

# Novel perspective of 'poor sleep' in public health: a narrative review

Damien Leger <sup>1,2</sup>, Luigi Ferini-Strambi,<sup>3</sup> Fang Han,<sup>4</sup> Dalva Poyares,<sup>5</sup> Makoto Uchiyama,<sup>6,7</sup> Phyllis C Zee<sup>8</sup>

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<sup>1</sup>Université Paris Cité, VIFASOM ERC 7330, Paris, France

<sup>2</sup>APHP, Hôtel-Dieu, Centre du Sommeil et de la Vigilance, DMU THOROS, Paris, France

<sup>3</sup>Department of Neurology, Vita-Salute San Raffaele University, Milano, Italy

<sup>4</sup>The Sleep Center, Peking University People's Hospital, Beijing, China

<sup>5</sup>Department of Psychobiology, Universidade Federal de São Paulo, Sao Paulo, Brazil

<sup>6</sup>Department of Psychiatry, Nihon University School of Medicine, Tokyo, Japan

<sup>7</sup>Tokyo Adachi Hospital, Tokyo, Japan

<sup>8</sup>Department of Neurology and Center for Circadian and Sleep Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA

**Correspondence to**  
Dr Damien Leger;  
damien.leger@aphp.fr

## ABSTRACT

A high percentage of people worldwide complain of sleep disturbances; however, the vast majority do not meet the diagnostic criteria for insomnia or other classic sleep disorders. Therefore, the 'classical' concept of *poor sleep* remains undetected, and patients stay ignored and unidentified. Also, *poor sleep* has been strongly associated with increased daytime function impairment, morbidity and mortality and is considered a risk factor for developing mental disorders. *Poor sleep* is the individual experience of insufficient restorative sleep and/or sleep satisfaction in adults who do not fulfil the criteria for sleep disorders. This article provides a review on the impact of *poor sleep* on a healthy life within the multidimensional concept of sleep health, including the COVID-19-affected period. We propose a wide definition of *poor sleep* and the key characteristics of *poor sleepers* and tools for (self) detection. We discuss sleep assessment methods that combine the ability to capture the subjective perception of the sleep experience and measure objective sleep parameters. We then report selected strategies to improve sleep health, focusing on healthy sleep habits, cognitive behavioural therapy, diet, exercise, food supplements and other sleep aids. Considering the current megalopolis way of life, young people are following a 24/24 hours 7 days/week rhythm of life, with increased exposure to noise and light pollution, night-shift work, higher commute time, increased global temperature and overuse of smartphones and screens. Therefore, there is an urgent need for increasing awareness of *poor sleep* and stimulating educational efforts targeted at *poor sleepers* and primary care specialists.

## INTRODUCTION

*Poor sleep* is a reality that has been known for decades. It also has a new public health perspective increasingly highlighted by public health authorities, that we aim to clarify and rationalise in this review.

It is estimated nearly one in two adults worldwide suffers from *poor sleep*, which is considered not restorative enough to allow good quality of life during the daytime. Many suffer from not getting enough sleep according to the definition criteria; 23%–35% of short sleepers are reported in Europe, the USA, Japan and China.<sup>1–6</sup> The determinants

for short sleep are environmental, linked to night work, work commute time and overuse of internet and social networks. Others suffer from *poor sleep*, about 23%–56% complain of difficulty in falling asleep, night-time awakenings and/or non-recovering or unsatisfactory sleep. The reasons for *poor sleep* are often different from short sleep, more linked to stress, comorbidities, noxious environment and media and social network overload.<sup>6–8</sup>

Faced with this complaint of *poor sleep*, the international sleep community has clearly defined sleep pathologies such as insomnia, sleep apnoea syndrome and periodic leg movement syndrome. Each of these pathologies has its own care and management protocol.<sup>9</sup> But alongside these pathologies, *poor sleep* persists and affects a large number of people around the world, who live with limited access to care and are not always in contact with sleep specialists or a dedicated prevention system. National and international campaigns with World Sleep Day inform the public about *poor sleep* and the ways to deal with it: "Lack of sleep or poor-quality sleep is known to have a significant negative impact on our health in the long and short term." (World sleep Day 2024).

