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Sleep Disturbances and Fatigue in Critically Ill Patients

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Have you ever tried to sleep in a brightly lit room, with tubes and wires attached, and with people periodically talking, touching, and moving you? It is not surprising that sleep disturbances and fatigue are among the most common symptoms in critically ill adults, regardless of the type of acute care hospital unit or disease process.[1, 2] Many factors contribute to sleep and fatigue symptoms during recovery from acute illness or injury. Pre-existing sleep disorders, pathophysiology of the underlying illness/injury, therapeutic interventions, medications, and the intensive care unit (ICU) environment are major contributing factors in sleep disruption and fatigue.[2–6] Regardless of the cause, consequences of sleep disturbances and fatigue include diminished physical and cognitive functioning, mood instability, emotional distress, and amplification of concurrent symptoms.[2, 7] Sleep disruption is a significant stressor in the ICU that can negatively affect recovery and even survival.[8, 9]

Sleep disturbance and debilitating fatigue that originate during acute illness may continue months after discharge from the ICU.[10] If unrecognized, lack of treatment may contribute to chronic sleep problems, impaired quality of life, and incomplete rehabilitation.[11, 12] Acute and chronic fatigue can diminish a patient's ability to participate in her or his own care. Experts have concluded that screening, evaluation, and management of sleep disturbances and fatigue are suboptimal in the critical care setting.[1, 13] An evidence-based approach to address these and related symptoms is recommended.[2] As patient advocates, nurses are well positioned to identify patient and environmental issues that prevent effective sleep and generate fatigue. The purpose of this article is two-fold: the first objective is to discuss the literature related to the occurrence, etiology and risk factors of sleep disturbance and fatigue, and the second one is to describe assessment and management options in critically ill adults.

Background

Adequate sleep is essential to survival of all mammals. Sleep provides necessary restorative, protective and energy-conserving functions. Indications of restorative sleep include awaking/feeling refreshed, and the absence of daytime sleepiness after nocturnal sleep periods. Sleep consists of two main types: rapid eye movement (REM) sleep, and nonrapid

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eye movement sleep (NREM). NREM sleep consists of several stages of light, transitional (new classification: N1, N2; previously classified as stage 1–2) to deeper sleep (new classification: N3; previously classified as stage 3–4).[14] Sleep "architecture" consists of several recurring 90-minute cycles of NREM and REM sleep. Sufficient quantities of both NREM and REM sleep stages are necessary for restoration of mental and physical processes.

Sleep disturbance is defined as the perceived or actual alterations in nighttime sleep (both quantity and quality) with subsequent daytime impairment.[15] Sleep disturbance may be acute and transient, but often it is a recurrent problem. Common complaints include difficulty in one or more of these areas: falling asleep, staying asleep, early morning awakenings with inability to resume sleep, non-restorative sleep, and excessive daytime sleepiness. Regardless of the cause, sleep disturbances have been associated with adverse physiological outcomes, including alterations in immune function, [16–18] metabolism, nitrogen balance, and protein catabolism.[19, 20] Sleep deprivation and disruption are known to diminish quality of life (QOL),[9] and cognitive abilities.[21] In addition, sleep disturbance can increase pain intensity, depression and anxiety.[22–25]

Sleep in ICU patients is characterized by fragmented nocturnal sleep, poor sleep efficiency, and prolonged sleep onset (sleep latency).[12] Sleep periods of ICU patients are described as brief, interrupted by frequent arousals, and evenly distributed over the day and night. When a sleep period is fragmented by frequent arousals, sleep architecture is significantly altered. Alterations include a greater percentage of transitional, light sleep, reduced deep, restorative sleep, and decreased REM sleep.[12]

Estimates of Sleep Disturbance in Critically Ill Patients

Evidence suggests that acute illness/injury and the ICU environment diminish restorative sleep, however, it has been difficult to quantify occurrence rates due to varied definitions of sleep disturbance, measurement issues, and the challenges of conducting sleep studies in the ICU.[26] Despite the challenges, evidence suggests that a substantial proportion of ICU patients experience poor sleep quality, prolonged sleep latency, and frequent arousals/ awakenings that contribute to physical and emotional distress.[27–29] In a large study of medical and surgical ICU patients (n = 1,625), 38% experienced difficulty falling asleep, and 61% reported a greater than usual need for sleep.[10] In another study, nearly 70% of ICU patients with cancer experienced a moderate or severe level of sleep disturbance, and poor sleep was identified as one of the most stressful aspects of their ICU stay.[30] Several months after hospital discharge, more than half of ICU survivors (n =39) continued to experience worse interrupted sleep or altered sleep patterns compared with their pre-hospital patterns.[31] Sleep research in the ICU is in its infancy and further investigations of nurse-driven assessment and interventions are needed to minimize the negative consequences of sleep disturbance in critically ill patients.[13]

Risk Factor Model for Sleep Disturbance

Spielman's Three-Factor Model proposes the interaction between predisposing, precipitating, and perpetuating factors in the development and continuation of sleep disturbances. [32] Predisposing factors are individual physiologic and psychological traits that affect the likelihood of developing sleep problems (e.g., age, hyperarousal). Precipitating factors are triggers that bring about or worsen sleep disturbances (e.g., acute illness, stressful life events, changes in sleep environment). Perpetuating factors include behaviors and beliefs that sustain the sleep disturbance even after the initial precipitating factor has resolved (e.g., substance use, poor sleep hygiene, maladaptive thoughts or behaviors related to sleep).[32] Thus, acute physical and psychological disorders in ICU patients may precipitate sleep disturbances that interact with the patient's innate predisposition for sleep problems.

Aging increases the incidence of sleep disorders and changes in sleep architecture. This risk factor is particularly significant to ICU clinicians, because more than half of all ICU days are attributable to patients older than 65.[33] The amount of sleep spent in REM and deep sleep diminishes with age. In general older adults have prolonged sleep latency (SL), shorter total sleep time (TST), reduced sleep efficiency (SE), and more awakenings.[34] In addition to factors contributing to sleep disturbance in younger ICU patients, sleep of older adults may be even further disrupted by the physiological processes of aging.

Etiology of ICU-related Sleep Disturbance

Sleep disturbances in critically ill patients may result from pre-existing primary sleep disorders, underlying injury or illness, therapeutic/diagnostic interventions, and environmental factors.[2, 35, 36] Extant sleep disorders can exacerbate ICU-related sleep disruption. Conversely, underlying medical diseases may give rise to various sleep disorders (e.g., sleep apnea, restless legs syndrome, circadian rhythm disorder).[35–37]

Primary Sleep Disorders

Obstructive sleep apnea syndrome (OSAS), central sleep apnea (CSA), parasomnias, and circadian rhythm sleep disorders occur in the general public with varying frequency, and have been reported in substantial numbers of ICU patients.[38] Table 1 outlines common sleep disorders that may be present in ICU patients and describes characteristics, risk factors, and selected interventions.

