Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Review Article

Overview of sleep management during COVID-19

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ABSTRACT

The sleep of millions has suffered during the global COVID-19 pandemic. Prevalence rates of 20–45% are reported globally for insomnia symptoms during the pandemic. Affected populations include the public and health care workers. A sleep deprived society faces the increased burden of COVID-related economic disruption, psychosocial problems, substance abuse, and suicide. Disordered sleep is not expected to disappear with control of infection, making interventions acutely necessary. The question becomes how to manage the sleep dysfunction during and after the pandemic. Depression and anxiety are prominent complaints during pandemic restrictions. Insomnia symptoms and fatigue continue even as mood improves in those who are in recovery from COVID-19 infection. Management of disturbed sleep and mental health is particularly needed in frontline health care workers. This overview describes 53 publications, as of February 2021, on disturbed sleep during the pandemic, treatment studies on COVID-related sleep disturbance, and need to rely on current treatment guidelines for common sleep disorders. The available research during the first year of COVID-19 has generally described symptoms of poor sleep rather than addressing treatment strategies. It covers digital cognitive behavioral therapy for insomnia (CBT-i) for the public and frontline workers, recognizing the need of greater acceptance and efficacy of controlled trials of CBT for affected groups. Recommendations based on a tiered public health model are discussed.

1. Introduction

Sars-CoV-2 is a novel coronavirus with increasing variants producing multisystem disease, COVID-19, which has been fatal to millions. Societies and health care systems face the challenge of many more millions in need of improvement to sleep from lifestyle disruption and threat of illness.

This overview describes the management of sleep complaints during the COVID-19 pandemic. It focuses on insomnia complaints as a growing problem for public health and frontline health care workers. Most of the studies to date have assessed insomnia complaints in relationship to other psychiatric symptoms with variable use of standardized measures. As this overview focuses on sleep, management of psychiatric disorders is left to other publications. Sleep apnea and repurposed medications will also be briefly discussed.

Even before COVID-19, moderate to severe insomnia was prevalent at 10–20% of the U.S. population [1]. There is potential financial impact of COVID-related insomnia as a prior representative sample of U.S Lifestyle interventions that include improvements in sleep and sleep disorders were needed before the pandemic as life expectancy was in decline from unhealthy behaviors, socioecological factors, and preventable disease [2]. Medicare beneficiaries with untreated insomnia demonstrated increased health care costs, especially in future hospital utilization by insomnia patients [3].

A systematic review showed national rates of insomnia symptoms from 20% to 45% during the COVID-19 pandemic [4]. A Chinese study of nearly 57,000 responders to an online survey reported emergent sleep and mental health symptoms from pandemic restrictions: 29.2% for insomnia, 27.9% for depression, 31.6% for anxiety, and 24.4% for acute stress [5]. Patients infected with COVID-19 experience very high rates of neuropsychiatric symptoms. Those hospitalized for seven or more days identified disturbed sleep and daytime sleepiness as frequent lingering symptoms [6]. During recovery from acute COVID-19 infection insomnia symptoms and fatigue were more frequent complaints than depression [7] or shortness of breath [8]. There is also concern that insufficient sleep or irregular sleep-wake cycles in patients with severe insomnia disorder and obstructive sleep apnea may impair the immune system and the inflammatory response, increasing vulnerability to

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viral infections [9]. Management and interventions must occur before chronicity, substance abuse and suicide increase [10], particularly since disordered sleep does not return to base rates even after control of infection [44]. This article overviews what is known about COVID-related disturbed sleep and its management, recognizing that there is limited information and the need to rely on clinical judgment and established therapeutic guidelines for sleep disorders. It concludes with recommended interventions according to a tiered public health model that is based on similar strategies for suicide or opioid abuse prevention.

