clinical and translational neuroscience

MDPI

Review

Sleep Health

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Abstract: Together with (physical and mental) exercise, diet, and social activities, sleep is a key health behavior that occupies one third of our lives, yet remains neglected. In the first part of this review, we present the current knowledge on how sleep promotes body, brain, mental, occupational, and social health as well as creativity, productivity, and well-being. In the second part, we discuss how good sleep and screening for sleep–wake disorders may improve health and reduce the burden of brain, mental, cardiovascular, metabolic disorders and cancer. We also review the literature on measurements of sleep health and present the Bernese Sleep Health Questionnaire, a new and simple tool to assess sleep health and screen for sleep–wake circadian disorders in clinical practice.

Keywords: sleep health; brain health; mental health; social health; occupational health; metabolism; cardiovascular health; cancer; Bernese sleep health questionnaire; sleep–wake circadian disorders

Citation: Vorster, A.P.A.; van Someren, E.J.W.; Pack, A.I.; Huber, R.; Schmidt, M.H.; Bassetti, C.L.A. Sleep Health. *Clin. Transl. Neurosci.* **2024**, *8*, 8. https://doi.org/10.3390/ctn8010008

Academic Editor: Antonio Toscano

Received: 3 October 2023
Revised: 14 December 2023
Accepted: 10 January 2024
Published: 24 January 2024

1. Sleep for Brain, Mental, Body, Occupational, and Social Health

Health encompasses multiple domains including physical, mental, and social well-being, and is not merely the absence of disease or infirmity, according to the World Health Organization [1].

Sleep is one of the major four health behaviors (Figure 1) [2–4] that most directly affect health [5–7]. But how does sleep contribute to maintaining and recovering health?

1.1. Sleep for Learning, Memory, and Cognitive Function

Sleep is essential for memory function [8,9]. During wakefulness, information is rapidly encoded and first accessed by the hippocampus. During slow-wave sleep, the hippocampus reactivates recent memories for redistribution and integration into the existing cortical memory context mediated via several mechanisms, including hippocampal ripples, thalamic spindles, neocortical slow oscillations, and noradrenergic activity. Hippocampal replay is thought to favor the transformation of hippocampus-dependent episodic memory into schema-like neocortical memory [10]. Thereby, memories become decontextualized and schema-like, a process termed gist extraction [8]. Through this process, reliable knowledge is generated as new experiences are matched with existing memory traces.

The memory function of sleep is reliably compromised through insufficient sleep. Sleep deprivation or restriction acutely impairs executive function, information processing, visual-spatial perception, psychomotor skills, and performance [11]. Cognitive deficits on memory scores and global cognitive performance manifest after several years of shift work.

The cognitive loss after more than 10 years of shift work may correspond to 6.5 years of age-related decline [12].

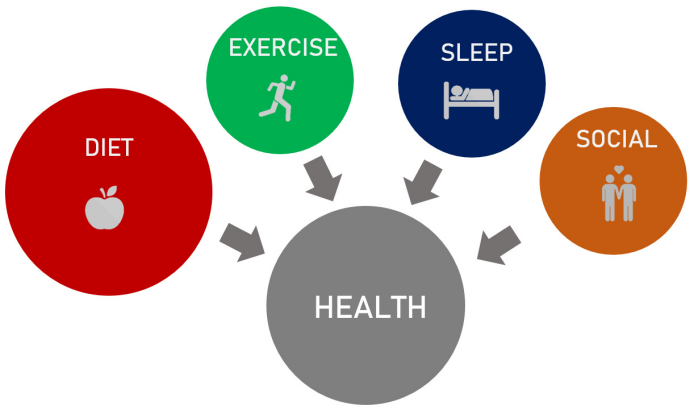

Figure 1. The big four of health and longevity. Optimal consumption of risk-decreasing foods was found to result in a 56% reduction of all-cause mortality, whereas consumption of risk-increasing foods is associated with a two-fold increased risk of all-cause mortality [2]. A meta-analysis on the effects of exercise found that highly active men have a 22% lower risk of all-cause mortality (RR = 0.78; 95% CI: 0.72 to 0.84) compared to mildly active men [3]. In a prospective cohort study (EPIC-Norfolk) including 25,639 participants, social participation was associated with lower all-cause mortality (HR 0.84, 95% CI 0.73–0.97). In a study of the UK biobank, which included 282,443 subjects, those with favorable sleep patterns (four or five of the following criteria met: early chronotype, adequate sleep duration, absence of insomnia, snoring and excessive daytime sleepiness) had a 24% lower risk of all-cause mortality compared to participants with an unfavorable sleep pattern (one or no criteria met) [4].