Underlying Illness and Injury

Respiratory, endocrine, renal, cardiovascular, infectious, and neurological diseases have been associated with a variety of symptoms that interfere with onset and maintenance of sleep.[35–37] Patients with pulmonary disorders are more susceptible to oxygen desaturation due to frequent arousals and physiologic changes during REM sleep.[36] Dyspnea, nocturnal cough, and wheezing symptoms in chronic obstructive pulmonary disease (COPD) may decrease sleep duration, REM, and deeper sleep stages.[39] Physical complications of Type II diabetes (e.g., neuropathic pain and nocturia) have been associated with sleep fragmentation and loss.[40] Sleep disorders are common in patients at all stages of renal disease including sleep apnea, insomnia, restless legs syndrome and periodic limb movement disorder.[41, 42] Underlying uremia, pain, nausea, and pruritus contribute to sleep fragmentation in end-stage renal disease.[41]

Neurodegenerative and neuromuscular disorders are associated with sleep fragmentation, daytime sleepiness, movement and breathing disturbances, and circadian rhythm disorders, which worsen with disease severity.[43] The brain plays an integral role in the regulation of sleep and wakefulness; therefore, it is not surprising that patients with dementia, epilepsy, and traumatic brain injury have an increased risk of developing sleep disturbances.[44] Following stroke, sleep-wake disturbance and sleep-disordered breathing are frequently observed as a direct or indirect (e.g., pain, depression, medications) consequence of acute focal brain damage. [45]

Sleep disturbance and delirium in the ICU are frequently related, in part, to the shared etiology of sleep loss due to interruptions and sedatives.[46] An imbalance in neurotransmitters and an alteration in melatonin production may contribute to the pathogenesis of both delirium and sleep disturbances.[38] Delirium is strongly correlated with greater morbidity and mortality, and thus, effective interventions to address sleep disturbances may result in improved clinical outcomes.[38, 46]

A majority of hospitalized patients with chronic pain syndromes[22, 47] or acute pain resulting from surgery or trauma[30, 36, 48–50] experience sleep loss and fragmentation. For example, poor sleep has been correlated with acute burn pain, where poor sleep leads to reports of higher pain intensity and lower pain tolerance. In return, greater pain affects quality of sleep.[50, 51] Evidence suggests increased pain sensitivity may be due to the affect of sleep deprivation on opioid protein synthesis or opioid receptor affinity.[52] Effective analgesia, therefore, is indicated for both pain control and improved sleep.[22]

Sleep disturbances are common in psychiatric and behavioral disorders, notably anxiety, depression, and personality disorders. In turn, sleep disturbance and sleep deprivation can adversely influence the course of psychiatric disorders.[37]

Therapeutic/Diagnostic Interventions and Environmental Factors

Necessary therapeutic interventions/diagnostic procedures (e.g., medications, surgery), and resultant side effects (e.g., sedation, pain) contribute to sleep disturbance. It is important to consider the role of medications as a factors contributing to impaired sleep in critically ill patients. The most common medications that impair sleep include sedative and analgesic combinations used to facilitate mechanical ventilation.[7, 35, 36] Cardiovascular, gastric protection, anti-asthma, anti-infective, antidepressant and anticonvulsant drugs have also been reported to cause a variety of sleep disturbances and are reviewed in detail elsewhere.[36]

Recent studies suggest that mechanical ventilation is associated with loss of circadian sleep pattern, sleep fragmentation, increasing proportions of transitional stages of sleep, and loss of deep, restorative and REM sleep, but the precise mechanism is not well understood.[27, 53–56] Sleep in ventilated patients may be further disrupted by dyssynchronous breathing, ventilator mode, sedation, discomfort from the endotracheal tube, and stress related to communication barriers.[12] Optimizing ventilator settings is an area that needs further investigation.[12] Measures to improve comfort, quantity and quality of sleep include careful attention to sedative agents and mode of mechanical ventilation.[56]

Environmental factors including patient care activities (e.g., therapeutic interventions, monitoring), diagnostic procedures (e.g., lab draws, × rays), and the absence of diurnal cues (e.g., excessive nocturnal noise and lighting)[57, 58] contribute to disrupted sleep in critically ill patients.[2, 59] Patients have reported that noise--specifically from conversations, but also from ventilators, alarms, television, phones, beepers--causes sleep disruption.[12] Although several questions remain unanswered, there is a growing interest in developing effective strategies to improve sleep quality through management of modifiable environmental factors.[29]

Evaluation of Sleep Disturbances

Assessment of sleep disturbances may be challenging at the onset of acute illness, trauma, or surgery. As the patient's physical condition stabilizes, the ICU team can better assess how the ICU environment, medications, and current treatments contribute to sleep problems. Sleep assessments may be categorized as objective, behavioral, and subjective. Table 2 describes selected examples of measurements in these categories and their applicability in ICU settings.

The most effective and accurate way to measure sleep is polysomnography (PSG), but this method may be limited in critical care settings due to expense and access.[60] Bispectral index (BIS) is an alternative method that has been used in some ICU settings to measure sleep.[61]

A behavioral option is actigraphy, a small wrist or leg accelerometer that records gross motor activity and rest over long periods.[60] Continuous actigraph monitoring has been used in critically ill patients to guide use of sedative medications and enhance recognition of agitation.[62]

Subjective evaluation methods (clinician observation and patient self-reports) may offer a more practical means of evaluating sleep quality and efficacy of sleep interventions. Clinicians may infer sleep and sedation based on patient behaviors, but the distinction between wakefulness (with eyes closed) and NREM and REM stages of sleep cannot be determined by observation alone.[7] The validity of sleep observation may be subject to observer bias and fatigue. Sedation evaluation tools that use descriptive numerical scales are potentially more accurate than simple judgments of sleep/non-sleep states.

Using a patients' own appraisal of her/his sleep is desirable because s/he is able to compare usual sleep quality and quantity with the sleep quality and quantity during her/his acute illness. Daily sleep diaries, visual analog scales (VAS), questionnaires, and symptom or quality of life questionnaires with sleep items have been used in a variety of critical care studies,[63–65] but they may prove challenging to implement outside a clinical trial.