2. Methodology

A literature search through PubMed was completed using the primary terms COVID-19 and SARS-CoV-2 and their relationship to either sleep disorders, sleep disorders treatment, insomnia, sleep apnea, narcolepsy, excessive sleepiness, parasomnias, restless legs syndrome, sleep medications, or cognitive behavioral therapy for insomnia. Three hundred and fifty-two citations were returned as of February 2021. Published studies during the pandemic generally report insomnia in its broader presentation, making little distinction among onset, maintenance, acute/transient (<2 weeks), short-term (2–12 weeks), chronic (>12 weeks) or insomnia disorder [27]. About 15% of the papers used validated measures such as the Insomnia Severity Index or Pittsburgh Sleep Quality Index to define sleep disturbance. Fifty-three articles are included in the overview although the articles often referenced treatment with general recommendations or expert opinion. Thirty-nine described disturbed sleep in the context of psychosocial and neuropsychiatric symptoms. As to specific management of sleep dysfunction during COVID-19, five studies of cognitive behavioral therapy (CBT) were available – two controlled trials of insomnia [11,12], one focused on worry and secondary insomnia [13], one case study [14] and a small online study in children [15]. Four similar treatment trials have begun or been proposed (see Table 1). Guidelines for obstructive sleep apnea, nasal positive airway pressure (PAP) therapy, and oral appliance therapy have been reviewed [16], primarily based on expert opinions from sleep societies and experience with prior severe respiratory infections [17,18]. There were no available controlled trials of sedative hypnotic agents or wake promoting agents in COVID-19, but an extensive review discussed the pathology and potential repurposing of psychiatric agents with anti-inflammatory properties [19]. In view of the limited number of controlled trials on sleep and COVID-19, treatment guidelines from professional societies are summarized until further research provides direction to sleep management.

3. Managing sleep disturbance in the public

The COVID-related sleep disruption and mental health burden impact millions. Although case counts are highest in North America, Europe and Brazil, similar rates of insomnia and psychiatric symptoms have been reported in Bangladesh [20], Jordan [21], Pakistan [22] and other countries. Insomnia complaints are two to three times higher during COVID-19 compared to prior years [4]. A systematic review of 19 of 43 studies in the public demonstrated mental health changes in psychological well-being, anxiety and depression early in the pandemic [23]. In two studies of recovering patients, post-traumatic stress and depressive symptoms were most prevalent. Patients with preexisting psychiatric disorders reported worsening of insomnia and psychiatric symptoms in two studies. Health care workers reported the highest rates of disturbed sleep in 20 of the 41 studies [23]. Another systematic review assessed the impact of quarantine and isolation. Only eight of 1364 studies met selection criteria and identified insomnia, depression, anxiety, and other psychological distress in patients, family caregivers, and healthcare providers [24]. During the pandemic nearly one-in-four adults had significant acute and traumatic stress and were considered candidates for intervention [25].

In view of home confinement with delay of bedtimes and arising times, circadian interventions were proposed for the general public such as minimizing screen time in the hours before bed, establishing a regular time for bed and arising, and one hour of morning light exposure, ideally including some outdoor exercise [26]. Such recommendations have received media attention but research of efficacy during the pandemic await study.

Based on study by professional sleep medicine organizations using the GRADE protocol [27,28], cognitive behavioral therapy of insomnia (CBT-i) is recommended as first-line treatment of insomnia disorder (see Table 2). Medications may be considered for patients with severe depressive or anxiety disorders as well. Multicomponent interventions include a comprehensive history, sleep diary highlighting potential behavioral changes, addressing dysfunctional beliefs, and use of stimulus control, sleep restriction and various relaxation methods based on patient and therapist preferences. Behavioral digital strategies have been proposed as online therapeutic interventions for the high number of symptomatic insomnia sufferers [29].