1.2. Sleep for Synaptic Homeostasis

Sleep is thought to be central for synaptic homeostasis, which is crucial for network stability and neurotransmitter balance in the brain. There is evidence that synaptic strength is upscaled during wakefulness and downscaled (for synapses involved in background activity) or up-scaled (for synapses related to specific tasks) during sleep [13,14]. Through this process, sleep serves network integrity, thereby improving signal-to-noise ratio as well as neurotransmitter homeostasis, thereby maintaining learning capacity, which is essential for lifelong learning. During learning, synaptic AMPA receptor density increases, while during subsequent sleep, synaptic AMPA receptor density is globally reduced [15]. REM sleep particularly appears to promote synaptic pruning and strengthen synaptic inhibition [16,17]. REM sleep following NREM sleep might therefore balance local synaptic rescaling with a sleep-dependent homeostatic process of global synaptic renormalization [10]. Increased excitability due to a lack of synaptic downscaling might be related to seizures. It has been shown that sleep-disordered breathing or sleep loss worsens seizure control [18], as it may reduce network stability.

1.3. Sleep for Waste Clearance of the Brain

Sleep is postulated to promote the removal of neurotoxic waste in the brain, through the glymphatic system—a waste removal system to clear protein debris that accumulates during wakefulness. Sleep triggers a 60% increase in interstitial neuronal space, thus enabling quicker exchange of cerebrospinal fluid, promoting, for example, ß-amyloid clearance [19,20]. Defective aquaporin-4-mediated glymphatic drainage has been linked to proteinopathies [21] alongside poor sleep quality, short sleep, and disturbed sleep through sleep-disordered breathing/sleep apnea. Sleep apnea often triggers excessive daytime sleepiness or marked sleep fragmentation, which increases the risk not only for Alzheimer's disease and Parkinson's disease, but also for stroke and cognitive decline [22–26]. The link between sleep and neurodegenerative disorders is further emphasized by the occurrence of

rapid eye movement sleep behavior disorder (RBD). RBD is one of the earliest symptoms in the prodromal phase of Parkinson's disease and is found in 50–90% of patients with synucleinopathies [27]. Parkinson's disease is further associated with disturbed circadian rhythmicity [28].

1.4. Sleep for Mental and Social Health

Social health can be defined as our ability to interact and form meaningful relationships with others and is therefore of outstanding importance for our society and well-being. Limiting one's sleep to four hours for one night already reduces the motivation to pursue social connections and reduces feelings of gratitude and social connectedness [29]. Sleep loss causes social withdrawal and loneliness [30]. Therefore, a lack of sleep may enforce us to separate from each other, increasing social distance and contributing to poorer social health. Unsurprisingly, individuals with insomnia exhibit a two-fold risk of developing depression [31]. Insomnia might promote allostatic overload, i.e., a breakdown of the body systems due to the cumulative burden of chronic stress and life events, impairing brain neuroplasticity and stress immune pathways. As a result, this may contribute to the development of mental disorders [32]. Up to 90% of patients with depression report sleep disturbances [33]. Roughly half of patients with bipolar disorder show symptoms of hypersomnia [34]. About two thirds of patients with generalized anxiety disorder and panic disorder report sleep disturbances [35,36]. Thus, sleep disturbances negatively affect the course of psychiatric illnesses and increase the risk of relapse of depressive episodes. Treating depression but neglecting to treat sleep problems increases the likelihood of a relapse by three to six fold [37].