When patient status permits, verbal complaints of difficulty falling asleep, interrupted sleep, or not feeling rested need to be elicited on a routine basis with or without the use of a formal measure. Assessment of past sleep patterns in a normal environment helps clinicians distinguish individual sleep problems from hospital-related causes. Pre-morbid health habits (e.g., exercise, caffeine, tobacco) may suggest areas that need to be addressed during the patient's post-ICU recovery.[66] Patients and family members may share insight to etiological factors (e.g., fear over results of diagnostic test), and assessment of their perception of sleep difficulties and possible relief measures may facilitate appropriate therapy. Although objective recording of the number of sleep hours and interruptions may differ from the patient's perception, observations of sleeping and wakeful behaviors over 24 hours, and notations of physical and psychological sleep interruptions (e.g., noise, pain, anxiety) can be helpful in developing a comprehensive care plan.[67]

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Interventions for Sleep Disturbances

If assessment suggests a sleep disturbance (with or without a diagnosed primary sleep disorder), a multidisciplinary approach should begin as soon as possible. Treatment choices include medications, non-pharmacologic interventions, simple sleep-preserving environmental changes in the ICU, and referral to or consultation with a sleep specialist.

Pharmacological Considerations

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Pharmacological treatment of sleep disturbance in the ICU begins with a careful review each patient's pharmacological treatment regimen and its impact on sleep. Many ICU patients receive medications to support blood pressure, improve urine and/or cardiac output, or enhance overall oxygen delivery. These agents are associated with changes in cortical activation and act through a variety of neurotransmitter pathways, receptors, and modulators that can adversely affect sleep-wake patterns.[68] Other common medications that have an effect on normal sleep physiology include sedatives, opioids, antidepressants, anticonvulsants, and medications for gastric protection, asthma, and infections.[2, 5, 12] Sleep-disrupting medications started in the ICU, therefore, should be discontinued as soon as possible. If medications that are disrupting sleep cannot be discontinued, administration of these agents at the lowest possible dose to achieve desired therapeutic results may be a possible compromise.

Sedatives and analgesics are examples of medications that may require dose reduction to improve sleep quality and quantity. Although necessary for many ICU patients, particularly those requiring mechanical ventilation, sedatives and analgesics are known to alter normal sleep patterns and architecture.[5, 68] Reductions in sedative dosage may improve sleep, but require careful titration and monitoring to prevent symptoms of withdrawal. Withdrawal symptoms (e.g., restlessness, sleep disturbances, fatigue) are associated most often with prolonged use of sedative agents. Guidelines developed by the American College of Critical Care Medicine recommend systematic tapering of sedatives to reduce the risk of these sleep-related withdrawal symptoms.[69] In addition to attention to sedative withdrawal reactions, nicotine and alcohol replacement may be indicated for heavy smokers or drinkers to manage sleep disturbance due to withdrawal of these substances.[5]

Before starting new sleep medications in ICU patients, a thorough appraisal of all current medications is advised.[5] Medications for acute sleep disturbances should be used for short periods with ongoing reassessment, and they should be administered in conjunction with non-pharmacologic interventions. It is important to recognize that even if total sleep time is increased, sleep medications may not necessarily improve sleep quality.

Benzodiazepines are commonly prescribed in the treatment of sleep disorders, but they alter sleep architecture, specifically decreasing deeper NREM and REM sleep phases. REM sleep is associated with respiratory dysfunction, so benzodiazepine-induced REM reduction may be advantageous in some patients (e.g., Cheyne-Stokes respiration and chronic obstructive pulmonary disease).[70] Newer, shorter acting benzodiazepines (zolpidem, zaleplon) have fewer hangover effects and less deep sleep suppression compared to previous generations of benzodiazepines (diazepam, nitrazepam). Midazolam, a short acting benzodiazepine, is often used in ICUs for procedural sedation and sedation of ventilated patients because of its favorable therapeutic profile: short half-life, no active metabolites, water soluble, and available intravenously or subcutaneously.[71] Limitations of benzodiazepines include tolerance within days of initiating therapy, risks of dependence, and adverse events (e.g., nightmares, restlessness).[5] Selected sleep medications are presented in Table 3.

Post-traumatic stress disorder (PTSD) and resultant nightmares are well-recognized complications of severe illness that have been described in ICU patients after multiple trauma, burns, myocardial infarction, acute respiratory distress syndrome or septic shock.[72] Pharmacological agents for treatment of PTSD-associated nightmares may include Prazosin and Clonidine.[73] Other medications may be considered for treatment of PTSD-related nightmares, but there is weak evidence for the use of the following: trazodone, atypical antipsychotic medications, topiramate, low dose cortisol, fluvoxamine, triazolam, nitrazepam, phenelzine, gabapentin, cyproheptadine, and tricyclic antidepressants.[73] Relaxation and other behavioral approaches may be considered for treatment of PTSD-associated nightmares based on patient needs and acceptance of therapy.[73] In summary, a wide variety of medications are available to treat sleep disturbances and nightmares arising from multiple etiologies, yet further investigation is needed to establish efficacy and utility in the ICU setting.

Non-pharmacologic Approaches to Manage Sleep Disturbance

Non-pharmacologic approaches to improve sleep may be broadly grouped into three areas: cognitive-behavioral interventions, complementary therapies, and environmental strategies. Cognitive Behavioral Therapy for Insomnia (CBTI) is an established treatment for comorbid insomnia in the context of medical and psychiatric illness, as well as for primary chronic insomnia.[74] For comorbid insomnia, some simple adaptations to standard CBTI may prove beneficial in ICU patients. The individual components, which include behavioral strategies (regular sleep scheduling, stimulus control), cognitive therapy, sleep hygiene education, and relaxation, can be delivered as monotherapies. Multi-component delivery, however, is widely accepted as the preferred approach.[75] The goal of CBTI is to reduce perpetuating factors below the insomnia threshold and to de-condition the hyperarousal response.[76] Cognitive therapy aims to decrease dysfunctional beliefs and attitudes that prevent sleep onset and maintenance. Sleep hygiene education addresses a variety of habits, environmental factors, and practices that influence the duration and quality of sleep. Educational subject matter typically includes simple guidelines to effectively promote sleep onset and maintenance. As with CBTI, sleep hygiene may need adaptation for the ICU setting.

Although still largely unexamined in the ICU, complementary therapies to improve sleep (e.g., muscle relaxation, massage, healing touch) have been found to be effective in other patient groups.[77] In recent reviews of complementary therapies tested in hospitalized and ICU patients,[78, 79] the reviewers concluded that massage,[80] music,[81] relaxation,[82] and therapeutic touch[83] are potentially beneficial nurse-driven interventions that promote sleep in critically ill adults. Additional well-designed studies are needed to evaluate the efficacy of complementary therapies on sleep in a variety of patient populations and settings.

Early mobility in the ICU is emerging as an important strategy to prevent and treat muscle weakness and improve long-term recovery.[84] Stepwise progressive mobility programs have been tested in a few small studies and have shown favorable effects on sleep outcomes.[85–87] Evidence to date shows a positive trend for early mobility that may lead to improved sleep in ICU patients, but results from larger studies are needed.