The European CBT-I Academy offered an excellent overview of how stress impacts sleep quality and duration. Its authors included practical recommendations to assist sleep during the pandemic [29] based on established treatment guidelines from the European Sleep Research Society [28] and American Academy of Sleep Medicine [27]. Advice to individuals, mothers, children and health care workers was covered. The Academy recommended to: 1) follow natural sleep rhythm on a set schedule; 2) address worry and stress by using diaries and conversations; 3) use the bed only for sleep (and sex); 4) share feelings via social media; 5) avoid devices in the 1–2 h before bed; 6) engage in safe, enjoyable activities; 6) follow healthy habits such as regular exercise, no eating in the 2–3 h before bed, seek natural light in the morning and then evening dim light; and 7) relax before bedtime, eg, reading a book, yoga, etc. Health care workers who are overwhelmed during work by fatigue were encouraged to inform colleagues or supervisor of their need for a short nap and then consider walking home, biking or public transportation after a long shift. For insomnia disorder with significant daytime dysfunction, the Academy emphasized CBT-i as the initial choice for treatment in view of established efficacy and no adverse events. If CBT-i was ineffective or unavailable/unfeasible, short-term administration of benzodiazepines, non-benzodiazepine receptor agonists and orexin antagonists might be considered, but close monitoring was recommended. Sedating antidepressants might be an option for short-term treatment of comorbid insomnia, mainly in anxiety disorder or major depressive disorder. The challenge is implementing such therapeutic interventions across a stressed and depressed population of millions.

There are a limited number of completed or proposed studies of behavioral therapy to manage COVID-related insomnia and anxiety (see Table 1). Digital recruitment and treatment are considered appropriate for the public. A randomized study from Sweden investigated a strategy to assist daily uncontrollable worry about COVID-19 using the Generalized Anxiety Disorder Scale (7-item) and also the Insomnia Severity Index among other scales. The investigators randomized 670 subjects to a waiting list or a self-guided, online cognitive behavioral intervention. The 3-week digital intervention significantly reduced dysfunctional worry while improving symptoms of insomnia, mood, daily functioning, and uncertainty [13]. Three years prior to the pandemic Cheng and colleagues had described the efficacy of digital CBT-i vs. an education only control in a randomized trial of insomnia disorder. The

Table 1
CBT-i studies of insomnia in COVID-19 pandemic through February 2021.

Completed Studies					
Author	Target	Study Groups	Intervention	Results	Reference
Wahland et al.	Randomized 670 adults with daily uncontrolled worry about COVID-19	Active vs. Wait List; Worry assessed with GAD-7[a] + ISI[b]	Controlled 3-week, self-guided, online cognitive behavioral intervention	Intention-to-treat analysis: significant reductions in worry compared to the waiting list on GAD-7 ($\beta = 1.14$, $Z = 9.27$, $p < 0.001$), medium effect size (bootstrapped d = 0.74 [95% CI: 0.58 −0.90]). ISI for active from mean 11.9 to 9.56; wait list from 6.1 to 5.7 ($p < 0.001$)	[13]
Philip et al.	2069 adult responders to online invitation	Good vs. poor sleepers (ISI>14)	Smartphone digital artificial intelligence (KANOPEE)	76% completed screening interview 37% had ISI score >14 (moderate to severe insomnia) But only 2.3% (47 with ISI>14) completed intervention Mean ISI score 18.87 reduced to 14.68 ($p < 0.001$) in poor sleepers	[11]
Cheng et al.	Diagnosis of DSM-5[c] insomnia disorder. Did prior CBTi offer protection during pandemic?	Prior CBT-i patients with chronic insomnia vs. education only.	Randomized controlled trial in 2016–2017of digital CBT-I (n = 102) versus sleep education control (n = 106)	CBT-i lowered ISI from original baseline of 17 to 10.5 vs. education only from 18 to 13.4 ($p < 0.001$). Also less stress cognitive intrusions, and depression. Resurgent insomnia during COVID-19 was 51% lower and depression was 57% lower in the CBT-i versus control condition). CBT-i increased health resilience.	[12]
Álvarez-García et al.	Case report	42-year-old man with overwork, insufficient sleep syndrome with COVID-19 pandemic	sleep restriction therapy, stimulus control therapy, sleep hygiene, and progressive muscle relaxation	Five weekly sessions; Telepsychology Increased total sleep time and subjective sleep quality.	[14]
Schlarb et al.	5-10 y/o children with insomnia during COVID-19	6 children + parents	Telehealth, online sessions of 3 h with parent; video session with child	67% of children showed reduced sleep problems according to parental rating.	[15]
Proposed Studies					
Elder et al.	Public	DSM-5 Insomniac vs. Good Sleepers	Self-help leaflet for worry; stimulus control	Await results; follow up at Day 7, 30 and 90	[31]
Weiner et al.	Frontline health care workers	N = 120 with stress levels >16 on the Perceived Stress Scale (PSS-10)	7-session online CBT sessions or bibliotherapy as control over 8 weeks.	Await results. Primary outcome: decrease of PSS-10 scores. Secondary: depression, insomnia, and PTSD symptoms; self-reported resilience and rumination. Assessments at 4, 8, 12, and 26 weeks.	[32]
Lai et al.	Frontline health care workers	Willingness to participate; Active Frontline employment	Sudarshan Kriya Yoga (SKY), 3 h of breath training and/or mind-body interventions including Health Enhancement Program (HEP)	Start June 2021; End September 2021 To assess whether online versions of SKY and/or HEP result in improvement in self-rated measures of insomnia, anxiety, depression, and resilience.	[33]
Kopelovich and Turkington	Psychotic patients	Unspecified but COVID-19 seen as special opportunity to assess feasibility and efficacy	16-session formulation-driven cognitive behavioral therapy for psychosis (CBTp)	Suggested trial to reduce anxiety, depression, and the insomnia that perpetuates psychotic symptoms; self-monitoring; reality testing; and wellness planning.	[34]

