

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

**Development of a multi-component intervention to promote sleep in persons with dementia transitioning from hospital to home**

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### **Abstract**

**Background and objectives:** Hospitalized older persons with dementia are commonly discharged with intensified sleep disturbances. These disturbances can impede the recovery process. Nurses are well-positioned to assist persons with dementia and their family caregivers in managing sleep disturbances during the transition from hospital to home. In this paper, we describe the development of a multi-component intervention to promote sleep.

**Research design and methods:** We applied three stages of the intervention mapping method to develop a non-pharmacological, multi-component sleep intervention. The first stage involved a review of the literature to generate an understanding of the determinants of sleep disturbances experienced by persons with dementia in hospital and home settings. The second stage consisted of a literature review to identify therapies for managing commonly reported determinants of sleep disturbances. The third stage entailed delineation of the intervention components.

**Results:** The most common determinants of sleep disturbances experienced by persons with dementia in hospital and home settings were: physiological changes associated with aging, sleep environments non-conducive to sleep, limited exposure to light and engagement in physical activity, stress, and sleep-related beliefs and behaviors. Therapies found effective included: light therapy, physical activity therapy, sleep hygiene, and stimulus control therapy. These therapies were integrated into a multi-component sleep intervention to be provided using the teach-back technique, during and following hospitalization.

**Discussion and implications:** Consistent with the principles of patient engagement, the multi-component sleep intervention will be evaluated for its acceptability and feasibility.

*Keywords:* Intervention mapping, Sleep disturbances, Determinants, Older persons, Dementia

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### *Implications for Practice*

What does this research add to existing knowledge in gerontology?

- Hospitalization intensifies sleep disturbances in older persons with dementia, impeding the recovery process at home.
- Personal characteristics and environmental factors in hospital and home settings are significant determinants of sleep disturbances.
- A multi-component intervention was developed to promote sleep during hospital-to-home transition.

What are the implications of this new knowledge for nursing care with older people?

- The multi-component intervention includes evidence-based therapies that address determinants of sleep disturbances.
- Nurses can provide the intervention, using the teach-back technique, during and following hospitalization.

How could the findings be used to influence policy or practice or research or education?

- A systematic process for developing interventions is described and illustrated.
- The acceptability and feasibility of the multi-component intervention are under investigation.

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### **Development of a multi-component intervention to promote sleep in older persons with dementia transitioning from hospital to home**

#### **Background and Objectives**

Sleep disturbances are common behavioral and psychological symptoms of dementia and are experienced by an estimated 70% of older persons with early-to-moderate stage dementia worldwide (Oliveira et al., 2015; Wennberg, Wu, Rosenberg & Spira, 2018). Older persons with dementia (PWD) have higher rates of hospital admission than persons without dementia (Afonso-Argilés, et al., 2020; Shepherd et al., 2019) as well as longer lengths of hospital stay as reported in a systematic review (Möllers et al., 2019). In general, hospitalization is stressful, and hospitals are notorious for disrupting sleep (Clark & Mills, 2017). Hospital environments are often busy with care provided around the clock (e.g., frequent assessment and treatment), noisy (with noise levels frequently exceeding those recommended by the World Health Organization; Delaney, Currie, Huang, Lopez, & Van Haren, 2018), and brightly lit (Kulpatcharapong et al., 2020). Therefore, PWD are commonly discharged home with intensified sleep disturbances.

Both in-hospital and post-discharge, sleep disturbances can impede the recovery process and negatively impact the quality of life of PWD. Abundant international evidence has established that reduced sleep duration and quality compromise the immune system; heighten the risk for various diseases; increase health services utilization and mortality rates (Bhaskar, Hemavathy, & Prasad, 2016; Medic, Wille, & Hemels, 2017); and impair daytime functioning reflected in altered cognitive performance (e.g., poor concentration) and mood (e.g., depressive symptoms). Further, sleep disturbances are associated with daytime fatigue; fatigue increases daytime sleepiness and limits engagement in activities of daily living, and post-discharge treatment and rehabilitation (Léger & Bayon, 2010).

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Internationally, nurses engage in holistic care, which involves comprehensive assessment and delivery of care that is responsive to older persons' needs (Sidani & Fox, 2014). Therefore, nurses are well-positioned to assist PWD and their family caregivers in managing sleep disturbances during the transition from hospital to home. Management of sleep disturbances will enhance physical and psycho-social functions, which are necessary to promote recovery and mitigate the negative impact of sleep disturbances on health and quality of life. Although some recommendations for managing the care of PWD are available (Fazio, Pace, Maslow, Zimmerman, & Kallmyer, 2018), there is a lack of practical guidance (e.g., what therapy to provide, how, why, where, and when) for nurses on how to best manage sleep disturbances during and following discharge from hospital, for this population.

In this paper, we describe the development of a non-pharmacological, multi-component intervention that nurses can provide to PWD and their family caregivers. Persons with dementia and their caregivers can be guided in learning how to apply the therapies starting in hospital and continuing at home after discharge; family caregivers can support PWD in enacting the therapies, as needed.

We review the method we used to design the intervention, which involved three stages of intervention mapping. The stages focus on synthesizing relevant literature to address two consecutive objectives: 1) to generate an understanding of sleep disturbances and 2) to select therapies to appropriately address them. We present the results of the intervention mapping for the health problem of sleep disturbances in PWD and the therapies that were found effective in managing them with the aim of maintaining close correspondence between the sleep disturbances and/or their determinants, and the choice of therapies. We delineate the components of the intervention, setting the stage for examining its acceptability and feasibility, as perceived by

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nurses, PWD, and their family caregivers. Determining the acceptability and feasibility of an intervention, and adapting it as necessary, are essential steps in preparation for its implementation in practice (Aarons et al., 2017).

### **Research Design and Methods**

We applied three stages of intervention mapping, which is a systematic process for developing interventions (Bartholomew et al., 2016). The first stage focused on generating an understanding of sleep disturbances as experienced by PWD. The second stage consisted of identifying evidence-based therapies for managing sleep disturbances or their determinants. The third stage entailed specifying the intervention components and strategies for providing the multi-component intervention to PWD and their family caregivers transitioning from hospital to home.

#### **Stage 1: Understanding the Problem**

Gaining a comprehensive understanding of a health problem requiring remediation is the initial step in designing interventions. This understanding elucidates the health problem of interest, as experienced by the target population, in the target setting. This understanding provides both a conceptual definition of the problem (what it is) and an operational definition (its indicators i.e., the signs and symptoms that characterize the health problem and point to its occurrence). In addition, factors that contribute to the problem (i.e., causes or determinants) are identified, and the pathways through which they lead to the problem are explained (Bleijenberg et al., 2018). This comprehensive understanding helps specify which aspects of the problem (i.e., indicators and/or determinants) are potentially modifiable, and what therapies are expected to successfully address it.

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We conducted a narrative review of the literature to develop a conceptualization of sleep disturbances as experienced by PWD in hospital and home settings. The steps of the literature search strategy are summarized in Table 1.

Quantitative and qualitative primary studies or reviews (e.g., narrative, scoping, systematic, or meta-analysis) of studies that investigated PWD experience of sleep disturbances and determinants of sleep disturbances in the hospital or home setting were selected. Data extraction focused on identifying the reported types, indicators and determinants of sleep disturbances; explanations of the pathways linking the determinants to sleep disturbances were also extracted. Synthesis of data involved the comparison of quantitative and qualitative study findings summarized in a matrix, and identification of results that converged across studies despite variability in designs and methods. Convergence of findings supports validity as the bias inherent in some studies is counterbalanced by the bias inherent in others (Sidani & Braden, 2021).

### **Stage 2: Identification of Therapies**

The conceptualization of a health problem, as experienced by the target population in the target setting, informs the identification or development of therapies to address it. A critical analysis of the conceptualization of a health problem points to what specific aspects of the experience of the problem – determinants and/or indicators – are malleable and have the greatest potential for change. Potentially modifiable determinants and indicators are targeted by the intervention (Bleijenberg et al., 2018). A comprehensive review of the literature is then conducted to identify evidence-based therapies that address a problem's modifiable determinants and indicators.

