Mini-Mental Status Exam, *QoL* Quality of Life, *HRQoL* Health-related Quality of Life, *PSQI* Pittsburgh Sleep Quality Index, *NEO-PI-R* NEO Personality Inventory Revised, *ICD* International Classification of Diseases, *ICSD-3* International Classification of Sleep Disorders, 3rd edition, *SOL* Sleep Onset Latency, *WASO* Wake After Sleep Onset

disorder diagnosis, with an estimated 83.2% having difficulty falling asleep or staying asleep [53]. In older adults, symptoms of insomnia are consistently associated with depression symptoms across a variety of samples and settings [8, 54–59]. However, there is still uncertainty about the specific details of this association. To elucidate underlying factors of this association, one study investigated how brain structures were associated with symptoms of insomnia and depression and found that lower cortical thickness in various brain areas, including the left insula, were associated with increased insomnia symptoms when adjusting for depression symptoms [60]. Other recent efforts have sought to examine how types of insomnia symptoms are associated with depression. For example, one study of Black adults found that depression symptoms were associated with the daytime symptoms of insomnia on the Insomnia Severity Index (ISI) and not the nighttime symptoms [61]. Another study observed that maintenance insomnia endorsed on the ISI (i.e., primary difficulty of staying asleep) was the only insomnia type associated with depression symptoms after controlling for anxiety [62]. However, a longitudinal study which investigated whether insomnia types predicted the onset of depression at 2-, 4-, and 6-year follow-ups found that maintenance insomnia did not predict the onset of depression symptoms at any follow-up, while early morning awakening (i.e., primary difficulty of waking up too early and not falling back to sleep) and sleep-onset (i.e., primary difficulty of falling asleep) types predicted depression onset at the 2-year follow-up, while nonrestorative sleep predicted the onset of depression at all follow-up time points [32•]. Another study investigated whether changes in sleep disturbance predicted a diagnosis of major depressive disorder and suicidal ideation 1 year later in older adult primary care patients and found that patients with worsening sleep disturbances were much more likely to have MDD and suicidal ideation and less likely to be in remission than those whose sleep disturbance persisted at a similar level [63•]. Taken together, these results suggest that insomnia symptoms play a significant role in subsequent depression symptoms and depressive episodes. However, there are mixed findings about the role that specific insomnia symptom types play in the subsequent development of depression. Moreover, a study that utilized a prospective, cross-lagged panel design observed that higher depression symptom burden was a significant predictor of increased insomnia symptoms the following week, thereby demonstrating that depression symptoms can also precede insomnia symptoms [64]. Thus, the association between insomnia and depression appears to be bi-directional in late life.

Insomnia, Depression, and Other Clinical Characteristics in Older Adults

Several studies have observed that both insomnia and depression are independent risk factors for cognitive decline

and post-operative delirium, with those who have comorbid insomnia and depression having the highest prevalence of Alzheimer's disease and related dementias [37, 65, 66]. Moreover, insomnia and depression have been associated with physical and cognitive frailty, with one longitudinal study showing that depression, but not insomnia, was predictive of later falls and another study demonstrating that individuals with insomnia had a higher prevalence and fear of falls [54, 67–70]. Other studies have observed that insomnia and depression are associated with poorer quality of life, with one study observing that those with comorbid insomnia and depression reported poorer quality of life than those with just insomnia or just depression [71–74]. Another study observed that older adults with asthma who had comorbid insomnia and depression were also much more likely to have ADL limitations than those who just had insomnia or depression [38•]. Moreover, one study of 2976 primary care patients with osteoarthritis found that individuals with increased symptoms of depression and insomnia were more likely to have higher utilization of healthcare services and increased costs associated with health care [75]. Taken together, these results demonstrate that insomnia and depression can have deleterious impacts on multiple aspects of older adult's health and well-being, including physical health and frailty, cognition, and dementias, particularly if the conditions are comorbid. These impacts may lead to increased healthcare utilization and increased costs associated with health care.

Treatment for Insomnia and Depression in Older Adults

Several studies have investigated the effects of treatments for insomnia and depression, with a particular emphasis on whether treatments for insomnia also reduce symptoms of depression or vice versa. For example, one systematic review examined whether cognitive-behavioral interventions in depressed and anxious older adults would also improve sleep disturbances and only found two studies that investigated this issue [76]. The two studies demonstrated evidence that Cognitive-Behavioral Therapy for Insomnia (CBT-I) in depressed and anxious older adults reduced both depression symptoms and sleep disturbances, although more research is clearly needed [76]. In another study, a group that was randomized to just 2 months of CBT-I had significantly less likelihood of incident depression than a group which received sleep education therapy [77]. One randomized controlled trial of 327 older adults with comorbid insomnia and osteoarthritis pain found that those who got six 30-min telephone sessions of CBT-I had significant decreases in insomnia symptoms over a 12-month period, but no significant decreases in depression symptoms, while a different study utilizing telephone CBT-I found significant decreases in both insomnia and depression across 6 months in the CBT-I group [78, 79]. A secondary