[a] GAD-7 = Generalized Anxiety Disorder 7-item scale modified.
[b] ISI = Insomnia Severity Index >14 represents clinically significant moderate to severe insomnia.
[c] DSM-5 criteria for acute insomnia: 1) difficulties in falling asleep, staying asleep, or awakening too early for at least three nights per week, lasting two weeks to three months; and 2) distress or impairment caused by sleep loss.

researchers resurveyed subjects during the pandemic on the Insomnia Severity Index, showing that the subjects who received CBT-i were moderately protected from COVID-related sleep disruption. The digital CBT-i group had significantly less insomnia symptoms, stress, cognitive intrusions and depression [12]. Benefit of behavioral therapy as well has been noted in a case report [14] and in a small group of children with insomnia [15]. There are various commercially available online CBTi treatments with Somryst having undergone two randomized controlled trials that resulted in FDA approval for treatment of insomnia disorder [30]. Table 1 also lists proposed CBT trials for insomnia during the pandemic [31–34].

Combined telehealth and office strategies that have been developed for veterans may offer benefit for COVID-related disturbed sleep and stress. An example of population-based therapeutic interventions can be found in the U.S. Veterans Health Administration efforts to deliver sleep care services in the TeleSleep program that includes online visits, CPAP management, and CBT-i Coach, a digital interface to address insomnia complaints and PTSD [35]. Positive coping styles such as life experience, humor and less use of self-blame have been shown to reduce the impact of traumatic stress in soldiers [36,37]. In military and veteran populations, a limited number of studies identified more consistent and significant improvements of PTSD symptoms for digital

Table 2
Practice parameters for the treatment of sleep disorders.