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From the previous search, we identified articles describing non-pharmacological therapies that have been shown to successfully manage the sleep disturbances or their determinants, experienced by PWD in hospital and home settings. Systematic reviews, meta-analyses (level 1 evidence), and experimental studies (level 2 evidence) that reported on the evaluation of therapies were reviewed to extract the following information: 1) a description of each therapy including its label, goals, components, and its mode and dose of delivery (Sidani, Fox, & El-Masri, 2020); 2) the target population i.e., PWD, their family caregivers, or both; 3) the setting in which the therapy was provided (e.g., hospital or home); and 4) results related to the effectiveness of the therapy in managing the targeted determinants and sleep disturbances and, where available, the effect sizes. We counted the number of studies (primary or review) that reported the success of the therapy in addressing sleep disturbances in PWD. Therapies found effective in most (> 50%) studies (supporting convergence despite variability in results) were selected for inclusion in the multi-component sleep intervention.

### **Stage 3: Delineation of the Intervention Components**

The evidence-based therapies (identified in Step 2) were operationalized to generate specific instructions for how to deliver them in practice. To this end, we created a matrix that identified the determinants of sleep disturbances targeted by the therapies and included a detailed description of each therapy. The description specified: 1) the goals of the therapy relative to the management of sleep disturbances or their determinants; 2) the components of the therapy relative to the information conveyed to PWD and their family caregivers (e.g., what contributes to sleep disturbances), activities in which PWD and their family caregivers engage throughout their exposure to the therapy (e.g., participating in the discussion of obstacles to carrying out the therapy recommendations), and the therapy recommendations that PWD and their family

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caregivers are to apply in daily life (e.g., avoiding caffeine in the evening); 3) the mode of delivery relative to the format (e.g., group face-to-face session) and the structure (e.g., tailored to the needs and life context of PWD); and, 4) the dose of the therapy (e.g., number of sessions, length of each session, and frequency of sessions; Sidani & Braden, 2021).

Analysis (using constant comparison) of the information in the matrix assisted in identifying therapies addressing a specific determinant of sleep disturbances. The therapies constituted the active ingredients of the multi-component intervention for managing sleep disturbances in PWD. Strategies were specified to facilitate the provision of the intervention in four components to PWD and their family caregivers in hospital and at home during the post-discharge period, taking into consideration:

**1. The level of Cognitive Function of PWD and Their Family Caregivers During and Following Hospitalization.** Mild-to-moderate dementia presents challenges in processing, retaining and recalling information (Bahar-Fuchs, Martyr, Goh, Sabates, & Clare, 2019), which necessitate the simplification of information to be conveyed; its presentation in easy to understand, lay terms; the discussion of one point or item at a time; and the repetition of the same information on different occasions (Alsawy, Mansell, McEvoy, & Tai, 2017; O'Rourke, Power, O'Halloran, & Rietdijk, 2018). Hospitalization and caring for PWD are stressful experiences for family caregivers. Stress and associated anxiety limit retention of information (Gerity, Silva, Reynolds, Hoffman, & Oermann, 2018). Retention can be promoted by providing the information in different formats (orally and in-writing), both during hospitalization and after discharge.

**2. Best Practices in Health Education of PWD and Older Adults such as Family Caregivers.** These practices involve: (i) engaging PWD and family caregivers in active learning,

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accomplished by making explicit the purpose of the educational session; discussing one point at a time and inquiring about PWD and family caregivers' comprehension as well as addressing concerns they may have; using symbols, pictograms or other visual / written information to foster understanding and recall; and (ii) using the teach-back technique, which consists of asking PWD and family caregivers to repeat key information and demonstrate the application of treatment recommendations they are expected to perform in daily life.

**3. The Principles of Patient-Centered Care.** These principles (Sidani & Fox, 2014) are operationalized in tailoring the intervention to the individual PWD experience of sleep disturbances. The tailoring is based on the determinants of sleep disturbances experienced by PWD as well as their preferences and those of their family caregivers.

The selected therapies and strategies to facilitate their delivery were integrated into components. Each component was described in detail. The description covered the specific treatment recommendations that nurses discuss with PWD and their family caregivers when implementing the intervention in practice. Further, the sequence for providing the components in the hospital and the PWD home was specified.

## Results

### Experience of Sleep Disturbances

Sleep disturbances are recognized as behavioral and psychological symptoms of dementia (Oliveira et al., 2015; Kales, Gitlin, & Lyketsos, 2015). They are often experienced as insomnia and circadian rhythm disorders that are associated with daytime dysfunction (Capezuti et al., 2018; Xu et al., 2015). Insomnia is characterized by difficulty initiating sleep and/or difficulty maintaining sleep (Dzierzewski, Dautovich, & Ravyts, 2018; Kinnunen, Vikhanova, & Livingston, 2017). Circadian rhythm disorders are indicated by delayed phase disorders or

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irregular sleep-wake patterns, whereby PWD get up at night, wander, behave as if it is morning, that is, are involved in inappropriate activities during the night (Dimitriou & Tsolaki, 2017; Kales et al., 2015). Daytime dysfunction is manifested in sleepiness and reduced cognitive functioning (Xu et al., 2015).

Sleep disturbances in PWD have typically been attributed to the neurological or physiological changes that take place with age, the pathophysiological alterations that underlie dementia and associated diseases like Alzheimer's disease and Lewy body disease, the multiple chronic physical (e.g., pain) and psychological health conditions (e.g., depression) common in PWD, as well as the treatment of those conditions (e.g., medications containing stimulants; Bathgate & Fernandez-Mendoza, 2018; Cardinali, Furio, & Brusco, 2011; Dzierzewski et al., 2018; Eshkoo Eshkoo, Hamid, Nudin, & Mun, 2014; Flo, Bjorvatn, Corbett, Pallesen, & Husebo, 2017; Chen et al., 2018; Munch et al., 2017). Recent evidence supports a bidirectional relationship between sleep disturbances and dementia, whereby sleep disturbances are both causes and outcomes of dementia (Chen et al., 2016; Ju, Lucey, & Holtzman, 2014; Liang, Qu, & Liu, 2019; Musiek, Xiong, & Holtzman, 2015). The results of two systematic reviews (Bubu et al., 2017; Shi et al., 2018) clearly showed that persons with sleep problems are at risk of developing cognitive impairment and all-cause dementia. This evidence implies that sleep disturbances may be associated with factors other than the pathophysiological alterations of dementia.

Six major factors are reported to precipitate, perpetuate, and worsen sleep disturbances in PWD in hospital and home settings.

### ***Physiological Changes Associated with Normal Aging***

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Changes include decreased production of melatonin (Alagiakrishnan, 2016; Cardinali et al., 2011) and progressive decline in the function of neurons of the biological clock (Figueiro, 2017; Mitolo et al., 2018; Munch et al., 2017). These changes result in a decrease in circadian amplitude and variations in phase or timing, which in turn lead to weaker synchronization (or entrainment) to the 24-hour day-night cycle, manifested in night-time awakenings and irregular sleep-wake cycles.

### *Sleep Environment*

Noise, light, and room temperature are environmental factors that interfere with sleep in the hospital or the home setting. These factors generate discomfort and increase arousal at night, resulting in lighter and fragmented sleep (Capezuti et al., 2018; Irish, Kline, Gunn, Buysse, & Hall, 2015; Kales et al., 2015). In the hospital setting, patients, including those with dementia, experience disturbing sounds at night from monitoring equipment, alarms, overhead paging, and talking by healthcare providers, visitors, and other patients (Ding, Redeker, Pisani, Yaggi, & Knauert, 2017). Further, patients are regularly disturbed by nursing activities that require adequate lighting to perform safely (Mattiussi, Danielis, Venuti, Vidoni, & Palese, 2019). In the home setting, night-time noise and light stem from local traffic and family members' or neighbors' activities such as watching television. Although people may report habituation to noise exposure in their sleep environment at home, their bodies continue to respond to noise resulting in delayed or fragmented sleep (Irish et al., 2015). Extremes in room temperature are not conducive to good sleep: cold temperatures make it difficult to fall asleep, whereas hot temperatures are associated with restlessness and frequent awakenings.