Most environmental interventions for sleep disturbances are centered on noise reduction or filtering,[4, 88–90] diurnal lighting practices,[88, 90, 91] and scheduling uninterrupted time for adequate sleep.[92] Intervention studies to reduce sleep disturbances resulting from environmental factors in ICU patients are presented in Table 4. In general, nursing interventions that focus on the abatement of ambient stressors in the ICU (light, noise, interruptions) were found to enhance patients' sleep.[93, 94] However, limitations of these studies include small samples (clinical and non-clinical), lack of standard measures, and non-randomized study designs. Additional, well-designed trials with a sufficient sample size are needed. In addition to providing an environment conducive to sleeping in the ICU, general strategies to improve sleep quantity and quality in ICU patients are identified in Table 5. [2, 6, 93]

Sleep Specialist Consultation

Primary sleep disorders may present as comorbidities in ICU patients, so consultation with a sleep specialist may be appropriate. For example, if OSAS is suspected, referral to a sleep specialist and a polysomnography (PSG) are indicated if the patient’s condition permits. In the interim, 24-hour oximetry may be used as a screening measure. If repetitive oxygen desaturations are recorded during sleep, a continuous positive airway pressure (CPAP) system may prove beneficial to the patient’s overall recovery. Once the patient’s condition is stabilized and a PSG can be performed, it will be necessary to confirm the OSAS diagnosis and titrate the CPAP.[66]

Sleep and Fatigue

Patients often complain of fatigue related to disrupted sleep. Fatigue and sleep disturbances are often interrelated, but also occur independently of each other. Sleep disturbances may lead to symptoms of excessive daytime sleepiness (EDS) and diminished energy. Although frequently noted in combination, fatigue is distinct from EDS. Endocrine, metabolic disorders, and psychiatric disease such as depression are associated with fatigue without excessive sleepiness.[95] EDS and lack of energy in fatigued patients may subsequently lead to reduced physical activity and prolonged daytime napping, which in turn perpetuates sleep disturbances such as sleep onset insomnia. Understanding and simultaneously treating symptoms such as sleep disturbance and fatigue may lead to the most parsimonious, effective strategies to alleviate these symptoms.

Fatigue

Defining Features and Incidence

Although ubiquitous in both acute and chronic illnesses, fatigue is not a trivial problem. The North American Nursing Diagnosis Association (NANDA) defines fatigue as an overwhelming sustained sense of exhaustion and decreased capacity for physical and mental work at a usual level.[67] During an acute illness, fatigue may have a protective function that keeps the patient from further injury and harm. As with sleep disturbance, few studies have specifically addressed the incidence of fatigue during and after ICU admission. Although it has not been the focus of research in ICU patients, fatigue emerges as a common problem during and after acute illness and injury. In a heterogeneous group of ICU patients at high risk of dying (n = 245), the vast majority (75%) reported fatigue.[96] Several studies have investigated the ongoing challenges of survivors after discharge from the ICU as the result of prolonged fatigue (e.g., physical functioning, role, and vitality).[9, 47, 97, 98] In a study examining quality of life and physical functioning of ICU survivors in the first six months of recovery, investigators found that half the participants (n = 39) reported difficulty with vitality, mobility and concentration, and 72% experienced a change in their responsibilities at home.[31] Although fatigue may not be a top priority during ICU admission, early recognition and treatment when a patient's condition stabilizes is needed to reduce long-term negative patient outcomes.

Etiology of Fatigue

Fatigue may involve the interaction of several physiologic and psycho-behavioral mechanisms, leading to its association with a variety of acute and chronic physical and psychological illnesses (e.g., cancer, hepatitis, rheumatoid arthritis, fibromyalgia, myasthenia gravis, and depression).[67] In addition, fatigue has been found in 46% of brain-injured patients, in 85% of multiple sclerosis patients, and in 50% of HIV/AIDS patients.[99] Psychological, physiological, and environmental/situational factors increase the risk of fatigue in many critical care patients. Psychological factors such as stress, anxiety, and depression, are common psychological factors. Physiological factors include sleep loss/poor sleep quality, weak physical condition, adverse effects of medications, malnutrition, and anemia. Factors in the ICU environment (e.g., light, noise, temperature) and the illness/injury/surgery that lead to ICU admission influence the onset and duration of fatigue.

The clinical expression of fatigue is multidimensional and disease-related, often making evaluation challenging. Fatigue may be experienced and reported differently by individuals, and assessment may impeded by communication impairments (e.g., intubation and sedation). Personality and coping style may also influence the experience of fatigue. The association between sleep disturbance and fatigue has been established in a variety of patient populations.[94, 100–104] In a recent study, Redeker et al. revealed that 51% of stable heart failure patients reported insomnia symptoms that were associated with increased fatigue, depression, excessive daytime sleepiness, and functional performance.[105] Researchers continue to examine the relationships among fatigue, sleep disturbance, depression, and cognitive dysfunction to understand possible shared neurophysiologic mechanisms.[106, 107]

Evaluating patients for fatigue is essential to improving management and is a key component of quality care. Brief screening measures for fatigue are available, sensitive, and applicable in critical care settings to identify patients who could benefit from further evaluation. Using a quantitative rating scale such as a 0 to 10 (where 0= no fatigue and 10= worst fatigue imaginable) allows the patient to describe the amount of fatigue experienced. Other rating scales can be developed using pictures or descriptive words. Routine screening should occur at regular intervals to determine if the fatigue is constant or varies over time.

Evaluation of Fatigue

Identifying related factors in patients with moderate or severe fatigue via a detailed history can aid in establishing an effective collaborative plan of care. The causes and severity of fatigue may change over time. Etiologic factors such as comorbidities, anemia, imbalanced nutritional intake, and sleep disorders that may aggravate fatigue require ongoing assessment. Fatigue may be a symptom of protein-calorie malnutrition, vitamin deficiencies, or iron deficiencies. Monitoring for alterations in blood glucose, hemoglobin/hematocrit, BUN, and oxygen saturation provide information about potential physiologic basis of fatigue. Changes in sleep-wake pattern may contribute to the development of fatigue; therefore, sleep quality/quantity, sleep latency and feeling upon awakening need to be assessed.

Periodically reviewing current medications identifies those with side-effects likely to intensify fatigue. Particular attention should be given to beta-blockers, calcium channel blockers, tranquilizers, muscle relaxants, opioids, and sedatives.[108] Medications may cause fatigue due to central nervous system (CNS) depression (i.e., anticholinergic agents, centrally acting α-agonists, anticonvulsants) or increased CNS inhibitory activity (i.e., benzodiazepines, barbiturates). Medications that cause bone marrow toxicity and resultant anemia include antineoplastic agents, anticonvulsants, antidepressants, and antimicrobial agents.[108] In addition to a review of the current medications, clinicians will want to elicit information about the consequences of fatigue by exploring its effects on mood. Anxiety and depression can add to fatigue levels and may affect a patient’s ability to participate in her or his plan of care in the ICU setting.