American Academy of Sleep Medicine Clinical Practice Guidelines				
	Age Group	As of	Primary Recommendations	Reference
Behavioral and Psychological Treatment Chronic Insomnia Disorder	Adults	2021	Therapist assessment to offer: - Multicomponent Cognitive Behavioral Therapy or - Multicomponent Brief Therapies or - Stimulus Control Therapy or - Sleep Restriction Therapy or - Relaxation Therapy Sleep Hygiene best used as component to other therapy	[27]
Pharmacologic Treatment of Chronic Insomnia	Adults	2017	Clinician's decision on therapy. CBTi should be first-line treatment. Onset insomnia: suvorexant (+other orexin antagonists), zaleplon, triazolam, ramelteon Onset + Maintenance: zolpidem, eszopiclone, temazepam, doxepin Risks: falls, memory disturbance, dependence requires monitoring	[57]
Positive Airway Pressure (PAP) in Obstructive Sleep Apnea	Adult	2019	Use PAP when sleepiness present. AutoPAP initiation at home when no significant comorbidities Ongoing education and monitoring	[55]
Obstructive Sleep Apnea and Snoring with Oral Appliance Therapy	Adults	2015	Primary snoring (without obstructive sleep apnea). Use a custom, titratable appliance over non-custom oral devices. (Guideline) Patients who are intolerant of CPAP therapy or prefer alternate therapy.	[56]
Intrinsic Circadian Rhythm Sleep-Wake Disorders: (Advanced, Delayed, Non-24-Hour, and Irregular). Update 2015	Any	2015	Strategically timed, certified melatonin for delay, blind adults with non-24-h, children/adolescents with irregular schedule + comorbid neurological disorders. Light therapy with or without accompanying behavioral interventions in adults with advance, children/adolescents with delay, and elderly with dementia).	[58]
Nightmare Disorder; PTSD Nightmares	Adults	2018	Clinician decision. First-line: image rehearsal therapy. Secondary options: - PTSD-associated nightmares: CBT; CBTi; EMDR; exposure, relaxation, and rescripting therapy. Meds: olanzapine, risperidone or aripiprazole; clonidine; cyproheptadine; fluvoxamine; gabapentin; nabilone; phenelzine; prazosin; topiramate; trazodone; and tricyclic antidepressants. - Nightmare disorder: CBT; exposure, relaxation, and rescripting therapy; hypnosis; lucid dreaming therapy; progressive deep muscle relaxation; sleep dynamic therapy; self-exposure therapy; systematic desensitization; testimony method. Meds: nitrazepam; prazosin; and triazolam.	[61]
Chronic Opioid Therapy and Sleep (Position statement)	Adult; Elderly	2019	Opioid therapy can alter sleep architecture, sleep quality, daytime sleepiness, respiratory function, including sleep-related hypoventilation, central sleep apnea (CSA), and obstructive sleep apnea (OSA). Monitoring and collaboration among providers strongly recommended.	[62]
Treatment Guidelines from other Professional Organizations				
European guideline for the diagnosis and treatment of insomnia from European Sleep Research Society	Adults	2017	Primary intervention is CBTi. If CBTi ineffective then short trials of benzodiazepines, benzodiazepine receptor agonists and some antidepressants are options. Antihistamines, antipsychotics, and melatonin are not recommended for insomnia disorder. Light therapy and exercise need to be further evaluated.	[28]
Restless legs syndrome and periodic limb movement disorder from IRLSSG	Adults	2016	For ≥ moderate RLS, gabapentin or gabapentin enacarbil is first line. Ropinirole, pramipexole, rotigotine are second line because of potential augmentation. Assess and replace low iron stores. Opioids used for refractory RLS under close monitoring.	[59]
Insomnia and disrupted sleep behavior in autism spectrum disorder from Academy of Neurology	Children and Adolescents	2020	Improved sleep habits with behavioral strategies alone or in combination with medications. Adjust sleep disruptive medications. Pharmaceutical-grade melatonin. Debate about weighted blankets.	[61]

CBT=Cognitive Behavioral Therapy; CBTi=Cognitive Behavioral Therapy for insomnia; EMDR = eye movement desensitization and reprocessing.
IRLSSG: International Restless Legs Syndrome Study Group.

cognitive behavioral therapy than other interventions. Clinical efficacy in community-based populations remains to be determined [38].

A challenge to population-based CBT-i may be protocol completion. A open-label, digital behavioral application via smartphone with movement measurement, KANOPEE, was used to pilot the utility and efficacy in 2069 French adults. Approximately 76% completed the online screening interview, but only 27% (431/1574) of respondents rated the app highly. Of 773 screened users who reported clinical insomnia (Insomnia Severity Index score >14), only 22% completed a one-week sleep diary, then only 2.3% (47/2069) completed the 10-day therapeutic intervention that resulted in a modest but statistically significant improvement in ratings on ISI [11]. Such digital treatment methods using artificial intelligence, education and follow up require refinement to enhance participation and outcomes.