The COVID-19 pandemic was a striking illustration of this, as studies carried out during this period showed that high proportions of adults, including young people, complained in particular of *poor sleep* as a symptom of the period's malaise.<sup>2 10–12</sup> The occupational, societal and informational upheavals associated with lockdown during this period were found to severely impact sleep, leading to higher prevalence of *poor sleep* around the world.<sup>13 14</sup>

Given the extent to which *poor sleep* deserves attention in public health, and in view of the multiple and heterogeneous definitions and different measuring instruments adopted by studies referring to *poor sleep* around the world, we wish to propose a consensual response derived from our expertise to the following questions in this narrative review—What is

**Table 1** Dimensions of sleep health<sup>16–18</sup>

Sleep dimensions	Proposed definition
Subjective quality	One’s satisfaction with the sleep experience, integrating aspects of sleep initiation, sleep maintenance, sleep quantity and refreshment on awakening.
Regularity	Having a regular schedule of bedtime and awakening time on weekdays and weekends.
Duration	Total sleep time (TST): typically measured as mean nocturnal sleep time, occurring after a more or less long sleep latency, but can also include daytime napping episodes.
Continuity	The amount and distribution of sleep stages versus wakefulness in a given sleep period; it includes both sleep initiation and sleep maintenance.
Efficiency	The ratio of the total time spent asleep (TST) in a night divided by the total amount of time spent in bed.

sleep health, and what is its place in public health? How do we define *poor sleep* and the *poor sleeper*? What strategies may be proposed among *poor sleepers*, general public and healthcare professionals (HCPs) on the front line, including pharmacists, nurses and family practitioners? We believe *poor sleep* is indeed associated with poor health, and well-informed HCPs may be helpful in the prevention and management of *poor sleep*.<sup>15 16</sup> Although the importance of children and adolescent sleep health has been acknowledged, this review focuses on the adult population only (≥18 years old). Clinically defined sleep disorders are considered outside the scope of this review.

**Sleep health: the missing pillar of general health**

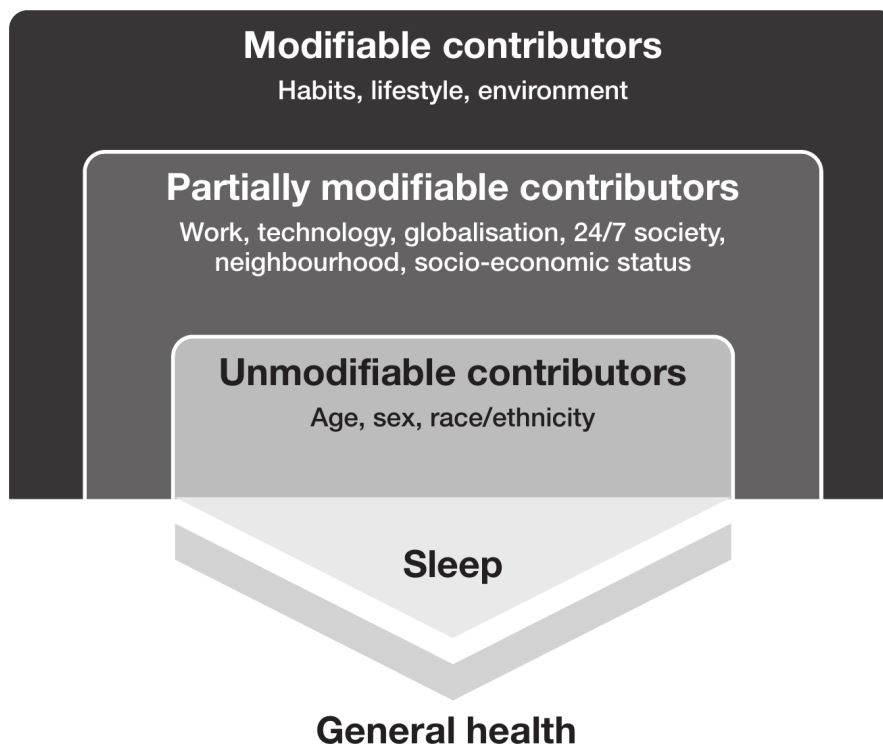
**Sleep health framework**

Sleep health, defined as “a multidimensional pattern of sleep-wakefulness, adapted to individual, social, and

environmental demands [...]” is an emerging critical contributor to mental and physical wellness and likely a causal factor of several morbidities.<sup>15</sup> Being a new concept, the parameters that would characterise sleep health are not yet well established. Here, some parameters have been proposed that would appropriately define sleep health spanning over several dimensions, as shown in [table 1](#).