Interventions for Fatigue

Interventions to manage fatigue are multimodal, and they begin with treatment of comorbid factors (anemia, depression, poor nutrition), followed by non-pharmacological approaches (e.g., progressive mobility programs to counteract deconditioning). Clinicians, patients and their families must work together to identify appropriate and acceptable management strategies during ICU stay and in preparation for discharge. Open communication will facilitate discussion about the experience of fatigue. Expected outcomes of fatigue interventions may include patient’s verbalization that s/he has sufficient energy to complete desired activities, or increasing capacity for physical and cognitive functioning.

Pharmacological Considerations

Pharmacologic agents for fatigue have been evaluated primarily in patients with cancer,[109] neuromuscular disease,[110] and depression,[111] with a scarcity of literature about ICU patients. Pharmacologic treatment needs to be considered in the context of the etiology of fatigue, disease entity, and other medications. Optimizing cardiopulmonary function is critical. Patients with fatigue and concurrent anemia should be evaluated to determine the cause of the anemia and managed according to practice guidelines. Stimulants such as caffeine and modafinil may improve short-term performance and daytime alertness.

Non-pharmacologic Approaches to Manage Fatigue

The importance of remaining active and participating in a consistent program of gentle exercise, individualized to the patient’s age, condition, and physical fitness level should be communicated to patients and families. Progressive mobility and limited exercise improves aerobic capacity, reduces muscle loss and deconditioning, and may produce favorable effects on sleep, mood, self-efficacy, body composition, immune system, and long-term disease outcomes.[67]

A physical therapy consultation may provide helpful recommendations about early mobility, and the type, intensity, and frequency of exercise for ICU patients who are stable but experiencing significant fatigue. Common elements in psycho-educational interventions include energy conservation strategies (such as daily planning and clustering of nursing activities to achieve optimal balance of rest and activity), and strategies to address sleep disturbances. Psychosocial interventions may include coaching to enhance engagement in the ICU plan of care and facilitating active coping with illness and hospitalization. Additional, general strategies to manage fatigue in ICU patients are described in Table 6.

Summary, Conclusions, and Future Directions

Sleep disturbances and fatigue are significant problems for patients in critical care units. Extant sleep disorders, underlying medical/surgical conditions, environmental factors, stress, medications, and other treatments all contribute to a patient's inability to sleep. A combined approach that incorporates assessment of sleep disturbances and fatigue, environmental controls, appropriate pharmacological management, educational, and behavioral interventions is necessary to reduce the impact of sleep disturbances and fatigue in ICU patients.

Following a comprehensive assessment of environmental and patient factors, a care plan can be devised to provide periods of uninterrupted sleep, identify medications regimens that promote sleep and reduce fatigue, and suggest non-pharmacological interventions based on individual patient needs and desires. Support from all members of the health care team is needed to implement changes and make progress in addressing patients' sleep and energy needs. Optimal management of patients' sleep disturbance and fatigue in the ICU may maximize patient progress and improve health outcomes long after discharge from the acute care setting. Nurses are well positioned to identify issues in their own units that prevent effective patient sleep. Education about sleep disturbance and fatigue assessment/management needs to be integrated into critical care courses and orientation programs.[112]

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Table 1

Common Sleep Disorders in Critically Ill Patients: Characteristics, Risk Factors, and Interventions.[37, 95]

Sleep Disorder	Characteristics	Risk Factors/Causes	General Interventions
Sleep deprivation	A sufficient lack of restorative sleep over a cumulative period resulting in physical or psychiatric symptoms, and affects usual performance	Medications Acute medical, neurological and psychiatric disorders ICU environment (noise, lighting) Routine patient care and monitoring activities Pain and other symptoms Inadequate sleep hygiene Acute stressors Other sleep disorders (e.g., RLS, OSA)	Address underlying causes of sleep deprivation: • Review patients' medication for adverse effects and potential for withdrawal phenomena related to sleep* • Treat underlying medical and psychiatric disorders* • Control environmental disruptions (e.g., noise and light exposure)* • Minimize unnecessary interruptions during the patient's normal sleep hours* • Review settings of mechanical ventilation to reduce dyssynchronous breathing and central apneas* • Provide sleep hygiene education as appropriate* • Review patients' history for symptoms that might suggest pre-existing sleep disorders – treat disorder*
Insomnia	Transient or chronic difficulty falling asleep, staying asleep or awakening too early, despite adequate opportunity, condition and time. Associated with impairment of daytime function.	Advanced age Female gender Medication and substance use Acute medical, neurological and psychiatric disorders Pain and other symptoms Inadequate sleep hygiene Acute stressors Other sleep disorders (e.g., RLS, OSA)	• Sleep deprivation interventions may also be used to address similar factors in insomnia • Address factors that precipitate or perpetuate insomnia* • General measures and standard non-pharmacologic strategies to improve sleep hygiene * • Multi-component cognitive-behavioral treatments • Relaxation techniques* • Appropriate short-term pharmacotherapy* (see Table 3)
Obstructive Sleep Apnea (OSA)	Repetitive reduction or cessation of airflow, despite the presence of respiratory efforts due to partial or complete upper airway occlusion during sleep	Advancing age Male gender Family history of OSA Menopausal state Excess body weight Snoring Specific cranio-facial and oropharyngeal features (e.g., neck circumference > 17 inches in men) Smoking and alcohol use Medications (e.g., muscle relaxants, sedatives, anesthetics, opioid analgesics) Primary medical disorders (e.g., acromegaly, androgen therapy, amyloidosis, CHF, neuromuscular disorders, stroke)	• General measures and appropriate non-pharmacologic strategies to improve sleep hygiene * • Positive airway pressure (PAP)* • Oral devices • Upper airway surgery
Central Sleep Apnea (CSA)	Repetitive cessation of airflow during sleep due	Cardiac, renal, and neurological disorders (e.g., CHF, renal failure,	Address underlying cause*