Longitudinal research, particularly on management, is greatly needed to understand the lingering impact of the pandemic on sleep and the best therapeutic interventions for impacted individuals, particularly those with insomnia disorder.

4. Managing sleep disturbance in the frontline

Frontline health care workers (Frontline) faced a growing tsunami of COVID-19 virulence, lethality and inadequate resources. COVID-19 threatened the health of the frontline, their families, and their identities as caregivers. Patients still died after heroic efforts. A systematic review of 69,499 frontline caregivers of COVID-19 patients from 44 published studies showed initial prevalence rates of 5%–40% for insomnia, depression, anxiety, acute stress reaction, post-traumatic stress disorder, and occupational burnout. Younger workers who had low social support reported the worst outcomes [39]. A literature review by da Silva and Neto showed health workers to have a significantly higher incidence of insomnia, anxiety and depression symptoms than other professionals [40]. The need to manage the stress, anxiety and sleep disturbance of the Frontline was rapidly recognized, even as interventions to assist the Frontline lagged.

Systematic studies on the efficacy of sleep interventions for frontline health care workers are limited with management strategies based on opinion while awaiting controlled trials. A survey in the early pandemic by Chinese nurse researchers resulted in recommended countermeasures of adequate protective gear, better targeted guidelines, additional training and increased social support [41]. Another Chinese group surveyed 994 medical and nursing staff working in Wuhan for anxiety and self-help strategies. To manage distress, 36% accessed books on mental health, 50.4% sought online coping methods, and 17.5% had participated in counseling or psychotherapy. The authors emphasized the need to support frontline workers through mental health interventions, including improvements to sleep [42]. Italian psychologists offered frontline workers at three university hospitals in Rome a booklet on psychobiological principles of sleep regulation and treatment guidelines for insomnia [43]. The efficacy of these recommendations from China and Italy is unknown.

A French group has begun testing a randomized controlled trial of online REduction of STress (REST) protocol in health care workers with a stress level defined as > 16 on the Perceived Stress Scale (PSS-10). A secondary assessment includes survey of insomnia complaints. The online cognitive behavioral therapy is targeted to reduce perceived stress and psychiatric disorders at 3- and 6-month follow-up compared to a control group of bibliotherapy [32]. Using Cochrane protocol to complete an extensive systematic review of interventions to address resilience and mental health of frontline workers, Pollack et al. identified no studies of high quality and only six of moderate quality since 2002. There is a lack of both quantitative and qualitative evidence of interventions during or after epidemics and pandemics for the Frontline. In their opinion the COVID-19 pandemic provides unique opportunities for evaluation of such interventions [44].

There may be some hope for the Frontline. An extensive literature review of severe acute respiratory syndrome, middle eastern respiratory syndrome, Ebola and swine flu found progressive adaptation of mental health in frontline health care workers. The selected 94 studies showed a majority of workers with acute stress, anxiety and other psychological symptoms that lessened over time. Yet, some studies reported continued symptoms of insomnia, burnout, and posttraumatic stress in a subset of frontline workers 3 years after the disease outbreak. The authors also conclude that few interventional strategies have been evaluated for efficacy in frontline workers [45].