Sleep health should not be interpreted as the absence of sleep problems or a series of separate sleep characteristics, but rather as a holistic multidimensional construct where all sleep habits may have an impact on an individual’s health and well-being.<sup>1 15 16</sup>

[Figure 1](#) also gives a schematic representation of sleep health as a function of multiple levels of influence, ranging from modifiable to unmodifiable factors.<sup>16 17</sup> For instance,



**Figure 1** The sleep health framework. Some studies identified associations between race and poor sleep health; however, the exact cause of poor sleep health may not be the genetic basis of race/ethnicity, but rather the associated cultural background and socioeconomic status. Therefore, race/ethnicity and socioeconomic status are discussed together in the chapter ‘partially modifiable contributors’.<sup>16 17</sup>

ageing is an unmodifiable factor where increasing age is associated with poorer rates of slow-wave sleep and a reduced ability to maintain sleep.<sup>18</sup> Mechanisms underlying sex differences in sleep are still unclear, but evidence points to differences in sex hormones and neuroendocrine mediators, with women more likely to suffer from sleep disturbances than men.<sup>16 19</sup> Among modifiable/partially modifiable factors, sleep disparity, intended as the disproportion of sleep symptoms experienced on a consistent basis by individuals based on race and socioeconomic status, is widely documented.<sup>20</sup> The identification of *poor sleep* factors linked to geographical origin in countries such as the USA, most often reflects sociodemographic rather than cultural characteristics: precarious housing, environmental conditions, level of education and type of employment. This is why we consider them partially modifiable.<sup>20 21</sup> Moreover, as globalisation, technology and a 24 hours/day, 7 days/week lifestyle penetrate society, there have been claims of an increasingly sleep-deprived society with work becoming one of the strongest determinants of sleep.<sup>22</sup> About 20%–30% of workers worldwide work night shifts or shift working hours, with well-documented consequences on sleep: desynchronisation of the biological clock, reduction of sleep time per 24 hours by an average of 1 hour compared with daytime workers and sleep and vigilance disorders.<sup>23</sup> Both, desynchronisation and sleep debt are implicated in the health consequences of shift and night work.<sup>23 24</sup> The most recognised are metabolic disorders (obesity, type 2 diabetes, adiposity),<sup>25 26</sup> cardiovascular disorders (hypertension, myocardial infarction), immunity,<sup>27</sup> pregnancy problems in women and the risk of breast cancer.<sup>28</sup>

At last, individual lifestyle (nutrition, exercise), sleep habits (regular, late), schedules and environmental factors (noise, air and artificial light pollution and increasing ambient temperature) can negatively impact sleep by suppressing melatonin secretion, affecting sleep onset and increasing sleep fragmentation.<sup>29 30</sup>

### Benefits of good sleep and health consequences of poor sleep

Several sleep associations have endorsed good sleep habits as a promoter of health, and the growing body of evidence supports the notion that sleep should be considered an essential pillar of a healthy life alongside a balanced diet, relaxation and physical activity.<sup>31 32</sup> Sleep plays a critical role in numerous physiological functions, and *poor sleep* has been strongly associated with increased daytime symptoms, morbidity and mortality.<sup>31</sup> Studies on the sleep's relation with and impact on brain functions and mental well-being found that both sleep duration and quality may affect daily mood.<sup>33</sup> A night with sufficient sleep resulted in an improved capacity to handle stressful events the next day, whereas reduced sleep amplified negative mood.<sup>33</sup> Additionally, lack of sleep has been linked to significantly more daytime fatigue, sleepiness, decreased attention and memory decline.<sup>34</sup> In the long-term, better sleep has been associated with better cognitive functions, including memory consolidation and with physiological