Sleep Disorder	Characteristics	Risk Factors/Causes	General Interventions
	to reduction or loss of ventilatory effort; may be primary or secondary to other medical disorders	brainstem lesions, head injury, neuromuscular disorders, stroke). Chronic use of long-acting opioids High altitude breathing	General measures non-pharmacologic strategies to improve sleep hygiene and * Avoid respiratory depressants* Oxygen therapy (for non-hypercapnic CSA)* PAP* Pharmacologic therapy (e.g., acetazolamide, theophylline, medroxyprogesterone, hypnotic agents)*
Parasomnias	Physical or experiential phenomena that occur during the sleep period that manifest as activation of the skeletal muscles or autonomic nervous system (e.g., confusional arousals, nightmares, sleep walking)	Risk factors are related to the specific manifestations: Familial pattern in confusional arousals Risk factors for nightmares include medications (e.g., amphetamines, barbiturates, dopamine agonists, antidepressants) and withdrawal from alcohol and REM sleep suppressants Sleepwalking (decreases in adulthood)	(Treatment is contingent on manifestation of parasomnia) General measures to improve sleep hygiene* Behavioral therapy and psychotherapy for nightmares
Restless legs syndrome (RLS) and periodic limb movement disorder	Neurological disorder characterized by an urge to move legs, or unpleasant sensations of the legs that begin or worsen during periods of inactivity, and are relieved by movement.	Female gender Iron deficiency anemia Uremia Pregnancy Peripheral neuropathy Attention deficit hyperactivity disorder Parkinson disease Diabetes mellitus Rheumatoid arthritis Alcohol or caffeine Smoking Medications (SSRI, TCA, MAOI, lithium, antihistamines, neuroleptics and dopamine antagonists)	Treat underlying causes or precipitating factors* General measures and standard non-pharmacologic strategies to improve sleep hygiene * Iron supplementation if serum ferritin < 5 μg/L* Dopamine agents* Benzodiazepines* Opioid agents* Additional medications (e.g., anticonvulsant agents, clonidine)*
Circadian Rhythm Sleep Disorders	Caused by recurrent or persistent misalignment between the desired sleep schedule and the circadian sleep-wake rhythm; can be associated with insomnia and excessive daytime sleepiness.	Advanced sleep phase disorder (early bedtime and wake time) onset is common in middle age, increases with advanced age. Delayed sleep phase disorder (late bedtime and wake time) onset in adolescence Irregular sleep-wake rhythm associated with neurological disorders (e.g., dementia)	General measures and standard non-pharmacologic strategies to improve sleep hygiene * Progressive mobility program* Regular sleep-wake and daytime activity schedules Bright light therapy Chronotherapy (progressive phase day or advancement) Melatonin

*Denotes current or potential use in the ICU setting

Table 2

Measures of Sleep Disturbance[1, 113]

Measure	Description
Objective	
Polysomnography (PSG)	A diagnostic test typically conducted in a sleep lab involving simultaneous recording of multiple physiologic variables during sleep. Sensors measure brain activity, airflow, respiratory effort, oxygen saturation, EKG, eye, jaw and leg muscle movement. Information is gathered, downloaded to computer, and outputted as waveform tracings which assist in the diagnosis of sleep disorders (e.g., sleep-related breathing disorders, movement disorders, parasomnias). The use of PSG in ICUs is possible but limited by access and cost.
Bispectral index (BIS)*	BIS is a measure of the level of consciousness by algorithmic analysis of a patient's EEG on a scale from 0–100 that represents cortical electrical activity (0 indicates cortical silence and 100 is equivalent to fully awake and alert). BIS scores correlate with different stages of sleep.
Multiple Sleep Latency Test (MSLT)	An objective measure of the physiologic tendency to fall asleep in quiet situations to evaluate unexplained excessive daytime sleepiness or suspected narcolepsy. PSG is usually performed immediately before a MSLT.
Behavioral	
Wrist Actigraphy*	A wristwatch-type device that records periods of activity and inactivity (rest or sleep) over days to weeks using sensors that detect movement. Actigraphs provide information about sleep latency, periods of nocturnal awakenings, total quantity of sleep and wake time. Limitations in ICU patients include decreased patient movement due to sedation, restraints, and weakness.
Subjective – Observation of Sedation	
Richmond Agitation and Sedation Score (RASS)[114]* *Nursing Instrument for the Communication of Sedation (NICS)[115]*	Feasible for clinical use, RASS and NICS are potentially more accurate than subjective observations of sleep because alertness and arousability to external stimuli are simultaneously assessed; these scales do not differentiate between persistent coma and transient sleep.
Subjective - Patient Self-Report	
Daily sleep diaries, sleep log	A self-report record of sleep and wake patterns with related information, usually over a period of several weeks. A sleep diary is useful in the diagnosis and treatment of insomnia, circadian rhythm sleep disorders, and in monitoring whether treatment is successful (e.g., CBTI). Sleep diaries may be used in conjunction with actigraphy.
Visual analog scales (VAS) such as The Leeds Sleep Evaluation Questionnaire (LSEQ)[116]*	An example of a widely used standardized measurement of sleep difficulties in clinical settings, the LSEQ contains 10 VASs (100mm) which assess four domains of sleep and daytime behavior: Getting To Sleep, Quality Of Sleep, Awakening From Sleep, and Behavior Following Wakening. Other VASs are available for use with conscious patients.
Verran/Snyder-Halpern (VSH) Sleep Scale [117]* Richardson-Campbell Sleep Questionnaire (RCSQ) [118]* Sleep in ICU questionnaire [119]*	The VSH, RCSQ, and Sleep in ICU questionnaire have been tested in ICU patients [120], however, patient self-report measures are often limited to nighttime sleep, and use with conscious and stable patients.
Epworth Sleepiness Scale (ESS) [121]* Stanford Sleepiness Scale (SSS)* The Pittsburgh Sleep Quality Index (PSQI) [122]	Additional, well-established self-rated questionnaire measures may provide valuable data about a patient's sleepiness, pre-ICU sleep quality, quantity, and sleep habits/knowledge when patient status stabilizes. Sleepiness scales (ESS, SSS) provide information about circadian rhythms by tracking sleepiness and wakefulness throughout the day, allowing scheduling of patient activities during alert periods, and uninterrupted quiet time during periods of sleepiness. Sleepiness scales are brief and easy to use in the clinical setting, but patients must have some awareness, and be able communicate their sleepiness and fatigue. • ESS is comprised of 8-items that measure general propensity to fall asleep in various situation in recent times • SSS is a brief 7-point measure of perception of sleepiness at a given time ranging from “wide awake, vital, and alert” to “unable to remain awake with sleep onset imminent.” • PSQI contains19-items which assesses sleep quality and disturbances over a 1-month time interval. Subscales include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction

*Denotes current or potential use in the ICU setting

Table 3

Medications Commonly Used for Sleep Disturbance (FDA approved for insomnia unless indicated)