5. Sleep -related strategies in the management of COVID-19 patients

Sleep-related strategies of melatonin and sedating psychotropic medications have been suggested as potentially beneficial in infected COVID-19 patients. In ICU patients, COVID-19 and its care increase delirium and post-intensive care syndrome, impacting recovery [46]. Exogenous administration of melatonin up to 10 mg and ramelteon 8 mg have modestly improved the sleep of ICU patients with more significant decreases in the prevalence of delirium and ICU length of stay [47]. As the melatonin on store shelves may vary in potency from what is on the label, only products that carry USP certification should be used. Chronotherapy to enhance sleep that manages light exposure and noise is also recommended to lessen ICU delirium, while education and care diaries have shown less benefit to ICU delirium, post-traumatic stress and depression [48,49]. A randomized trial of fluvoxamine 100 mg t.i.d., a selective serotonergic agent approved to treat obsessive compulsive disorder, showed very encouraging preliminary results to limit disease progression in mild to moderate COVID-10 patients [50], although much larger trials are planned in view of initial positive than disappointing results with other agents such as hydroxychloroquine. Chlorpromazine in an observational study seemingly lowered incidence of symptomatic forms of COVID-19 in psychiatric patients versus caregivers [51]. An extensive review is available of neuropsychiatric mechanisms of inflammation that are common to SARS-CoV-2 and the therapeutic potential of psychiatric medications. Agents with anti-inflammatory properties and clinical use in psychiatry and sleep medicine include amelatine (melatonin analog not available in U.S.), olanzapine, venlafaxine, mirtazapine, amitriptyline and others [18]. Based on preliminary in vitro studies of psychoactive drugs, antihistaminic and cationic amphiphilic drugs that disrupt SARS-CoV-2 entry and replication are under therapeutic consideration [52]. The anti-inflammatory explanation may not be the entire story. Fluvoxamine stimulates the sigma-1 receptor to reduce inflammatory response, but it also nearly triples nocturnal plasma levels of melatonin [53]. There are also pharmacologic questions about possible interactions among COVID-19, antiviral agents, dexamethasone, and psychiatric/sleep medications, raising cautions during concurrent use [9]. Prescribers will have to await further study in COVID patients on the appropriate use of common agents in sleep medicine.

6. Applying guidelines in the care of clinical patients

In view of limited research on the management of sleep during the pandemic, clinicians will need to rely on their best judgment while adapting the established standards of care for common sleep disorders as defined by professional organizations (Table 2). There have been efforts to modify the guidelines for positive airway pressure (PAP) therapy in obstructive sleep apnea (OSA) to enhance safety and prevent aerosol droplets of SARS-CoV-2 [16] based on experience with previous respiratory infections [17,18,54]. PAP therapy is considered first-line for the hypersomnic OSA patient [55]. Although the significance of PAP-related aerosol risk is unknown, a benefit: risk assessment for each PAP patient is recommended before determining whether to continue or interrupt therapy. During acute infection, possible alternatives to PAP might include oral appliance therapy [56], changing sleep position, limiting alcohol or sedating medication, and management of nasal allergies. If continuation of PAP is necessary, the bedpartner should sleep elsewhere and follow guidelines from the CDC and WHO.

Table 2 identifies practice guidelines or position papers and lists the primary therapeutic recommendations for common sleep disorders. Insomnia disorder is diagnosed as > 1 month of disturbed sleep on 3 or more nights per week and daytime dysfunction. It should initially be managed with cognitive behavioral therapy according to the American Academy of Sleep Medicine and the European Sleep Research Society [27,28]. Medications have a secondary role in therapy of chronic insomnia unless CBTi has

failed, is unavailable, or insomnia is concomitant with major depression or other psychiatric disorders [28,57]. Intrinsic circadian rhythm sleep-wake disorders [58], sleep-related movement disorders [59], nightmares [60], autism spectrum disorders [61], and use of opioids during sleep [62] have established practice guidelines as well. The impact and management of COVID-19 and other sleep disorders such as narcolepsy, idiopathic hypersomnia, and disorders of arousal await study.

International collaboration has begun to understand sleep and sleep disorders to better define management. The International COVID-19 Sleep Study intends to use standardized questionnaires in multiple countries to assess insomnia, nightmares, sleep apnea, fatigue, exhaustion, and REM sleep behavior disorder in relationship to SARS-CoV-2 infection, public health confinement and psychosocial factors [63]. The lingering symptoms of patients who had mild to severe COVID-19, variously called "long haulers or long COVID," should benefit from this international study.