analysis of these same data showed that those who improved their insomnia or pain in the first 2 months were more likely to have improved in their sleep, pain, depression, and fatigue at the 12-month follow-up [80•]. Yet, another randomized controlled trial with 47 older adults found that a brief CBT-I intervention was effective in reducing depression symptoms but not effective in producing a change in global sleep quality [81]. A systematic review from McLaren and colleagues investigated whether behavioral interventions for insomnia, such as stimulus control and sleep restriction, were effective in reducing insomnia and mood symptoms [82]. This review found that all behavioral interventions reviewed improved self-reported aspects of sleep and also improved depression symptoms [82]. Overall, a greater preponderance of evidence suggests that interventions targeting sleep, including CBT-I and behavioral interventions, may also be efficacious in reducing depression symptoms, although this also may depend on treatment modality (e.g., in-person vs. online vs. telephone). Future research that investigates which treatments, and which components of those treatments, are most effective in reducing insomnia and depression when they are comorbid would help elucidate when treatments are most effective.

Summary

Sleep problems and depression are prevalent phenomena in older adults, especially in clinical settings. While changes in sleep, including decreases in sleep duration and quality, can be a normal part of the aging process, poor sleep does not have to be part of the aging experience. Short and long sleep duration are associated with adverse impacts on the health and well-being of older adults and are particularly important risk factors for depression in older adults. Sleep duration and depression are also risk factors for other important clinical characteristics including cognitive and physical frailty, cognitive decline, and poorer quality of life. Importantly, sleep duration and depression symptoms are modifiable and treatable, with recent hypothetical interventions demonstrating that improvements in sleep duration and depression symptoms should lead to decreased risk of falls and cognitive impairment. Public health interventions aimed at promoting healthy sleep opportunity (i.e., setting aside enough time to get 7–8 h of sleep at night) and practices (e.g., regular bedtime and waketime, sleeping in a dark, quiet, and cool environment) may help improve the public's sleep health and mental health as well. Insomnia and depression are highly comorbid phenomena in older adults, and when these phenomena are comorbid, the deleterious impacts on health appear to be additive. Because of the high patient burden and healthcare costs of insomnia and depression, there have been efforts to investigate potential interventions that reduce symptoms of both disorders at once. Several studies demonstrated that CBT-I and multicomponent behavioral interventions are effective in reducing both insomnia and mood symptoms, while other research has not had similar success in demonstrating these effects. Future research that investigates whether different treatment modalities (e.g., in-person, online, and telephone) affect the outcomes of these interventions, including the efficacy of improving both insomnia and depression symptoms, may have particular implications in expanding the accessibility of treatments to older adults. Moreover, investigating participant characteristics, such as various health comorbidities that are especially prevalent in older adults (e.g., osteoarthritis and dementia), may have important implications on the generalizability of treatment studies.

Limitations and Future Directions

While exciting work has been and continues to be done in the field, it is important to consider the recent research findings in light of a few limitations. Firstly, many studies are cross-sectional in nature. While cross-sectional studies are important and informative in their own right, more temporal research designs (e.g., longitudinal and cohort studies) would benefit the field, as these designs allow researchers to examine directionality in the associations between sleep problems and depression. Investigating directionality in these associations will have clear implications for treatment considerations. Another limitation of recent research is that sleep duration is frequently measured using self-report data. Utilizing behavioral measures of sleep duration (e.g., actigraphy and other accelerometers) would have the benefit of assessing sleep–wake activity rhythms in a person's natural environment across several days which may have the potential to elucidate how changes in activity rhythms across both sleep and wake are associated with changes in depression [83]. Moreover, prospectively measuring sleep duration could also enhance our understanding of the complex interplay between sleep and depression, as it would allow for researchers to examine whether inter-individual and intra-individual fluctuation in sleep duration is associated with changes in depression symptoms. A final limitation of current research is that many intervention studies have small sample sizes, which limits the statistical power of the studies and the generalizability of the effects observed. Including more participants, especially those with comorbid conditions, could help determine which interventions are most effective for a variety of older adults.

Conclusions

This review summarized and synthesized recent research investigating the link between sleep duration and depression and the link between insomnia and depression in

older adults. Recent studies demonstrated that both short (< 7 h) and long (> 8–9 h) sleep durations and insomnia are independent and important risk factors for depression. Moreover, short and long sleep durations, insomnia, and depression are risk factors for poorer health in older adults, including increased risk of cognitive decline and falls, and poorer quality of life. Importantly, sleep and depression are modifiable, and studies have suggested that interventions that improve sleep duration or insomnia (e.g., CBT-I) may also improve depression symptoms. Future research that examines whether inter-individual and intra-individual fluctuations in sleep duration and insomnia are associated with changes in depression symptoms may have important implications regarding the directionality of the association between sleep and depression in older adults, which may then lead to refinements in current treatments.

Declarations

Conflict of Interest The authors declare no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Disclaimer The views, opinions, and/or findings contained in this article are those of the authors and should not be construed as an official National Sleep Foundation position, policy or decision, unless so designated by other official documentation.

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