### *Exposure to Light*

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Limited exposure to daylight disrupts the secretion of melatonin and increases the risk for alterations in circadian rhythm patterns (Figueiro, 2017; Sekiguchi, Iritani, & Fujita, 2017). Furthermore, older people, especially those with dementia, may experience reduced visual sensitivity to light; this reduced sensitivity, in combination with limited exposure to light, increase the risk of sleep disturbances, in particular delayed sleep (Abraha et al., 2017).

### *Engagement in Physical Activity*

Limited physical activity is associated with poor night-time sleep, while regular exercise enhances the quantity and the quality of sleep (Gallaway et al., 2017). The mechanism responsible for the influence of physical activity on sleep is still largely unknown (Irish et al., 2015). Evidence indicates that both community-dwelling PWD and PWD residing in long-term care facilities are largely inactive during the day or engage in light physical activities for a very short time (less than two hours) (Moyle et al., 2017; van Alphen, Hortobagyi, & van Heuvelen, 2016a), which is associated with poor sleep quality (Shih et al., 2017). van Alphen et al. (2016a), for instance, reported that 66% of community-dwelling PWD are sedentary for most of the day and perform physical activity only at low intensity. The most common barriers to the engagement of PWD in daytime physical activity include limitations in the physical and mental functions of PWD, and challenges encountered by family caregivers in organizing and guiding PWD in performing physical activity (Cedervall, Torres, & Åberg 2015; van Alphen et al., 2016b).

### *Stress*

Life events and experiences, including hospitalization, are stressful and generate a stress response. Acute or chronic stress responses influence physiological (e.g., heightened blood pressure) and psychological (e.g., anxiety) functions. When stressful events take place or are

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recounted / remembered around sleep time, they can precipitate physiological arousal (e.g., increased heart rate) and cognitive arousal (e.g., worry). Both types of arousal interfere with sleep onset and sleep maintenance (Irish et al., 2015). Results of systematic quantitative and qualitative reviews summarized by Cipriani, Lucetti, Danti, & Nuti (2015) indicate that 71.4% of PWD experience fear and worry (e.g., worry about their prognosis and their family) and, therefore, are unable to sleep (Gibson et al., 2014).

### *Beliefs and Behaviors*

Misconceptions about sleep disturbances, their causes, and sleep-promoting practices, together with unrealistic sleep expectations, contribute to and perpetuate sleep disturbances in the general population (Morin, Vallières, & Ivers, 2007). These misconceptions and unrealistic sleep expectations may also be prevalent in PWD and their family caregivers, and in combination with beliefs related to the importance of napping and of staying in bed to recover after hospitalization, influence their sleep-related behaviors. Some PWD believe that spending time in bed is a good strategy to promote sleep and to catch up on lost sleep hours. Consequently, PWD may go to bed early in the hope they will get to sleep at the desired time; if they are unable to sleep and if they wake up during the night, they stay in bed, with the expectation that this will induce sleep. However, staying in bed when unable to sleep becomes a signal for wakefulness rather than sleepiness. In addition, PWD may take long naps during the day, which interfere with their sleep drive at night (Bootzin & Epstein, 2011). PWD with limited physical functioning spend excessive time asleep during the day at home (Cipriani et al., 2015) and hospital (Boltz, Resnick, Capezuti, & Shuluk, 2014). Excessive daytime sleep affects their sleep drive and perpetuates or worsens sleep disturbances. Some PWD and their family caregivers believe that staying in bed is useful in promoting recovery from illness or surgery. About one third of

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hospitalized older adults reported they needed to stay in bed, focus on recovery, and not engage in physical activity such as walking (Boltz et al., 2014; So & Pierluissi, 2012). Bed rest and lack of engagement in physical activity result in functional decline (Fox, Sidani, & Brooks, 2010; Guedes, Oliveira, & Carvalho, 2018) and sleep disturbances, initiating a vicious cycle whereby sleep disturbances lead to limited daytime functioning which in turn, contributes to poor sleep. Addressing sleep disturbances is one way to break the cycle.

### **Evidence-Based Therapies**

Various non-pharmacological therapies have been evaluated for their effectiveness in managing sleep disturbances in community-dwelling and hospitalized PWD with acute conditions, including bright light therapy, behavioral interventions, acupuncture (e.g., Capezuti et al., 2018; Papadopolous, Papadoudis, Kiagia, & Syrigos, 2018) and massage therapy (e.g., Scales, Zimmerman, & Miller, 2018; Tamrat, Huynh-Le, & Goyal, 2014). We selected evidence-based therapies that addressed the modifiable determinants of sleep disturbances experienced by PWD and included treatment recommendations that can be learned by PWD and their family caregivers in hospital and continue to implement them at home; family caregivers can support PWD in implementing the therapies as needed. Four therapies met these selection criteria: light therapy, physical activity, sleep hygiene, and stimulus control therapy. Table 2 illustrates the linkages between the determinants of sleep disturbances and the evidence-based therapies as well as their respective treatment recommendations. The evidence supporting the effectiveness of the therapies is summarized below.

#### ***Light Therapy***

Bright light therapy is the most frequently examined therapy for the management of sleep disturbances, depression and behavioral symptoms experienced by PWD. Although commonly

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used in long-term care facilities, light boxes are now available for use in the home setting. The benefits of bright light therapy, given alone or in combination with other interventions, in improving sleep are supported by the results of seven systematic reviews (Brown et al., 2013; Cibeira et al., 2020; Dimitrou & Tsolaki, 2017; Oliveira et al., 2015; Mitolo et al., 2018; Tamrat et al., 2013; Van Maanen, Meijer, van der Heijden, & Oort, 2016). van Maanen et al. (2016) found a small-moderate ( $g = .30$ ) effect of bright therapy on sleep disturbances in PWD, whereas Mitolo et al. (2018) concluded that bright light therapy seems most effective in persons with mild-to-moderate Alzheimer's disease and its effects on sleep are more marked in the wintertime. Mixed results were reported in other reviews and primary studies (Figueiro et al., 2014; Kinnunen et al., 2017; Scales et al., 2018; David et al., 2010). Forbes, Blake, Thiessen, Peacock, & Hawranik (2014) reported there was no significant evidence of the effectiveness of bright light therapy in improving sleep. Despite its potential benefits, bright light therapy is associated with side effects; it was reported to cause eye strain, nausea, agitation, headache and migraine (Auger et al., 2015; Forbes et al., 2014; Scales et al., 2018). Further, PWD may not be able to afford the costs related to the purchase and use of a light box at home.

Exposure to natural daylight is an alternative strategy recommended to reset the circadian rhythm and improve sleep-wake rhythm. This strategy is simple, easy to perform, affordable, and useful in promoting sleep and reducing night-time awakening (Cibeira et al., 2020; Forbes et al., 2014; Kinnunen et al., 2017; Oliveira et al., 2015).

### ***Physical Activity Therapy***

Engaging in daytime physical activity is effective in promoting sleep in acutely ill older adults with and without dementia. The evidence is derived from primary studies and systematic reviews of studies that evaluated the impact of physical activity as a stand-alone therapy

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(Capezuti et al., 2018; Kales et al., 2015; Papadopoulus et al., 2018; Thuné-Boyle, Iliffe, Cerga-Pashoja, Lowery, & Warner, 2012), or as a component of complex interventions (Forlenza, Loureiro, J. C., Pais, M. V., & Stella, F 2017; Kinnunen et al., 2017; Nascimento et al., 2014).