1.5. Sleep for Endocrine Functions and Immune Response

Growth hormone and prolactin are mainly released in response to sleep [38]. These hormones are central for health and the maintenance of bones, muscle, and tissues. Growth hormone serves at the same time as a neuroendocrine mediator for immune cells. It generates a pro-inflammatory endocrine milieu during sleep that is essential for the formation of immunological memory and the effectiveness of vaccinations. Good sleep helps to reduce infection risk and improves infection outcome, while restoring inflammatory homeostasis through the regulation of cytokine release [39].

Disturbed sleep is also linked to cancer initiation and progression [40]. Sleep disturbance seems to provide a tumor microenvironment that increases the abilities of tumor cells to grow and escape from immunosurveillance, contributing to tumor progression [41]. Similarly, insomnia is a predictor for survival in newly diagnosed lung cancer patients. Fragmented sleep through obstructive sleep apnea is associated with increased cancer incidence and mortality [42]. Sleep counseling as a measure in cancer treatment plans to slow cancer progression is a promising new component of treatment [43].

1.6. Sleep and Body Metabolism

Sleep rebalances blood sugar and serum lipid/lipoprotein levels while restoring insulin sensitivity [44]. Sufficient and high-quality sleep lowers the risk of diabetes [45]. Consequently, continuous airway pressure (CPAP) therapy helps improve glycemic control in sleep apnea patients [46]. Sleep determines the secretion of the hunger hormone ghrelin and the satiety hormone leptin. Hence, sufficient sleep helps individuals to lose weight [47]. Sufficient sleep lowers the risk of high triglycerides and low HDL levels in women, contributing to reducing cardiovascular risk [48]. Sleep durations that are either too short or too long are associated with morbidity risk for diabetes mellitus, obesity, and dyslipidemia [49]. Individuals exposed to a shift work schedule experience a decrease in insulin sensitivity by almost 60%, comparable to a 20 kg gain in weight [50].

1.7. Sleep for Cardiovascular Health

Blood pressure is at its lowest during deep sleep and varies with sleep stage [51] as plasma renin activity is coupled to NREM sleep [52]. Nocturnal dipping, i.e., the drop in blood pressure by 10 to 20% during sleep, keeps blood vessels flexible and helps to prevent vascular damages. Increasing one's sleep duration by just 30 min effectively decreases blood pressure [53]. Good sleeping habits may reduce the risk of cardiovascular disease by 35% as well as of heart disease and stroke [54]. At the same time, sleep regulates hematopoiesis and protects against atherosclerosis through proper hypothalamic release of hypocretin [55]. This neuro–immune axis links sleep, immune function, and cardiovascular disease. Improving sleep quality may thus represent one preventive strategy for lowering inflammatory status and thus atherosclerosis risk [56]. Lately, sleep health was linked in a large UK Biobank cohort with nearly 400,000 participants to the incidence of cardiovascular disease (CVD) [54]. In the same cohort, a sleep health score was found to be associated with the incidence of atrial fibrillation and cardiac arrhythmias [57]. Electrical activity in the heart exhibits a 24 h rhythmicity, and potentially fatal arrhythmias are more likely to occur at specific times of day. Shift work disrupts sleep patterns and may increase susceptibility to arrhythmias [58]. Either too-short or too-long sleep durations and mistimed sleep are associated with morbidity risk for hypertension, coronary heart disease, and atherosclerosis [4,49,54,59] (Figure 2).