7. Conclusion and recommendations

Management of sleep during and after the COVID-19 pandemic is challenged by overwhelming numbers, inadequate research and uncertainty how established practice guidelines will address needed care. Insomnia complaints have nearly tripled. Society faces the consequences of the pandemic and disturbed sleep, increasing risks of suicide, substance abuse, accident, cardiovascular disease and ongoing immunologic dysfunction. Previous epidemics demonstrate that insomnia symptoms and daytime dysfunction continue past the threat of infection [45].

The scope of the public's sleep disruption cannot be managed by professional services alone. Intervention must start now to address the needs of the symptomatic public and frontline health care workers, beginning with buy-in from leadership in government health care systems and professional associations. Public health strategies for suicide [64] or opioid addiction [65] offer potential models of care using primary, secondary and tertiary interventions. A primary strategy focuses on prevention of SARS-CoV-2 transmission through isolation, quarantine, masks, distancing and vaccination. Secondary intervention necessitates advocacy groups, professional organizations, and health care systems to activate the media in campaigns for better sleep. Every avenue of promotion should engage good sleep behaviors (regular schedule, evening light with reduced screen time, set arising time, morning light during exercise) such as described by the European CBT-I Academy [29] and others. Sleep specialists could expand their role by facilitating these educational efforts. Leadership and funding of secondary strategies would require either government or foundation support. Mobilizing secondary strategies will be challenging in view of huge numbers and competing demands, and yet better sleep will lower costs [3] and improve productivity of those societies who respond.

Tertiary strategies involve treatment of chronic insomnia that can be digital, individual, or group therapy. Treatment should incorporate the best practices for better sleep and mental health as occurs in the TeleSleep program at the U.S. Veterans Health Administration [35]. Online, digital cognitive behavioral therapy may be able to address the multitude in need of intervention for insomnia disorder [29,30]. Outcome assessment and process improvement are needed for digital CBT. Shorter courses of treatment may increase participation, presuming sufficient efficacy. Consideration needs to be given to whether there is a role for commercial companies and their wrist monitors.

In particular, there should be active promotion to primary care providers of the Sleep Vital Sign. In a primary care visit, sleep complaints are queried only half as often as diet or exercise [66]. All patients should complete a simple question, "About your sleep, are you getting enough sleep to feel rested?" Each provider should know how to direct their patient to resources to address the "no I'm not" answer. The Insomnia Severity Index could be to characterize the sleep complaint as a clinically significant reduction in the ISI was noted during a randomized, nurse-directed, group behavioral therapy trial [67].

Frontline health workers have higher rates of insomnia and posttraumatic stress [40] and may need targeted assistance. All healthcare settings should offer all COVID-19 providers regular information on insomnia and stress [29,43], self-assessment tools, and direction to resources of digital online CBT or telehealth behavioral counseling. Sleep specialists, particularly the double-boarded pulmonologist, and sleep laboratory staff might prove respected resources to employee health departments.

As to specific tertiary strategies of intervention, PAP therapy should be continued in the severe OSA COVID-19 patient with partners leaving the bedroom while following CDC guidelines. Ongoing research is needed of COVID-19 and treatment of other sleep disorders – hypersomnia, parasomnia, and movement. The repurposing of select melatonergic, neuroleptic and antidepressant medications with anti-inflammatory properties awaits further clinical trials. Disability in patients with long COVID, including worsening insomnia, could increase risks for worsening mental health and substance misuse [10], increasing the urgency of effective interventions.

In summary, nearly every article referenced in this overview calls for research to allow a fuller understanding of current and future characteristics of pandemic-related sleep disorders and their effective treatment. Government programs, global health care systems, and primary/specialty providers will face an ongoing need for effective therapies of disturbed sleep and sleep disorders. Action is needed now to expand from analysis of COVID-related disturbed sleep to effective therapeutic interventions.

Conflict of interest

None declared.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: https://doi.org/10.1016/j.sleep.2021.04.024.

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