adaptation such as neuroplasticity,<sup>35</sup> whereas sleep disturbances may play a causal role in mental and mood disorders (eg, depression and anxiety).<sup>36</sup> For instance, non-depressed people with insomnia have a two times higher risk of developing depression than people with no sleep difficulties.<sup>36</sup> However, *poor sleep* may also be an early sign of depression. *Poor sleep*, either qualitative or quantitative, has been linked with an increased risk of several conditions, namely hypertension, coronary heart disease, type 2 diabetes, obesity and increased overall mortality.<sup>5</sup> Also, sleep plays a major role in immune functions as findings associate an increase in markers of systemic inflammation with short sleep duration (< 5–6 hours). During the COVID-19 pandemic, based on the UK Biobank (n=231 000) and FinnGen (n=392 000), it has been found that chronic *poor sleep* is a causal risk factor for contracting respiratory infections and may also increase the severity of respiratory infections. *Poor sleep* leading to compromised immune response particularly in night-shift workers may also have unfavourable consequences on increased transmission and infection of COVID-19.<sup>37</sup> These findings highlight the role of sleep in maintaining immune response against pathogens.<sup>5</sup>

Morbidities described here represent only a small fraction of all instances of the impact of sleep on general health and most of the scientific literature focuses on sleep disorders such as insomnia, rather than the broader concept of *poor sleep*. However, it can be concluded that inadequate sleep (hazard threshold of  $\leq 5$ –6 hours/night) may be a risk factor for developing non-communicable diseases and morbidity.<sup>32</sup> Noteworthy, recent studies have identified *poor sleep* as a risk factor for insomnia, suggesting that it may lead to the development of clinical sleep disorders.<sup>38</sup> Focusing on *poor sleepers* and addressing the modifiable risk factors may help reduce the incidence of common morbidities across the general population.

## POOR SLEEP

### Proposed definition of poor sleep

Based on the current knowledge and available data, the definition of *poor sleep* has been proposed here as: “*Poor sleep* is the individual experience of insufficient restorative sleep and/or sleep satisfaction and the absence of a consensual defined sleep disorder (insomnia, obstructive sleep apnoea...)” This is intended for all adults (aged  $\geq 18$  years), either healthy or with comorbidities. However, it does not include people who sleep less than they would like (eg, night-shift workers) or short sleepers (naturally sleep less than the recommended 8 hours) who are not negatively affected by it, and thereby do not require any support.

### Poor sleep literature gap and relevance to identify poor sleepers

As previously mentioned, based on the available literature, the definition of *poor sleep* is unclear, making it difficult to estimate its prevalence. For some, *poor sleep*

is an insufficient amount of sleep over 24 hours.<sup>1-5</sup> For others, it is a complaint regarding difficulty in falling asleep, maintaining sleep or *poor sleep* quality, but does not fall within the criteria for insomnia,<sup>6 18</sup> and therefore the recommendations for patients with insomnia does not apply for the management of *poor sleep* in these patients. In epidemiological terms, *poor sleep* is defined by the percentage of responses above a certain score.<sup>39 40</sup> Finally, most agree that *poor sleep* corresponds to dissatisfaction linked to environmental conditions, lifestyle and media overuse.<sup>7 8</sup> A systematic review, analysing 45 publications indicating a pooled prevalence of more than 30% *poor sleepers* based on subjective reports for most of them and one on polysomnography, also reports that in low-income and middle-income countries, the lack of doctors has a deleterious impact on *poor sleepers*.<sup>41</sup> *Poor sleep* has been strongly associated with poorer quality of life or health-related quality of life.<sup>42</sup> Nonetheless, *poor sleepers* are generally missed or overlooked in primary care,<sup>43</sup> only 43% of primary care physicians routinely enquire about sleep, whereas 80% discuss exercise and 79% discuss healthy diet.<sup>44</sup> This heterogeneity of the literature hinders the prevention and management of *poor sleep*, which we aim to define in a more operational way.

### Proposed operational definition of poor sleep

The term '*poor sleep*' is already present in the scientific literature, but how it is defined remains an open topic. Many studies have been devoted to *poor sleep* around the world, but the criteria to define *poor sleep* besides defined sleep disorders are still needed. *Poor sleep* definition needs to encompass a broader construct than what is habitually used in the clinical diagnostic criteria for sleep disorders and should include objective and subjective measures while considering the individual variability of sleep habits. Here, a synergistic model to define *poor sleep* has been proposed.