### *Sleep Hygiene*

Sleep hygiene consists of recommendations that address most determinants of sleep disturbances (Irish et al., 2015). The recommendations aim to: 1) promote a bedroom environment that is conducive to sleep and entails noise reduction, comfortable temperature, and dim light; 2) minimize physiological arousal prior to bedtime by avoiding stimulants; and 3) reduce cognitive arousal as well as mental or emotional stimulation around bedtime by maintaining a consistent bedtime routine and winding down before going to bed. Sleep hygiene recommendations were presented to PWD and their family caregivers in individual or group sessions, and in written format (e.g., workbooks), as a stand-alone therapy or as a component in multi-component interventions. Sleep hygiene education was useful in enhancing the application of the recommendations (Brown et al., 2013) and in improving sleep in PWD (Capezuti et al., 2018; Kinnunen et al., 2017); it increased total sleep time in hospitalized persons with an acute illness (Tamrat et al., 2014). Sleep hygiene had no significant effect on sleep in two studies as reported by Hellström et al. (2011).

### *Stimulus Control Therapy*

Stimulus control therapy addresses the sleep-related behaviors, with the aim of re-associating the bed with sleepiness (Bootzin & Epstein, 2011). The therapy consists of six instructions listed in Table 2, and represents one component of cognitive behavioral therapy for insomnia, which was found to improve sleep in hospitalized older persons (Capezuti et al., 2018) and PWD (Kinnunen et al., 2017).

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### **Components**

Informed by the description of the evidence-based therapies extracted from the articles reviewed, we specified the components of the intervention and the respective treatment recommendations in the form of activities that PWD should engage in or avoid. As presented in Table 1, each recommendation consists of one activity, and specifies in simple, lay language: what exactly is to be done, as well as how, where, when, and how frequently to do it.

The multi-component intervention we developed involves conveying the treatment recommendations to PWD and their family caregivers during and following hospitalization, using the teach-back strategy to enhance understanding. We integrated the treatment recommendations and the strategies discussed above into four components to be provided in the following sequence:

#### ***Component 1***

Assessing PWD for existing sleep disturbances including the type and determinants (i.e., six categories described previously) of sleep disturbances that PWD experience at home prior to and during hospitalization. Simple questions with Yes-No response options (Fox et al., 2011) are used to inquire about the experience of sleep disturbances and each determinant. The assessment is done within 24 hours of admission to guide the selection and implementation of relevant therapies during hospitalization.

#### ***Component 2***

Monitoring PWD sleep (using the Yes-No questions described above) and providing education as well as implementing relevant treatment recommendations. Monitoring sleep is useful in substantiating the type and determinants of sleep disturbances, and offering opportunities to revise or tailor the education, to demonstrate the application of treatment

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recommendations and evaluate their preliminary effectiveness. The focus of education is on explaining how the determinants experienced by the PWD contribute to sleep disturbances, and to describe the application of relevant treatment recommendations. This component is delivered during hospitalization.

### ***Component 3***

Treatment recommendations, tailored to the PWD experience of sleep disturbances, their determinants, and their home setting, are reviewed to enhance their recall; their correct application is reinforced; and questions that PWD and their family caregivers may have are addressed. The review is done in a one-on-one, face-to-face session, scheduled within 24 hours before discharge from the hospital. Written materials, including a list of the treatment recommendations and pictograms depicting the key activities to be performed, are provided as a reference to guide their application at home.

### ***Component 4***

Supporting the PWD and their caregivers' implementation of the treatment recommendations at home involves: 1) assessing PWD experience of sleep disturbances and perceived usefulness of the treatment recommendations in improving sleep; 2) reinforcing the use of the treatment recommendations or prescribing new ones tailored to changes in the PWD experience of sleep disturbances; 3) identifying and discussing strategies to overcome barriers to the appropriate implementation of treatment recommendations; 4) validating PWD and their family caregivers' knowledge and skills in applying the treatment recommendations; and, 5) determining the need for continued support. The support is given during follow-up telephone calls or home visits, initiated within 24 to 48 hours of discharge from hospital, and continued over the following month.

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### **Discussion and Implications**

Hospitalization intensifies sleep disturbances in older PWD, impeding their recovery process, and generating the need for a comprehensive nursing intervention to promote sleep during the hospital-to-home transition. We applied the intervention mapping method to systematically develop a multi-component intervention. The intervention aligns specific evidence-based therapies with specific determinants of sleep disturbances commonly experienced in hospital and home settings, and incorporates strategies to promote the retention of information and the appropriate implementation of the therapies by PWD, supported by their family caregivers.

The use of the intervention mapping method has the advantage of ensuring correspondence among the conceptualization of health problems such as sleep disturbances, the delineation of the intervention's active ingredients, and the specification of the respective components to be delivered in the selected mode and dose. Such correspondence enhances the appropriateness and the effectiveness of interventions (Sidani & Braden, 2021). The results of systematic reviews indicate that interventions developed through a well-structured process are more effective than interventions designed following less structured approaches (e.g., Fassier et al., 2019; Lamon-Bouché et al., 2018). The conceptualization of sleep disturbances (i.e., the definition, determinants, and pathways linking determinants to sleep disturbances), the delineation of the active ingredients (i.e., therapies addressing specific determinants), and the specification of components (how to deliver the therapies) were informed by the strongest empirical evidence available (levels I and II), synthesized from extant literature. However, the literature that was reviewed was restricted to those published in English and peer-reviewed journals, preventing the inclusion of other potentially relevant evidence.

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The multi-component intervention represents an alternative to pharmacological treatments that are associated with adverse reactions and that may interact with other medications prescribed to older PWD during and following hospitalization. The intervention has no or minimal side effects (as reported in the literature reviewed) and has the advantage of addressing the underlying determinants of sleep disturbances as experienced by older PWD. The intervention includes different therapies to manage a range of personal determinants and environmental factors in hospital and home settings while accounting for individual PWD's needs and preferences, thereby conforming to the principles of person-centeredness. The intervention is designed to be delivered using instructional techniques (e.g., teach-back) and the multiple components given during and following hospitalization help reinforce the internalization of information and acquisition skills needed for the appropriate implementation of the therapies by older PWD at home. The matrix delineating the linkages between the determinants of sleep disturbances and the therapies (Table 2) can serve as a blueprint to inform the standardized or tailored implementation of the multi-component intervention in research or practice.

Despite its potential benefits, the intervention is complex, involving multiple components that are delivered by nurses over a long period spanning hospitalization and the one-month post-discharge period; it also incorporates numerous treatment recommendations that, although given in response to PWD experience of sleep disturbances and their determinants, demand significant changes in their daily activities and sleep-related behaviors.

### **Next steps**

Consistent with the World Health Organization's endorsement of engaging patients in their own care, and with the principles of patient engagement in the design and production of

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health interventions (Smith Smith, Wallengren, & Öhlén, 2017), we are currently examining the acceptability and feasibility of providing the multi-component sleep intervention in an ongoing study (Fox et al., 2021). The study targets PWD, their family caregivers, and nurses. Their perception of the intervention's acceptability and feasibility are assessed using a mix of quantitative measures and qualitative interviews. Acceptability reflects the perceived appropriateness or relevance, ease of implementation, and benefits of the intervention in managing sleep disturbances. Issues of feasibility are related to the logistics of implementing the intervention's components, the availability of staff, the type of nurses (Registered Nurses or Advanced Practice Nurses) capable of implementing the components, and the relevance of the questions used to assess and monitor sleep disturbances. The results of the study will inform the implementation of the multi-component intervention in practice, to promote sleep in older PWD in hospital and home settings.