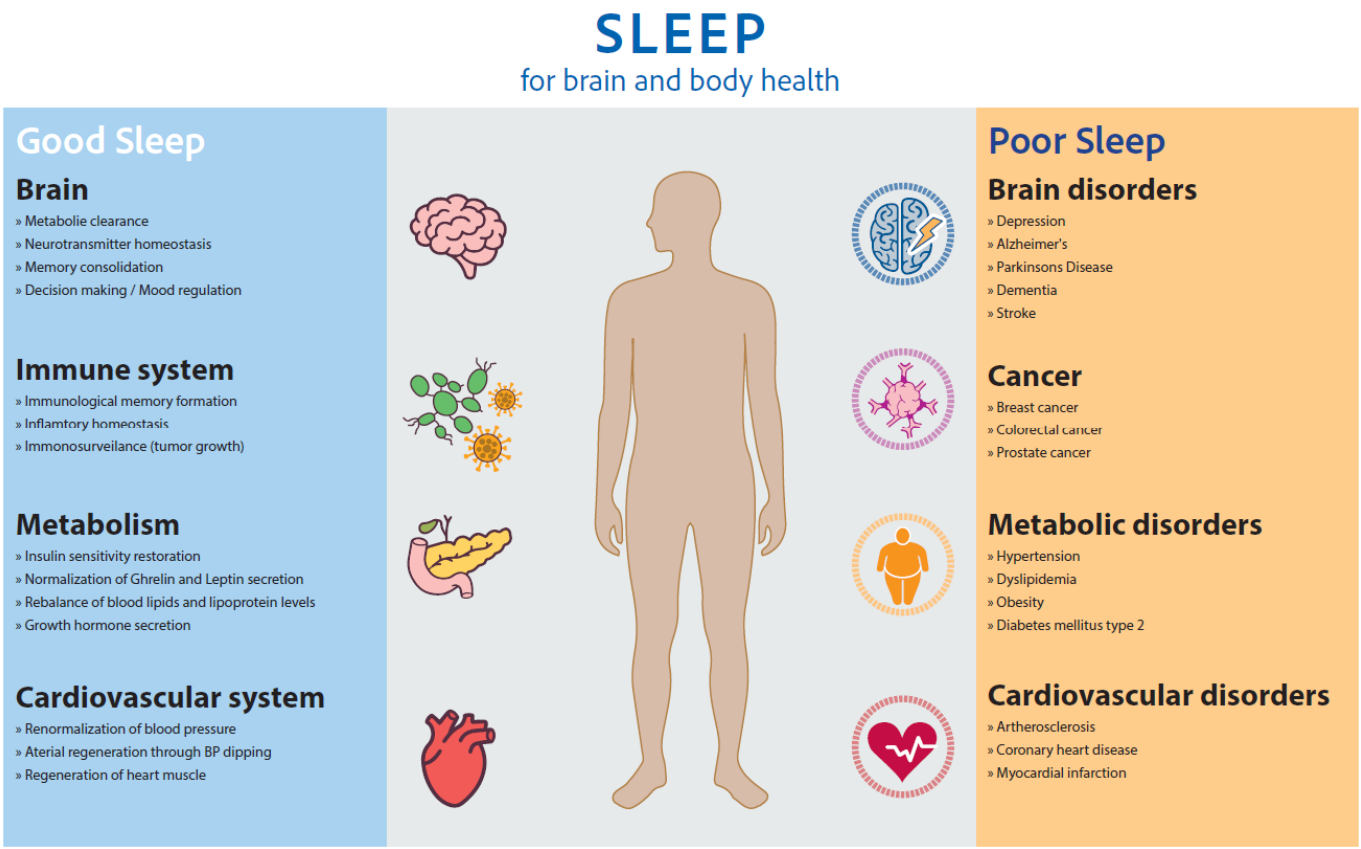

Figure 2. Sleep for brain/mental and body health [8,19,39,49,60–62].

2. Sleep Health

2.1. Getting the Right Sleep

What is the right kind of sleep? How do we measure if someone is at risk of developing a sleep disorder or a health problem as a consequence of their sleep behavior? How can we measure sleep health even in the absence of a sleep disorder, as we can for normal blood pressure or pulse for cardiac health? There is a need for a simple tool to measure and assess

the sleep health of a person especially in the light of disease prevention, in analogy to a blood pressure measurement or depression screening instruments.

2.2. Defining Sleep Health

It is now evident that a single metric is not sufficient to fully capture the quality of sleep and its effects on health. Some individuals might be predominantly affected by having too little sleep, while others might face a combination of issues: such as insufficient and irregular sleep accompanied by disturbed breathing. In cases like this, sleep health and overall health outcome would be more severely affected. As a result, sleep health is defined as a multidimensional pattern of sleep–wakefulness that promotes physical and mental (brain) well-being [63]. This definition shifts the focus from isolated symptoms and disorders to a broader view. Unlike sleep symptoms and disorders, multidimensional sleep health can be measured as a continuous variable. This allows us to assess each person in the population, regardless of their health condition.