Pharmacologic Class	Usual Adult Dose (mg)	Onset (min)	Average 1/2 Life (hr)	General Comments
Benzodiazepines Triazolam (Halcion®) Oxazepam (Serax®) Temazepam (Restoril®) Flurazepam (Dalmane®)	0.125–0.25 10–30 7.5–30 15–30	15–30 30–60 45–60 60–120	2–4 5–10 8–17 48–100	Prototype class of hypnotics – supplanted by newer benzodiazepine receptor agonists (BZRAs) with shorter half-lives Cautious use in the elderly, hepatic insufficiency, untreated sleep apnea Side effects include tolerance, dependency, morning-after sedation, cognitive impairment, rebound insomnia
Non-Benzodiazepine Benzodiazepine receptor agonist Zaleplon (Sonata®) Eszopiclone (Lunesta®) Zolpidem (Ambien®) Zolpidem CR (Ambien CR®) Zolpidem tartrate sublingual (Edluar) Zolpidem tartrate mist (Zolpimist)	5–20 1–3 5–10 5–10 5–10 5–10	20 30 30 30	1–1.5 1.5–2.5 2.5–2.8 1.6–5.5	BzRAs have lower risk of rebound insomnia, tolerance, sleep architecture change, muscle relaxation compared with older benzodiazepines, most indicated for onset insomnia Zolpidem is available as generic medication and available in several FDA approved forms: oral, oral extended release, sublingual, mist (with similar drug absorption and pharmacokinetic profiles). Rare but widely publicized sleep-eating and sleep-walking incidents with zolpidem Extended dosing zolpidem CR has initial release and slow release throughout the night Reduced dosage of BzRAs is recommended for elderly patients
Melatonin receptor agonist Ramelteon (Rozeram®)	8	30	1–5	Ramelteon has advantageous safety profile, minimal abuse and dependence potential. Modest efficacy, associated with multiple drug and food interactions (avoid taking with or right after a high fat meal). Side effects include headache, fatigue, dizziness, nausea, respiratory infection. Cautious use in elderly and patients with hepatic impairment.
Antidepressants **TCA**[b] Amitryptline (Elavil®) Doxepin (Sinequan®) Doxepin (Silenor®) **Serotonin Modulating** Trazodone (Drsyrel®)	10–300 25–50 3–6 25–150	30–60 30–60 30 30–60	14–18 20–25 4–7	Despite widespread off label use, most antidepressants are **not** FDA approved for insomnia; exception: low dose doxepin (Silenor) FDA approved for onset and maintenance insomnia (March/2010) Antidepressants for insomnia may be clinically justified if sleep disturbance is *concomitant with depression* and doses to treat insomnia are typically below antidepressant dose TCAs suppress REM sleep, have many drug interactions and impair cognition and psychomotor performance, therefore use cautiously in the elderly Trazodone may increase slow wave sleep and sleep continuity; should *not* be taken with MAO inhibitors; Trazadone affects daytime performance, and is associated with cardiac arrythmias, orthostatic hypertension, priapism.
Antihistamines Diphenhydramine (Benadryl®) (in Tylenol PM) Doxylamine (Unisom®)	25–50 25	60–180 60–120	4–10.4 10	Antihistamines are not recommended for insomnia Diphenhydramine extends sleep duration but is associated with tolerance to hypnotic effect, residual daytime sleepiness, and anticholinergic effects (e.g., dry mouth, constipation, urinary retention and excess sedation, dizziness, confusion, delirium) Use with caution in the elderly and those with narrow-angle glaucoma. Chlorpromazine, promethazine and other older sedating antihistamines are not good choices due to their profound antimuscarinic effects.
Melatonin	Usual dose: 1–3 mg			Melatonin is an endogenous hormone released by the pineal gland in response to dim light onset in early evening (normally production < 0.3 mg per day); exogenous melatonin is available as OTC nutritional supplement (not FDA approved; recommended dose has not been established). Limited clinical trial data to support efficacy of exogenous melatonin for insomnia, however, clinically it is often used to mange insomnia and circadian rhythm disorders including jet lag.

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				Significant variability in melatonin content in OTC preparations have been reported. 1 to 3 mg, one hour before bedtime is usually effective for insomnia. Individual effects have been reported; higher doses may cause anxiety and irritability, start with the lowest dose – close to amount produced by our bodies (0.3 mg).
Nutritional Supplements Kava, Valerian, Skullcap, Passionflower				Inconsistent evidence for effectiveness of most nutritional supplements. Some placebo controlled studies have demonstrated short-term, subjective improvement in insomnia with valerian. FDA regulation of manufacturing of supplements is lacking.

(Note: Not intended as a prescribing guide)

Note: TCA = Tricyclic Antidepressants, OTC = over the counter

Table 4

Recent Intervention Studies Related to Environmental Impact on Sleep Disturbance (1999–2010)

Study	Participants	Intervention	Measures	Results/Conclusions
Dennis et al., 2010[92]	50 neuro-ICU patients, 35 observed during day hours and 15 observed during night hours.	Quiet time, a period of reduced controllable noise and light, took place twice daily coinciding with circadian rhythms.	Noise and light levels: measured at multiple locations before, during, and after quiet time hours. Sleep behavior was recorded every ½ hour, beginning 30 min before quiet time until 30 minutes after.	Results demonstrated significantly lower noise and light levels during day shift quiet time. Patients were significantly more likely to be observed sleeping during day shift quiet time hours.
Hu et al., 2010[88]	14 healthy participants exposed to ICU noise and light.	Use of earplugs and eye masks.	Sleep: assessed via polysomnography under four conditions: adaptation, baseline, exposure to recorded ICU noise and light (NL), and NL plus use of earplugs and eye masks (NLEE).	Participants had poorer perceived sleep quality, more light sleep, longer REM latency, less REM sleep when exposed to simulated ICU noise and light. Nocturnal melatonin and cortisol secretion levels differed significantly by condition but not anxiety levels. Use of earplugs and eye masks resulted in more REM time, shorter REM latency, less arousal and elevated melatonin levels. Earplugs and eye masks enhanced sleep and hormone balance in healthy subjects exposed to simulated ICU noise and light, suggesting their use in ICU patients may be reasonable.
Monsen & Edell-Gustafsson, 2005[123]	No participants – study examined disturbance factors and noise levels in a neuro ICU before and after a behavior program to limit disturbances and noise.	A behavioral modification program: changing nursing and medical routines and the introduction of afternoon and night non-disturbance periods.	Sleep disturbance factors and noise level were measured during two weeks before (M1) and after (M2) the implementation of the behavioral modification program and non-disturbance periods.	The greatest sleep disturbing factors at both M1 and M2 were general nursing care activities. Noise levels showed great variation at both M1 and M2. Implementation of a behavioral modification program and non-disturbance periods coordinated routines resulted in reduced sleep disturbance factors and partly reduced noise levels on the neuro ICU. Results suggest changes of the physical care/working environment, preparations before non-disturbance periods, regular evaluations of routines and education are needed to improve sleep on neuro ICUs.
Olson et al., 2001[120]	239 neuro ICU patients: 118 patients in the control group; 121 patients in the intervention group.	“Quiet-time” protocol to reduce environmental stimuli: sounds and lights were decreased from 2 AM to 4 AM and from 2 PM to 4 PM.	Sleep observation: Glasgow Coma Scale	The percentage of patients observed asleep was significantly higher during the months the quite- time period was implemented than during the control period before the intervention was started. The increase in sleep behavior was associated with decreased sound and light levels during the quiet time. Patients observed during the intervention period were more likely to be asleep during the quiet time than were patients observed during the control period. Results suggest a concentrated effort by staff to reduce environmental stimuli at discrete preset intervals increases the likelihood of sleep during scheduled quiet time in a neuro ICU.
Richardson et al., 2007[124]	64 cardiothoracic critical care unit (CCU) patients consented; 34 patients tried earplugs and eye masks.	Eye masks and earplugs to control patients’ exposure to noise and light within the CCU environment.	Sleep assessment rating scales and open-ended questions were used to obtain patients’ reported experiences of their sleep. Patients self-selected into either an intervention or non-intervention group.	Many patients who used the earplugs and eye masks found they improved sleep, however, noise was still a factor preventing sleep for both groups of patients. Mixed reports were found with the interventions from very comfortable to very uncomfortable. Investigators concluded that offering patient’s earplugs and eye masks to improve sleep is an inexpensive intervention that may be considered as a matter of routine nursing practice. This