Regarding sleep quality: *poor sleep* may be adequately described by the words: sleep satisfaction, sleep restoration or sleep efficiency.

Regarding sleep quantity: *poor sleep* may be adequately described by the words: sleep continuity, sleep regularity, sleep duration and sleep timing or chronicity.

Regarding daytime functioning: *poor sleep* may be adequately described by the words: short-term symptoms of *poor sleep* or unplanned napping.

Subjective sleep dimensions such as sleep quality and sleep satisfaction are combined with objective assessments of sleep, namely sleep duration, sleep regularity and sleep continuity. Symptoms of daily functioning are also included as they have been associated with physical and mental health<sup>45</sup> and reinforce the concept of *poor sleep* as an individual experience.

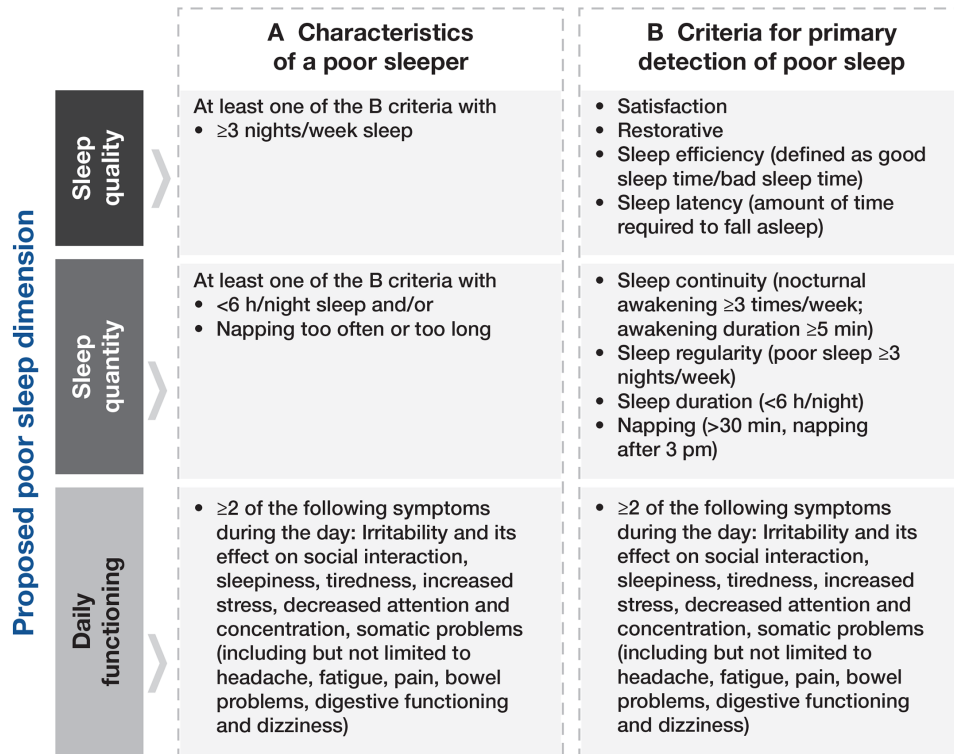
### Who are the poor sleepers?

*Poor sleep* represents a new category of sleep disturbances, which does not fall within any existing definitions of sleep disorder, yet it affects a large part of the

general population. *Poor sleepers* need to be recognised as sufferers, not only because of the impact on their quality of life but also because sleep disturbances affect long-term mental and physical health and can ultimately lead to the development of sleep disorders. We propose that a *poor sleeper* is someone who regularly sleeps less than 6 hours/night, for at least three times/week for 3 months (consensus between expert authors), experiencing unsatisfactory, non-restorative sleep episodes that result in two or more symptoms impacting the following day's activities. Although the recommended amount of sleep for a healthy adult is at least 7 hours/night, less than 6 hours is the duration associated with increased health risk in the literature, and the one considered more appropriate for the definition of *poor sleepers* in order to account for individual variations.<sup>32</sup> Similarly, the frequency of sleep problems occurring more than or equal to three times a week is an indicative measure based on existing evidence.<sup>46</sup> Sleep regularity (eg, weekdays vs weekend) and napping are important factors to consider when assessing sleep duration, as catching up on sleep in the long term may contribute to developing irregular sleep patterns.<sup>47</sup> However, short 10 min naps taken in the afternoon have been shown to produce immediate benefits without the side effect of sleep inertia.<sup>48</sup> The following is a non-comprehensive list of day-to-day symptoms associated with *poor sleepers*: (1) irritability, (2) sleepiness, (3) tiredness, (4) increased stress, (5) decreased attention and concentration and (6) somatic problems, such as headache, fatigue, pain, bowel problems or dizziness. A summary of the characteristics of a *poor sleeper* is shown in [figure 2A](#).