2.3. Multidimensional Factors of Sleep Health Based on Empirical Findings

Currently, there is a discussion about which factors to include in creating a sleep health score. Several independent dimensions of sleep health have been described and sorted out as follows during recent years by several independent groups:

Regularity, Satisfaction, Alertness/Sleepiness, Timing, Efficiency (Continuity/Fragmentation), Duration, Breathing (Snoring), and Disordered Sleep [7,54,63–65] (Figure 3). All of these dimensions may act independently, additively, or synergistically to influence health risks and outcomes. Importantly, these dimensions are not strongly related to each other [66]. This means that each of these dimensions is associated with health outcomes, although with somewhat different outcomes for each dimension.

Figure 3. Eight suggested new dimensions of sleep health.

2.3.1. Duration

Sleep duration is most certainly the most widely studied dimension of sleep health and is among the first named when thinking of good sleep. Yet, both too-long and too-short sleep durations are associated with greater mortality risk, forming a U-shaped curve [67]. Interestingly, mortality increases to a stronger degree with longer sleep durations. Sleep duration is Gaussian-distributed across the population. Between 6 and 8 h of sleep is found to be the optimal amount for the majority of adults [68]. Patients with too-short sleep durations are at risk of suffering from insufficient sleep syndrome, while idiopathic hypersomnia describes patients with excessive sleep durations.

2.3.2. Efficiency

Problems initiating and maintaining sleep (insomnia) are among the most common sleep disorders. While some short waking periods during sleep appear to be normal, very long sleep latency or wake time after sleep onset are perceived to be disturbing and have detrimental effects.

A sleep efficiency below 83% was found to be correlated to greater cardiometabolic morbidity [69], while a sleep efficiency below 75% was found to be among the best predictors of all-cause mortality over a follow-up of 15 years [65]. On the other hand, a very high sleep efficiency/increased sleep propensity may indicate the presence of an underlying sleep pathology [70].

Consolidated sleep is essential for overnight resolution of emotional distress [71], promotes recovery from depression, and reduces the risk of new depressive episodes [72].

Consolidated sleep, rather than sleep duration, predicts favorable health outcomes including longevity and low Alzheimer's pathology [73].

Poor sleep efficiency may or may not be accompanied by increased sleep fragmentation (poor sleep continuity), i.e., a high number of arousals. Sleep fragmentation, even in the absence of sleep loss, can increase daytime sleepiness, impair psychomotor performance, cause deficits in attention and memory, and impair glucose homeostasis [74–76]. Optogenetically induced sleep fragmentation in animal models confirms that a minimal unit of uninterrupted sleep is crucial for normal brain function, regardless of total sleep time [77]. While poor sleep efficiency increases mortality, high sleep fragmentation is associated with increased frailty [78].

Sleep fragmentation may be measured using an arousal index, movement index, sleep stage transition rate, or pulse wave amplitude drop index [79]. While low sleep efficiency might be primarily caused by overly long bedtimes in proportion to sleep need, fragmented sleep might be caused by various reasons, such as: sleep-disordered breathing, periodic limb movements, stress, noise, pain, and endocrine causes such as hot flashes during menopause or hypoglycemia.

2.3.3. Regularity and Circadian Rhythm Entrainment

Night-by-night irregularity of bedtimes and get-up times on its own is associated with higher mortality risk [59]. In fact, sleep regularity appears to be a stronger predictor of mortality risk than sleep duration [80].

Strengthening circadian rhythms becomes increasingly important as our modern society does not catch enough daylight and follows a more irregular lifestyle [81]. More than 1.5 h of daylight per day can profoundly support brain and body health, enhancing circadian amplitude, supporting regular sleep, and advancing circadian phases. Thus, greater time spent in outdoor light during the day is associated with lower odds of lifetime-recurrent major depressive disorder and usage of antidepressant medication, less tiredness, earlier chronotypes and therefore greater ease of getting up in the morning, and better sleep [82].

Chronotherapeutic support of sleep–wake rhythm regularity becomes increasingly relevant at older ages to overcome the waning intrinsic strength of the hypothalamic clock of the brain [83], and can be enhanced by cognitive, behavioral, and chronobiological interventions that promote sleeping regularly and in phase with one's circadian sleep window [84]. Regularity is most severely challenged by any form of shift work.