Study	Participants	Intervention	Measures	Results/Conclusions
				should include time to show patients how to use and try them out for comfort.
Scotto et al., 2009[125]	88 ICU patients (non-ventilated, non-sedated); 49 intervention/39 control.	Earplugs.	Subjective sleep was assessed via Verran-Snyder-Halpern Sleep Scale, an 8-question visual analogue scale.	Earplug use improved the subjective experience of sleep for un-medicated critical care patients without interfering with care delivery. Authors concluded the negligible cost and low level of invasiveness of earplugs makes this preferable as a primary intervention to promote sleep while avoiding unnecessary sedating medications.
Stanchina et al., 2005[89]	Four healthy volunteers	White noise added to the sleep environment.	Sleep was measured by polysomnography. Baseline and peak noise levels were recorded for each arousal from sleep during exposure to recorded ICU noise, and exposure to ICU noise with mixed- frequency white noise.	A total of 1178 arousals were recorded. Compared to the baseline night, the arousal index increased during the noise but not the white noise/ICU noise night. The change in sound from baseline to peak, rather than the peak sound level, determined whether an arousal occurred and was the same for the ICU noise and white noise/ICU noise condition. Peak noise was not the main determinant of sleep disruption from ICU noise. Mixed frequency white noise increases arousal thresholds in normal individuals exposed to recorded ICU noise by reducing the difference between background noise and peak noise.
Walder et al., 2000[90]	Critically ill adult patients admitted to a surgical ICU, subdivided into six identical three-bed rooms.	Between two observation periods, five guidelines were implemented to decrease both light and noise during the night shift in the patient's room.	Light levels and noise levels were obtained using a luxmeter and a sound level meter [A-weighted decibels (dB) scale] and were monitored continuously from 11 pm to 5 am both before (P1) and after (P2) the implementation of guidelines.	The implementation of guidelines lowered mean light disturbance intensity with a greater variability of light during P2. The night light levels were low during both periods, and lowering the light levels induced a greater variation of light, which may impair sleep quality. All measured noise levels were high during both periods, which could contribute to sleep disturbance, and the implementation of guidelines significantly lowers some important noise levels. The background noise level was unchanged.
Wallace et al., 1999[126]	6 paid, healthy volunteers at 7-day intervals in a sleep disorders center exposed to simulated ICU noise.	After the first 3 quiet nights, earplugs were randomly assigned to be worn on the fourth and fifth nights during exposure to the recorded ICU noise.	Sleep was measured by polysomnography.	Sleep architecture and sound measurements on quiet nights did not differ significantly. Sound levels were significantly lower on quiet nights than on noise nights. Exposure to the noise increased the number of awakenings, percentage of stage 2 sleep, REM latency and decreased time asleep, sleep maintenance efficiency index, and percentage of rapid REM sleep. Earplugs worn during exposure to the noise produced a significant decrease in REM latency and an increase in the percentage of REM sleep. The results provide a reasonable basis for testing the effects of earplugs on the sleep of critically ill subjects.

Table 5

Nursing Strategies to Promote Sleep in the Hospital .

The following nursing interventions may be considered on an individual basis:

1. Facilitate a consistent sleep schedule as much as possible to promote regulation of the circadian rhythm.
2. Increase daytime physical activities as tolerated to reduce stress and promote sleep, and consider implementation of a stepwise progressive mobility program.
3. Discourage pattern of daytime naps unless deemed necessary to meet sleep requirements because excessive napping can disrupt normal sleep patterns; if napping is necessary, keep duration to < 45 minutes and schedule early in the day when possible.
4. Assess ambient environmental stressors in the ICU and provide an environment conducive to sleep (e.g., quiet periods, comfortable temperature, ventilation, dim light). Suggest use of earplugs or eye shades as appropriate to patient condition and wishes.
5. Promote relaxing activity before anticipated bedtime (e.g., back rub, massage, music, relaxation techniques).
6. Provide nursing care (e.g., bedtime care, pain relief, comfortable position) to promote the onset and maintenance of sleep.
7. When possible, schedule the timing of treatments and medications to normalize nocturnal sleep periods and minimize disruptions during sleep. Schedule bed baths during daytime hours rather than at the convenience of nursing staff. Organize nursing care and eliminate nonessential nursing activities. Prepare patient for necessary anticipated interruptions. Allow sleep periods of at least 90 minutes to complete one sleep cycle.
8. After exhausting less aggressive means, consider hypnotics or sedatives and evaluate effectiveness. Because of their potential for cumulative effects and generally limited period of benefit, carefully consider the use of hypnotic medications. Those that suppress REM sleep should be avoided.
9. As indicated by patient condition and ability to eat, encourage light evening meals and avoid stimulating medications, food and beverages close to bedtime to reduce hunger, gastric digestion, and stimulation. Consider food that contains L-tryptophan (e.g., dairy products, hummus, peanut butter) which may facilitate sleep.

Table 6

Nursing Strategies to Manage Fatigue in the Hospital [67]

The following nursing interventions for the management of fatigue may be considered on an individual basis:	
1	Evaluate and treat underlying factors that contribute to fatigue.
2	Minimize environmental stimuli, especially during planned times for rest and sleep. (Bright lighting, noise, visitors, frequent distractions, and clutter in the patient's physical environment can inhibit relaxation, interrupt rest/sleep, and contribute to fatigue).
3	Monitor nutritional intake for adequate energy sources and metabolic requirements (carbohydrates, protein, vitamins, and minerals).
4	Assist the patient to develop a schedule for daily activity and rest that provide an optimal balance of activity/rest.
5	Help patients set priorities for desired activities--achieving desired goals can improve mood and sense of emotional well-being.
6	Consider referral to an occupational therapist to evaluate the need for assistive devices and teach the patient and family energy conservation techniques.