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

**References**

- Aarons, G.A., Sklar, M., Mustanski, B., Benbow, N. & Brown, H. (2017). "Scaling-out" evidence-based interventions to new populations or new health care delivery system. *Implementation Science*, 12, 111-123. Doi: 10.1186/s13012-017-0640-6
- Abraha, I., Rimland, J. M., Trotta, F. M., Dell'Aquila, G., Cruz-Jentoft, A., Petrovic, M., Gudmundsson, A., Soiza, R., O'Mahony, D., Guaita, A., & Cherubini, A. (2017). Systematic review of systematic reviews of non-pharmacological interventions to treat behavioural disturbances in older patients with dementia. The SENATOR-OnTop series. *BMJ open*, 7(3), e012759. <http://dx.doi.org/10.1136/bmjopen-2016-012759>
- Afonso-Argilés, F.J., Meyer, G., Stephan, A., Coma, M., Wubkjer, A.,...et al. (2020). Emergency department and hospital admissions among people with dementia living at home or in nursing homes: Results of the European *RightTimePlaceCare* project on their frequency, associated factors and costs. *BMC Geriatr* 20, 453. <https://doi.org/10.1186/s12877-020-01835-x>
- Alagiakrishnan, K. (2016). Melatonin based therapies for delirium and dementia. *Discovery Medicine*, 21(117), 363-371. <https://doi.org/10.1186/s12877-019-1297-6>
- Alsawy, S., Mansell, W., McEvoy, P., & Tai, S. (2017). What is good communication for people living with dementia? A mixed-methods systematic review. *International Psychogeriatrics*, 29(11), 1785-1800. <http://dx.doi.org/10.1017/S1041610217001429>
- Auger, R. R., Burgess, H. J., Emens, J. S., Deriy, L. V., Thomas, S. M., & Sharkey, K. M. (2015). Clinical practice guideline for the treatment of intrinsic circadian rhythm sleep-wake disorders: advanced sleep-wake phase disorder (ASWPD), delayed sleep-wake phase disorder (DSWPD), non-24-hour sleep-wake rhythm disorder (N24SWD), and

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- irregular sleep-wake rhythm disorder (ISWRD). An update for 2015: an American Academy of Sleep Medicine clinical practice guideline. *Journal of Clinical Sleep Medicine*, 11(10), 1199-1236. <https://doi.org/10.5664/jcsm.5100>
- Bahar-Fuchs, A., Martyr, A., Goh, A. M., Sabates, J., & Clare, L. (2019). Cognitive training for people with mild to moderate dementia. *Cochrane Database of Systematic Reviews*, (3). <http://dx.doi.org/10.1002/14651858.CD013069.pub2>
- Bartholomew Eldredge, L. K., Markham, C. M., Ruiter, R. A., Fernandez, M. E., Kok, G., & Parcel, G. S. (2016). Planning health promotion programs: An intervention mapping approach. Jossey-Bass Inc.
- Bathgate, C. J., & Fernandez-Mendoza, J. (2018). Insomnia, short sleep duration, and high blood pressure: Recent evidence and future directions for the prevention and management of hypertension. *Current Hypertension Reports*, 20(6), 1-10. <http://dx.doi.org/10.1007/s11906-018-0850-6>
- Bhaskar, S., Hemavathy, D., & Prasad, S. (2016). Prevalence of chronic insomnia in adult patients and its correlation with medical comorbidities. *Journal of Family Medicine and Primary Care*, 5(4), 780. <http://dx.doi.org/10.4103/2249-4863.201153>
- Bleijenberg, N., Janneke, M., Trappenburg, J. C., Ettema, R. G., Sino, C. G., Heim, N., ... & Schuurmans, M. J. (2018). Increasing value and reducing waste by optimizing the development of complex interventions: Enriching the development phase of the Medical Research Council (MRC) Framework. *International Journal of Nursing Studies*, 79, 86-93. <http://dx.doi.org/10.1016/j.ijnurstu.2017.12.001>
- Boltz, M., Resnick, B., Capezuti, E., & Shuluk, J. (2014). Activity restriction vs. self-direction:

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- Hospitalised older adults' response to fear of falling. *International Journal of Older People Nursing*, 9(1), 44-53. <http://dx.doi.org/10.1111/opn.12015>
- Bootzin, R. R., & Epstein, D. R. (2011). Understanding and treating insomnia. *Annual Review of Clinical Psychology*, 7, 435-458.  
<http://dx.doi.org/10.1146/annurev.clinpsy.3.022806.091516>
- Brown, C. A., Berry, R., Tan, M. C., Khoshia, A., Turlapati, L., & Swedlove, F. (2013). A critique of the evidence base for non-pharmacological sleep interventions for persons with dementia. *Dementia*, 12(2), 210-237. <http://dx.doi.org/10.1177/1471301211426909>
- Bubu, O. M., Brannick, M., Mortimer, J., Umasabor-Bubu, O., Sebastião, Y. V., Wen, Y., ... & Anderson, W. M. (2017). Sleep, cognitive impairment, and Alzheimer's disease: A systematic review and meta-analysis. *Sleep*, 40(1), zsw032.  
<http://dx.doi.org/10.1093/sleep/zsw032>
- Capezuti, E., Sagha Zadeh, R., Woody, N., Basara, A., & Krieger, A. C. (2018). An integrative review of nonpharmacological interventions to improve sleep among adults with advanced serious illness. *Journal of Palliative Medicine*, 21(5), 700-717.  
<http://dx.doi.org/10.1089/jpm.2017.0152>
- Cardinali, D. P., Furio, A. M., & Brusco, L. I. (2011). The use of chronobiotics in the resynchronization of the sleep/wake cycle: Therapeutical application in the early phases of Alzheimer's disease. *Recent Patents on Endocrine, Metabolic & Immune Drug Discovery*, 5(2): 80-90. <http://dx.doi.org/10.2174/187221411799015354>
- Cedervall, Y., Torres, S., & Åberg, A. C. (2015). Maintaining well-being and selfhood through physical activity: Experiences of people with mild Alzheimer's disease. *Aging & Mental Health*, 19(8), 679-688. <http://dx.doi.org/10.1080/13607863.2014.962004>

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- Chen, J. C., Espeland, M. A., Brunner, R. L., Lovato, L. C., Wallace, R. B., Leng, X., ... & Mysiw, W. J. (2016). Sleep duration, cognitive decline, and dementia risk in older women. *Alzheimer's & Dementia*, *12*(1), 21-33.  
<http://dx.doi.org/10.1016/j.jalz.2015.03.004>
- Cibeira, N., Maseda, A. Lorenzo-López, L., Rodriguez-Villamil, J.L., López-López, R. & Milláan-Calenti, J.C. (2020). Application of light therapy in older adults with cognitive impairment: A systematic review. *Geriatric Nursing*, *41*(6), 970-983.
- Cipriani, G., Lucetti, C., Danti, S., & Nuti, A. (2015). Sleep disturbances and dementia. *Psychogeriatrics*, *15*(1), 65-74. <http://dx.doi.org/10.1111/psyg.12069>
- Clark, A., & Mills, M. (2017). Can a sleep menu enhance the quality of sleep for the hospitalized patient? *MedSurg Nursing*, *26*(4), 253-258.
- David, R., Zeitzer, J., Friedman, L., Noda, A., O'hara, R., Robert, P., & Yesavage, J. A. (2010). Non-pharmacologic management of sleep disturbance in Alzheimer's disease. *The Journal of Nutrition, Health & Aging*, *14*(3), 203-206. <http://dx.doi.org/10.1007/s12603-010-0050-9>
- Delaney, L. J., Currie, M. J., Huang, H. C. C., Lopez, V., & Van Haren, F. (2018). "They can rest at home": An observational study of patients' quality of sleep in an Australian hospital. *BMC Health Services Research*, *18*(1), 1-9. <http://dx.doi.org/10.1186/s12913-018-3201-z>
- Dimitriou, T. D., & Tsolaki, M. (2017). Evaluation of the efficacy of randomized controlled trials of sensory stimulation interventions for sleeping disturbances in patients with dementia: A systematic review. *Clinical Interventions in Aging*, *12*, 543-548.  
<http://dx.doi.org/10.2147/CIA.S115397>