### How to identify poor sleepers

The criteria that may be considered for the identification of *poor sleepers* in primary care are shown in [figure 2B](#), and the possible detection tools and their characteristics are reported in [figure 2C](#).<sup>49</sup> Ideally, the tool used for the detection of *poor sleepers* should combine the ability to capture subjective measures, such as a patient's perception of the sleep experience, and objective parameters, such as sleep quantity. Additionally, it should be open-ended, short and adaptable to self-assessment use. Self-assessment methods could be helpful to encourage *poor sleepers* to seek medical care; however, it should be noted that the correlation between self-reported and objectively measured sleep is moderately biased and only HCPs can diagnose *poor sleep*.<sup>50</sup> Five self-rated questionnaires are of interest because they focus on sleep quality and quality of life and may be helpful in assessing *poor sleepers*: (1) the Pittsburgh Sleep Quality Index assesses sleep quality and disturbances<sup>39</sup>; (2) the Mini-Sleep Questionnaire investigates both sleep quality and daytime sleepiness<sup>51</sup>; (3) the Jenkins Sleep Scale evaluates the most common symptoms in the general population (trouble falling asleep, waking up during the night with/without trouble falling back asleep and feeling tired after sleep)<sup>52</sup>; (4) the Leeds Sleep Evaluation Questionnaire assesses sleep



### C Tools for the identification of poor sleepers

	Characteristics	
	Favourable	Against
<b>Sleep diary</b>	<ul style="list-style-type: none"> <li>Low cost</li> <li>High accuracy for subjective measures</li> <li>Self-administer</li> <li>Do not require attendance at a sleep centre</li> </ul>	<ul style="list-style-type: none"> <li>Do not capture objective measures</li> </ul>
<b>Sleep questionnaire</b>	<ul style="list-style-type: none"> <li>Easy to administer</li> <li>Self-administer</li> <li>Do not require attendance at a sleep centre</li> <li>Capture subjective measures and some objective measures</li> </ul>	<ul style="list-style-type: none"> <li>There are many versions</li> </ul>
<b>Mobile application</b>	<ul style="list-style-type: none"> <li>Low cost</li> <li>Self-administer</li> <li>Can provide reports without the need of medical assistance</li> </ul>	<ul style="list-style-type: none"> <li>Not validated</li> </ul>

**Figure 2** Characteristics of poor sleepers and their detection. This details (A) the definition criteria we propose for characterising poor sleep in terms of sleep quality, sleep quantity and daytime function. (B) The criteria for primary detection of these characteristics in the same three domains. (C) The proposed tools for identifying poor sleepers. The sleep diary is the most appropriate tool, followed by subjective questionnaires, of which we propose five references in the paragraph following the figure. We recommend objective tools such as polysomnography, polygraphy and actigraphy only for identification of sleep disorders such as obstructive sleep apnea or insomnia and not for poor sleep. Mobile applications or connected tools are promising, but not sufficiently validated at this stage for us to recommend them on a large scale.

onset, quality of sleep, awakening from sleep and behaviour following wakefulness.<sup>53</sup> Finally, the National Institutes of Health Patient Reported Outcomes Measurement Information System is a validated questionnaire associated with health outcome measures that assesses qualitative aspects of sleep and wake function.<sup>40</sup> Assessing daytime impact of *poor sleep* and proposing circadian scales or questionnaires devoted to overuse of media besides anxiety and depression consensual questionnaires is also important in chronic *poor sleepers* associated

with COVID-19.<sup>12 54 55</sup> A high proportion of *poor sleepers* are found to snore. In order to detect those who might present with sleep apnoea syndrome, several scales are commonly proposed, including Berlin Scale questionnaire, STOP (Snoring, Tiredness, Observed apnoea, and high blood Pressure) questionnaire, STOP-BANG (Body mass index, Age, Neck circumference, Gender) questionnaire and the more recently NOSAS (Neck circumference, Obesity, Snoring, Age, Sex) score, which may be the most discriminating one addressing unselected

general population.<sup>56–58</sup> For night workers, the BOAH (Body mass index, Observed apnea, Age, and Hypertension) scale has also been proposed alongside these latter scales.<sup>59</sup>