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- Ding, Q., Redeker, N. S., Pisani, M. A., Yaggi, H. K., & Knauert, M. P. (2017). Factors influencing patients' sleep in the intensive care unit: Perceptions of patients and clinical staff. *American Journal of Critical Care*, 26(4), 278-286.  
<http://dx.doi.org/10.4037/ajcc2017333>
- Dzierzewski, J. M., Dautovich, N., & Ravyts, S. (2018). Sleep and cognition in older adults. *Sleep Medicine Clinics*, 13(1), 93-106. <http://dx.doi.org/10.1016/j.jsmc.2017.09.009>
- Eshkooor, S. A., Hamid, T. A., Nudin, S. S. A. H., & Mun, C. Y. (2014). Importance of hypertension and social isolation in causing sleep disruption in dementia. *American Journal of Alzheimer's Disease & Other Dementias*®, 29(1), 61-66.  
<http://dx.doi.org/10.1177/1533317513505136>
- Fassier, J.B., Sarnin, P., Rouat, S., Péron, J., Kok, G., Letrilliart, L. & Lamort-Bouche, M. (2019) Interventions Developed with the Intervention Mapping Protocol in Work Disability Prevention: A Systematic Review of the Literature. *Journal of Occupational Rehabilitation*, 29, 11–24. <https://doi.org/10.1007/s10926-018-9776-8>
- Fazio, S., Pace, D., Maslow, K., Zimmerman, S., & Kallmyer, B. (2018). Alzheimer's Association dementia care practice recommendations. In S. Meeks, S., Fazio, D. Pace, B.A Kallmyer, K. Maslow, & S. Zimmerman. Alzheimer's Association dementia care practice recommendations (pp. S1-S9). *The Gerontologist*, 58 (Supplement 1).
- Figueiro, M. G. (2017). Light, sleep and circadian rhythms in older adults with Alzheimer's disease and related dementias. *Neurodegenerative Disease Management*, 7(2), 119-145.  
<http://dx.doi.org/10.2217/nmt-2016-0060>

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

Figueiro, M. G., Plitnick, B. A., Lok, A., Jones, G. E., Higgins, P., Hornick, T. R., & Rea, M. S.

(2014). Tailored lighting intervention improves measures of sleep, depression, and agitation in persons with Alzheimer's disease and related dementia living in long-term care facilities. *Clinical Interventions in Aging*, 9, 1527-1537.

<https://doi.org/10.2147/cia.s68557>

Flo, E., Bjorvatn, B., Corbett, A., Pallesen, S., & S Husebo, B. (2017). Joint occurrence of pain and sleep disturbances in people with dementia. A systematic review. *Current Alzheimer Research*, 14(5), 538-545. <http://dx.doi.org/10.2174/1567205013666160602234932>

<http://dx.doi.org/10.2174/1567205013666160602234932>

Forbes, D., Blake, C. M., Thiessen, E. J., Peacock, S., & Hawranik, P. (2014). Light therapy for improving cognition, activities of daily living, sleep, challenging behaviour, and psychiatric disturbances in dementia. *Cochrane Database of Systematic Reviews*, (2).

CD003946-CD. <http://dx.doi.org/10.1002/14651858.CD003946.pub4>

Forlenza, O. V., Loureiro, J. C., Pais, M. V., & Stella, F. (2017). Recent advances in the management of neuropsychiatric symptoms in dementia. *Current Opinion in Psychiatry*,

30(2), 151-158. <http://dx.doi.org/10.1097/YCO.0000000000000309>

Fox, M.T., Sidani, S, Butler, J.I., Skinner, M.W., Macdonald, M., Durocher, E., Hunter, K.F.,

Wagg, A., Weeks, L.E. MacLeod, A. Dahlke, S. (2021). Optimizing hospital-to-home transitions for older persons in rural communities: A participatory, multimethod study protocol, *Implementation Science Communications*, 2,

81. <https://doi.org/10.1186/s43058-021-00179-w>

Fox, M. T., Sidani, S., & Brooks, D. (2010). Differences in sleep complaints in adults with

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- varying levels of bed days residing in extended care facilities for chronic disease management. *Clinical Nursing Research*, 19(2), 181-202.  
<http://dx.doi.org/10.1177/1054773810365957>
- Fox, M.T., Sidani, S., Streiner, D., McGilton, K.S., & Grady, C. (2011). Effect of the response tree format on the utility and psychometric properties of scales measuring symptoms in adults undergoing in-patient rehabilitation, *Research in Nursing & Health*, 34, 509-519.
- Gallaway, P. J., Miyake, H., Buchowski, M. S., Shimada, M., Yoshitake, Y., Kim, A. S., & Hongu, N. (2017). Physical activity: A viable way to reduce the risks of mild cognitive impairment, Alzheimer's disease, and vascular dementia in older adults. *Brain Sciences*, 7(2), 22. <http://dx.doi.org/10.3390/brainsci7020022>
- Gerity, S. L., Silva, S. G., Reynolds, J. M., Hoffman, B., & Oermann, M. H. (2018). Multimedia education reduces anxiety in lung transplant patients. *Progress in Transplantation*, 28(1), 83-86. <http://dx.doi.org/10.1177/1526924817746910>
- Guedes, L. P. C. M., Oliveira, M. L. C. D., & Carvalho, G. D. A. (2018). Deleterious effects of prolonged bed rest on the body systems of the elderly: A review. *Revista Brasileira de Geriatria e Gerontologia*, 21(4), 499-506. <http://dx.doi.org/10.1590/1981-22562018021.170167>
- Gibson, R. H., Gander, P. H., & Jones, L. M. (2014). Understanding the sleep problems of people with dementia and their family caregivers. *Dementia*, 13(3), 350-365.  
<http://dx.doi.org/10.1177/1471301212473884>
- Hellström, A., & Willman, A. (2011). Promoting sleep by nursing interventions in health care settings: A systematic review. *Worldviews on Evidence-Based Nursing*, 8(3), 128-142.  
<http://dx.doi.org/10.1111/j.1741-6787.2010.00203.x>

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- Irish, L. A., Kline, C. E., Gunn, H. E., Buysse, D. J., & Hall, M. H. (2015). The role of sleep hygiene in promoting public health: A review of empirical evidence. *Sleep Medicine Reviews*, 22, 23-36. <http://dx.doi.org/10.1016/j.smr.2014.10.001>
- Ju, Y. E. S., Lucey, B. P., & Holtzman, D. M. (2014). Sleep and Alzheimer disease pathology—a bidirectional relationship. *Nature Reviews Neurology*, 10(2), 115-119. <http://dx.doi.org/10.1038/nrneurol.2013.269>
- Kales, H. C., Gitlin, L. N., & Lyketsos, C. G. (2015). Assessment and management of behavioral and psychological symptoms of dementia. *Bmj*, 350: h369-h369. <http://dx.doi.org/10.1136/bmj.h369>
- Kinnunen, K. M., Vikhanova, A., & Livingston, G. (2017). The management of sleep disorders in dementia: An update. *Current Opinion in Psychiatry*, 30(6), 491-497. <http://dx.doi.org/10.1097/YCO.0000000000000370>
- Kinnunen, K. M., Rapaport, P., Webster, L., Barber, J., Kyle, S. D., Hallam, B., ... & Livingston, G. (2018). A manual-based intervention for carers of people with dementia and sleep disturbances: an acceptability and feasibility RCT. *Health Technology Assessment*, 22(71), 1-408. <http://dx.doi.org/10.3310/hta22710>
- Kulpatcharapong, S., Chewcharat, P., Ruxringtham, K., Gonlachanvit, S., Patcharatrakul, T., Chaitusaney, B., Muntham, D., Reutrakul, S. & Chiarakalwason. N. (2020). Sleep quality of hospitalized patients, contributing factors, and prevalence of associated disorders. *Sleep Disorders*, vol. 2020, Article ID 8518396. <https://doi.org/10.1155/2020/8518396>
- Lamort-Bouché, M., Sarnin, P., Kok, G., Rouat, S., Péron, J., Letrilliart, L. & Fassier, J-B. (2018) Interventions developed with the Intervention Mapping protocol in the field of cancer: A systematic review. *Psycho-Oncology*, 27, 1138–1149. DOI: 10.1002/pon.4611

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- Léger, D., & Bayon, V. (2010). Societal costs of insomnia. *Sleep Medicine Reviews, 14*(6), 379-389. <http://dx.doi.org/10.1016/j.smr.2010.01.003>
- Liang, Y., Qu, L. B., & Liu, H. (2019). Non-Linear associations between sleep duration and the risks of mild cognitive impairment/dementia and cognitive decline: A dose–response meta-analysis of observational studies. *Aging Clinical and Experimental Research, 31*(3), 309-320. <http://dx.doi.org/10.1007/s40520-018-1005-y>
- Mattiussi, E., Danielis, M., Venuti, L., Vidoni, M., & Palese, A. (2019). Sleep deprivation determinants as perceived by intensive care unit patients: Findings from a systematic review, meta-summary and meta-synthesis. *Intensive and Critical Care Nursing, 53*, 43-53. <http://dx.doi.org/10.1016/j.iccn.2019.03.006>
- Medic, G., Wille, M., & Hemels, M. E. (2017). Short-and long-term health consequences of sleep disruption. *Nature and Science of Sleep, 9*, 151-161. <http://dx.doi.org/10.2147/NSS.S134864>
- Mitolo, M., Tonon, C., La Morgia, C., Testa, C., Carelli, V., & Lodi, R. (2018). Effects of light treatment on sleep, cognition, mood, and behavior in Alzheimer’s disease: a systematic review. *Dementia and Geriatric Cognitive Disorders, 46*(5-6), 371-384. <http://dx.doi.org/10.1159/000494921>
- Möllers T, Stocker H, Wei W, Perna L, Brenner H. (2019). Length of hospital stay and dementia: A systematic review of observational studies. *Int J Geriatr Psychiatry, 34*(1), 8-21. doi: 10.1002/gps.4993.
- Morin, C. M., Vallières, A., & Ivers, H. (2007). Dysfunctional beliefs and attitudes about sleep (DBAS): Validation of a brief version (DBAS-16). *Sleep, 30*(11), 1547-1554. <https://doi.org/10.1093/sleep/30.11.1547>

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

Moyle, W., Jones, C., Murfield, J., Draper, B., Beattie, E., Shum, D., ... & Mervin, C. M. (2017).

Levels of physical activity and sleep patterns among older people with dementia living in long-term care facilities: A 24-h snapshot. *Maturitas*, *102*, 62-68.

<http://dx.doi.org/10.1016/j.maturitas.2017.05.015>

Munch, M., Schmieder, M., Bieler, K., Goldbach, R., Fuhrmann, T., Zumstein, N., ... &

Cajochen, C. (2017). Bright light delights: Effects of daily light exposure on emotions, restactivity cycles, sleep and melatonin secretion in severely demented patients. *Current Alzheimer Research*, *14*(10), 1063-1075.

<https://doi.org/10.2174/1567205014666170523092858>

Musiek, E. S., Xiong, D. D., & Holtzman, D. M. (2015). Sleep, circadian rhythms, and the pathogenesis of Alzheimer disease. *Experimental & Molecular Medicine*, *47*(3), e148-

e148. <http://dx.doi.org/10.1038/emm.2014.121>

Nascimento, C. M. C., Ayan, C., Cancela, J. M., Gobbi, L. T. B., Gobbi, S., & Stella, F. (2014).

Effect of a multimodal exercise program on sleep disturbances and instrumental activities of daily living performance on Parkinson's and Alzheimer's disease patients. *Geriatrics & Gerontology International*, *14*(2), 259-266. <http://dx.doi.org/10.1111/ggi.12082>

Oliveira, A. M. D., Radanovic, M., Mello, P. C. H. D., Buchain, P. C., Vizzotto, A. D. B.,

Celestino, D. L., ... & Forlenza, O. V. (2015). Nonpharmacological interventions to reduce behavioral and psychological symptoms of dementia: A systematic review.

*BioMed Research International*, vol. 2015. <http://dx.doi.org/10.1155/2015/218980>

O'Rourke, A., Power, E., O'Halloran, R., & Rietdijk, R. (2018). Common and distinct

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- components of communication partner training programmes in stroke, traumatic brain injury and dementia. *International Journal of Language & Communication Disorders*, 53(6), 1150-1168. <http://dx.doi.org/10.1111/1460-6984.12428>
- Papadopoulos, D., Papadoudis, A., Kiagia, M., & Syrigos, K. (2018). Nonpharmacologic interventions for improving sleep disturbances in patients with lung Cancer: A systematic review and meta-analysis. *Journal of Pain and Symptom Management*, 55(5), 1364-1381. <http://dx.doi.org/10.1016/j.jpainsymman.2017.12.491>
- Scales, K., Zimmerman, S., & Miller, S. J. (2018). Evidence-based nonpharmacological practices to address behavioral and psychological symptoms of dementia. In S. Meeks, S., Fazio, D. Pace, B.A Kallmyer, K. Maslow, & S. Zimmerman. Alzheimer's Association dementia care practice recommendations (pp. S88-S102). *The Gerontologist*, 58 (Supplement 1).
- Sekiguchi, H., Iritani, S., & Fujita, K. (2017). Bright light therapy for sleep disturbance in dementia is most effective for mild to moderate Alzheimer's type dementia: A case series. *Psychogeriatrics*, 17(5), 275-281. <http://dx.doi.org/10.1111/psyg.12233>
- Shepherd, H., Livingston, G., Chan, J., & Sommerlad, A. (2019). Hospitalisation rates and predictors in people with dementia: a systematic review and meta-analysis. *BMC Med*, 17(1), 1-13. <https://doi.org/10.1186/s12916-019-1369-7>
- Shi, L., Chen, S. J., Ma, M. Y., Bao, Y. P., Han, Y., Wang, Y. M., ... & Lu, L. (2018). Sleep disturbances increase the risk of dementia: A systematic review and meta-analysis. *Sleep Medicine Reviews*, 40, 4-16. <http://dx.doi.org/10.1016/j.smr.2017.06.010>
- Shih, Y. H., Pai, M. C., Huang, Y. C., & Wang, J. J. (2017). Sundown syndrome, sleep quality,

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- and walking among community-dwelling people with Alzheimer disease. *Journal of the American Medical Directors Association*, 18(5), 396-401.  
<http://dx.doi.org/10.1016/j.jamda.2016.10.016>
- Sidani, S. & Braden, C.J. (2021). *Nursing and health interventions: Design, evaluation and implementation* (2nd ed.). Wiley Press.
- Sidani, S. & Fox, M. (2014). Patient-centered care: A clarification of its active ingredients. *Journal of Interprofessional Care*, 28(2), 134-141.
- Sidani, S., Fox, M., & El-Masri, M. M. (2020). Guidance for the reporting of an intervention's theory. *Research and Theory for Nursing Practice*, 34(1), 35-48.  
<http://dx.doi.org/10.1891/1541-6577.34.1.35>
- Smith, F., Wallengren, C., & Öhlén, J. (2017). Participatory design in education materials in a health care context. *Action Research*, 15(3), 310-336.  
<http://dx.doi.org/10.1177/1476750316646832>
- So, C., & Pierluissi, E. (2012). Attitudes and expectations regarding exercise in the hospital of hospitalized older adults: A qualitative study. *Journal of the American Geriatrics Society*, 60(4), 713-718. <http://dx.doi.org/10.1111/j.1532-5415.2012.03900.x>
- Tamrat, R., Huynh-Le, M. P., & Goyal, M. (2014). Non-pharmacologic interventions to improve the sleep of hospitalized patients: A systematic review. *Journal of General Internal Medicine*, 29(5), 788-795. <http://doi.org/10.1007/s11606-013-2640-9>
- Thuné-Boyle, I. C. V., Iliffe, S., Cerga-Pashoja, A., Lowery, D., & Warner, J. (2012). The effect of exercise on behavioral and psychological symptoms of dementia: Towards a research agenda. *International Psychogeriatrics*, 24(7): 1046-1057.  
<http://dx.doi.org/10.1017/S1041610211002365>