### How to improve poor sleep health?

To address *poor sleep* in the general population, it is important to promote sleep as a self-modifiable behaviour associated with health and to increase awareness of alternative approaches with a well rationale of improving sleep health. As first line, we recommend using several non-pharmacological strategies in the management of *poor sleep*, starting with sleep hygiene education, and, when appropriate, additional interventions are considered.

#### Healthy sleep habits

Sleep hygiene refers to a set of recommended behaviours a person can engage in throughout the day or before bedtime to promote good sleep.<sup>60</sup> Habits that promote healthy sleep include abstinence from caffeine, alcohol and nicotine late in the day, restricting bedtime activity to sleep and sex, regular sleep/wake times, modifying the bedroom environment (eg, reduce impact of noise/light), napping (<30 min, mid-afternoon) and minimal use of light-emitting devices (such as smartphones) in the hour before bedtime. There is limited empirical support for sleep hygiene recommendations as standalone interventions when offered without personalisation; however, they can be a valuable resource to increase sleep awareness. Sleep hygiene education can be widely disseminated to individuals not likely to seek medical treatment and may be a more appealing and intuitive option for the general population. We encourage public health authorities in every country to develop specific programmes of sleep hygiene, focusing on people that are more vulnerable: elderly, teenagers, those with mental disability or comorbidities and night workers.

#### Additional strategies to improve sleep health

Individuals can also adopt the following well-established additional strategies to improve their *poor sleep* experience.

*Routine physical activity* is usually considered beneficial in aiding sleep.<sup>61</sup> Studies have found that regular and moderate aerobic exercise can improve sleep quality, sleep onset, sleep continuity and feeling more refreshed.<sup>61</sup> Timing and intensity of the exercise are important factors to consider, but regularity is the key for improvement<sup>61</sup>; a study found that 6-month moderate aerobic exercise in 90 sedentary individuals with chronic primary insomnia significantly improved sleep as well as mood and overall quality of life.<sup>62</sup>

*A growing body of research supports the beneficial effects of diet on sleep.* High intake of carbohydrates is associated with reduced sleep onset, deep sleep and increased rapid eye movement in sleep, whereas high intake of fat promotes lower sleep efficiency and wakefulness.<sup>63</sup> Although these effects appear to be mediated by specific physiological

mechanisms, the clinical relevance needs to be studied further. Eating outside the usual mealtimes, such as breakfast, lunch and dinner, and particularly eating late night, can disrupt the synchronisation of the biological clock leading to disruption of normal sleep patterns. On the other hand, regular timing of meals can train circadian clocks, preventing the development of sleep disturbances.<sup>63</sup>

*Cognitive-behavioural therapies (CBTs)* are another recognised strategies to support individuals who are in need to improve their sleep health.<sup>60</sup> CBTs may include any of the following: stimulus control, sleep restriction, relaxation and cognitive restructuring.<sup>60</sup> The goal of stimulus control is to break the ‘bad habits’ (eg, watching TV in bed) and help associating the bedroom with only a regular sleep routine and sex. Sleep restriction focuses on the improvement of sleep efficiency and aims to reduce the gap between time spent in bed and time spent sleeping. Relaxation techniques, such as breathing exercises, autogenic training or meditation, help reduce anxiety and other factors that cause *poor sleep*. Other complementary approaches include biofeedback along with relaxation training. Biofeedback uses technology to help monitor physiological processes: brain waves, heart rate, breathing and body temperature.<sup>64</sup> Using the information provided by electronic devices, people may begin to learn to have more control over these processes.<sup>65</sup> Finally, in people with inaccurate or dysfunctional thoughts on sleep (eg, prior experience of insomnia may lead to worry about falling asleep), cognitive restructuring helps identifying and modifying thoughts that contribute to *poor sleep*.