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

- van Alphen, H. J., Hortobágyi, T., & van Heuvelen, M. J. (2016a). Barriers, motivators, and facilitators of physical activity in dementia patients: A systematic review. *Archives of Gerontology and Geriatrics*, *66*, 109-118.  
<http://dx.doi.org/10.1016/j.archger.2016.05.008>
- van Alphen, H. J., Volkers, K. M., Blankevoort, C. G., Scherder, E. J., Hortobágyi, T., & van Heuvelen, M. J. (2016b). Older adults with dementia are sedentary for most of the day. *PloS one*, *11*(3), e0152457. <http://dx.doi.org/10.1371/journal.pone.0152457>
- Van Maanen, A., Meijer, A. M., van der Heijden, K. B., & Oort, F. J. (2016). The effects of light therapy on sleep problems: a systematic review and meta-analysis. *Sleep Medicine Reviews*, *29*, 52-62. <http://dx.doi.org/10.1016/j.smrv.2015.08.009>
- Wennberg, A. M., Wu, M. N., Rosenberg, P. B., & Spira, A. P. (2017). Sleep disturbance, cognitive decline, and dementia: A review. *Seminars in Neurology* (37) 4, 395-406. NIH Public Access.
- Xu, J., Wang, L. L., Dammer, E. B., Li, C. B., Xu, G., Chen, S. D., & Wang, G. (2015). Melatonin for sleep disorders and cognition in dementia: A meta-analysis of randomized controlled trials. *American Journal of Alzheimer's Disease & Other Dementias*®, *30*(5), 439-447. <http://dx.doi.org/10.1177/1533317514568005>

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

**Tables/Figures****Table 1***Literature review*

Steps	Treatment Recommendations
Specification of keywords for the search	<p>Keyword reflecting sleep disturbances: Circadian Rhythm/, exp Sleep/Wake Disorders/, Syndromes/, Snoring/; (sleep* or snore or snoring or wakeful*) or (circadian adj2 (rhythm* or system*)) or insomnia*</p> <p>Combined with:</p> <p>Keywords reflecting the dementia concept: exp Dementia/; (dement* or alzheimer* or lewy bod*)</p>
Search limits	<p>Older adult population Aged 65+</p> <p>English language publications</p> <p>Year of publication: 2000 to 2020 (for comprehensiveness)</p>
Databases searched	MEDLINE, CINAHL, PSYCHINFO, AGELINE.

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

**Table 2***Matrix Linking Determinants of Sleep Disturbances and Evidence-Based Therapies*

Determinants	Therapy	Treatment Recommendations
Physiological changes (melatonin and circadian rhythms)	Bright light therapy	<p>Use light box:</p> <ul style="list-style-type: none"> <li>- Place the box one meter away from the PWD, at a height within visual field to ensure the light enters users' eyes</li> </ul> <p>Dose: expose PWD to light for 30 minutes to 2 hours, in the morning (around 9am), 5 days per week, over a period of 10 days to 2 months, especially in the wintertime.</p>
Limited or lack of exposure to daylight	Exposure to natural daylight	<p>Get exposure to outdoor daylight:</p> <ul style="list-style-type: none"> <li>- Go outside the home; sit or walk during the recommended exposure time; or</li> <li>- Open blinds and sit next to the window during the recommended exposure time</li> </ul> <p>Dose: exposure is for one hour, in the morning around 9am.</p>
Limited engagement in physical activity	Physical activity therapy	<p>Highlight the benefits of physical activity to recovery, sleep, and general health</p> <p>Explain strategies to get involved in daytime activity (see sleep hygiene recommendations)</p>
Beliefs about bedrest	Sleep hygiene recommendation for daytime activity	Get involved in daytime activity:

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- Select an activity that is enjoyable, appropriate to PWD functional capacity, not medically contraindicated, and feasible (e.g., walking, making swimming movements with arms, yoga or tai chi movements, stretches)
- Perform the activity during the daytime

Dose: engage in the activity for as long as tolerated, everyday

Sleep environment (noise, light, temperature)

Sleep hygiene recommendations for sleep environment

Promote environment conducive to sleep:

In the hospital:

- Limit visitors in the evening according to PWD sleep needs
- Turn off electronics (e.g., mobile telephone, television, radio) when going to bed
- If possible, do not give treatments or perform procedures in the evening and at night if they are not necessary at that time

In the home:

- Limit visitors or household chores when PWD is trying to sleep
- Turn off electronics (e.g., mobile telephones, radios) or place mobile telephones on vibration mode or lower ring volume
- Turn off equipment not being used (e.g., oxygen tank)
- Reduce noise while falling asleep and while sleeping; consider using earplugs or a fan to block out disturbing noise that cannot be controlled
- Reduce light in the bedroom; consider dark shades on bedroom windows and a night light for safety, as needed
- Have a comfortable bedroom temperature (between 12 and 24 degrees Celsius), based on PWD preference

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Dose: apply everyday

Stress resulting in physiological, psychological and cognitive arousal

Sleep hygiene recommendations for minimizing arousal around bedtime

Strategies to minimize arousal:

- Avoid food (e.g., those containing chocolate), beverages (hot chocolate, coffee, tea, regular soda soft drinks) and medications or over-the-counter remedies (e.g., cough medicine), which contain stimulants, 4 to 6 hours before bedtime. Note: check with the doctor before stopping prescribed medications that contain stimulants
- Avoid smoking or drinking alcohol, which delay sleep, 4 to 6 hours before bedtime
- Avoid large meals, which may be uncomfortable, 3 to 4 hours before bedtime; however, if hungry, have a light snack to promote sleep and prevent awakening from hunger
- Avoid drinking excessive fluids (e.g., water, juice) in the evening to reduce the chance of waking up at night to urinate
- Avoid emotional or mental stimulation before bedtime that may lead to anxiety, worry or the inability to relax (e.g., limit discussion that may be distressing)
- Wind down before going to bed by: 1) setting aside time to deal with worries: review the worries, make a plan to deal with them the next day, and write the plan down to prevent trying to think about or remember them at night; 2) doing a relaxing activity (e.g., listening to music, reading a book, taking a warm bath, having a back massage) 30 to 60 minutes before going to bed; 3) developing a pre-bedtime routine, 20 to 30 minutes before going to bed; the routine includes

## INTERVENTION TO PROMOTE SLEEP IN PERSONS WITH DEMENTIA

		brushing teeth, preparing the bed, and putting on the pajamas
		Dose: apply every day, as needed
Sleep-related behaviors	Stimulus control therapy	Provide the six instructions:
		<ul style="list-style-type: none"> <li>- Go to bed only when sleepy.</li> <li>- Use the bed only for sleeping or sex; that is, do not use the bed or bedroom for other activities such as reading, watching television, eating, or worrying.</li> <li>- If unable to sleep within 15 to 20 minutes, get up and go to another room and engage in a quiet activity until sleepy.</li> <li>- If awakened during the night and unable to fall back to sleep, get out of bed and engage in a quiet activity until sleepy.</li> <li>- Wake up at the same time every morning, regardless of amount of sleep, which is important to develop a consistent sleep rhythm and generate the sleep drive.</li> <li>- Take a nap, if needed, in bed, for no longer than 30 minutes during the day only and before 3 pm.</li> </ul>
		Dose: apply every day

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*Note:* PWD = Persons with dementia.