A number of other popular non-prescription treatments have demonstrated safety and varying levels of effectiveness.<sup>66</sup> Melatonin, a hormone secreted by the pineal gland, plays a fundamental role in regulating sleep-wake cycle and circadian rhythm, and melatonin-based supplements are available to manage sleep disturbances.<sup>67</sup> Melatonin helps to reduce the time to fall asleep; however, there is no recommended dosage regimen for melatonin supplementation.<sup>67</sup> Common side effects, such as somnolence and headaches, have been associated with the use of melatonin.<sup>68</sup>

Plants or plant-derived materials have long been used to treat a range of sleep disturbances; these include chamomile (*Matricaria recutita*), valerian (*Valeriana officinalis*), hops (*Humulus lupulus*), lemon balm (*Melissa officinalis*), lavender (*Lavandula angustifolia*) and passion-flower (*Passiflora incarnata*).<sup>69</sup> Recent meta-analyses found conflicting results on the actual efficacy of these substances,<sup>66</sup> but have emphasised the lack of efficacy of most herbal components for insomnia.<sup>69</sup> Some dietary supplements, for example, iron, zinc, magnesium, calcium, nicotinamide, B vitamins and polyphenols, have shown some positive effect on sleep.<sup>70</sup> There are still a few studies examining the relationship between micronutrient status and sleep; however, emerging evidence suggests a link between dietary micronutrient intake and sleep.<sup>71</sup>

Finally, other sleep aids can improve sleep by modifying environmental factors.<sup>29 30</sup> Body temperature is a critical determinant of both falling asleep (core body temperature drops) and staying asleep (core body temperature increases).<sup>72</sup> Different devices have been investigated (mattress, bedsheet and warming eye mask) and results were consistent in reporting objective and subjective sleep quality in adults with mild difficulty in falling asleep.<sup>73 74</sup> Light plays a central role in regulating the circadian rhythm. In response to darkness, the pineal gland initiates production of melatonin, but light exposure slows or halts that production. Short wavelength light, emitted by smartphone screens, highly influences the biological clock and therefore can affect sleep quality through suppression of melatonin production. A study investigated the effect of an amber filter for screens on sleep quality and found that blocking the short-wavelength light component may improve sleep length.<sup>75</sup>

## CONCLUSIONS AND FUTURE STEPS

The aim of this review is to broadly explain the benefit of a better definition of *poor sleep* and *poor sleepers* to public health stakeholders. *Poor sleep* is not a new concept in the literature, as it has been the subject of numerous studies around the world. However, we felt it was important to clearly define these criteria to be better able to propose solutions and management.

Considering the current megalopolis way of life, even young people are running after time, following a 24/24 hours 7 days/week rhythm of life, exposed to noise and light pollution, night-shift work, increasing commute time, increasing global temperature, overuse of smartphones and screens. *Poor sleep* is also a reflection of this stressed environment whereas a good sleep is the way to cope with this environment which will eventually prevent the occurrence of metabolic and cardiovascular diseases, obesity, depression, anxiety, accidents and even cancer, that are associated with too short sleep.

Since the COVID-19 pandemics, the prevalence of *poor sleep* has significantly increased and especially in the most vulnerable individuals.<sup>36–38</sup> This is why we need to underscore that *poor sleep* is a public health issue that must be prioritised in the coming years.

Most importantly, *poor sleep* is a relatively easily modifiable risk factor for developing morbidities. Public and HCPs need better guidance on *poor sleep* as a new, broader category that is well separated from defined sleep disorders, such as insomnia or sleep apnoea. Increasing *poor sleep* awareness is paramount to improve sleep habits and early recognition of sleep sufferers. Tactics to enhance awareness should focus on the target audience. HCP education should also incorporate understanding of patients' decision-making processes and accordingly provide sleep management strategies for resolving sleep problems. Practitioners need to empathise, listen, elicit patients' beliefs and expectations, assess sleep better and offer a range of therapeutic measures tailored

to individual needs. Policymakers should encourage national educational efforts to raise public awareness of the importance of healthy sleep. Global public health concern over *poor sleep* has increased the demand for effective sleep promotion strategies that are easily accessible to the general population.

Let us give everyone a time to sleep and recover.

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## ORCID iD

Damien Leger <http://orcid.org/0000-0003-1168-480X>

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