2.3.4. Timing

A prerequisite for good sleep health is adequate timing. It is essential to sleep in phase with one's circadian sleep window. Timing is most disturbed in night shift workers and is the reason for the reduced mortality in morning-type people, as they are allowed to wake according their circadian clock [85]. Mistimed sleep might induce health-related consequences, especially in patients with delayed sleep phase syndrome forced to work early in the morning.

2.3.5. Alertness/Daytime Sleepiness

Excessive daytime sleepiness has several severe health-related consequences and refers to the ability to maintain attentive wakefulness throughout the day. Excessive daytime sleepiness is a strong warning sign of poor sleep quality or insufficient sleep. Participants with excessive daytime sleepiness were shown to have a 2.85 times greater risk of cardiovascular death [86].

2.3.6. Satisfaction/Perceived Sleep Quality

Sleep quality is the strongest predictor of mental health and well-being among young adults, rather than sleep duration [87]. Good sleep quality may lower the risk and severity of neurodegenerative and psychiatric disorders [73,88].

2.3.7. Good Breathing

Sleep-disturbed breathing is the most common sleep disorder. Snoring (not sleep apnea) was found to be an independent risk factor for cardiovascular health [54]. The percentage of sleep time with oxygen saturation < 90% (T90) is among the most predictive measures of mortality [89].

2.3.8. Disordered Sleep

Additional sleep disorders like nightmare disorder, parasomnias, and restless legs pose a health risk on their own and are not fully represented by the other dimensions [64]. For example, parasomnias pose the risk of falls and injuries, while RBD is a very early sign of progressing alpha synucleopathy [90]. Nightmare disorder increases the risk of suicide [91].

2.4. Evidence for the Sleep Health Concept

After the introduction of the term 'sleep health' in 2014 by Daniel Buysse [63], several studies applied a sleep health score to associate sleep health with other health outcomes. In these studies, usually, one point per sleep dimension was awarded. These studies found that the total score correlated significantly with: psychological distress [92]; incidence of CVD [54]; all-cause, cardiovascular, and cancer-specific mortality [4]; incident arrhythmias [57]; mental state outcome [93]; risk of delirium [94]; body weight [95]; and all-cause mortality [65]. For example, Furihata et al., 2017, found by simply looking at the number of poor sleep health dimensions a relationship with concurrent depression [96]. In addition, over a period of 6 years, they found a relationship between sleep health and the likelihood of developing depression. Duss et al., 2023 found that a sleep burden index based on sleep-disordered breathing, insomnia, RLS severity, and sleep duration predicted recurrent cardio-cerebrovascular events and death in stroke and TIA patients better than when these measures were taken in isolation [97]. Thus, measuring sleep health may be an important strategy for disease prevention and may help to provide feedback to patients regarding their overall sleep behavior and health status. This is underlined by the finding that poor sleep health showed the strongest independent association with poor self-perceived health status in a representative Spanish cohort of 4385 individuals [98].

2.5. No Linear Combination of Dimensions

It is unlikely that sleep health poses risk or protection as a linear combination of dimensions. To this point, it is unclear whether we should weight duration the same as regularity, alertness, and efficiency. In fact, it is very likely that some dimensions may weight more heavily on one dimension than others. Additionally, there are multiple different health outcomes. Thus, some dimensions might pose a greater risk to certain health outcomes than others. For instance, sleep fragmentation or regularity might be more sensitive to depression than to cardiovascular disease. Therefore, it is important to assess all sleep dimensions for all health outcomes and not to focus on singular dimensions of sleep health for certain diseases or health outcomes.

2.6. Measurement of Sleep Health

Sleep health can be measured through quantifiable characteristics of sleep that are associated with physical, mental, and neurobehavioral well-being. These sleep dimensions may be simply assessed via self-reported short questionnaires, sleep diaries in combination with actigraphy (smartwatches or commercially available fitness trackers), or (mobile) EEG/polysomnography.

Examples of questionnaire-based studies include the Ru_SATED questionnaire by Bussey [99], or studies using a comprehensive sleep score based on the sleep questions posed in the UK Biobank [54] or the National Sleep Foundation Sleep Health Index [64]. Lately, cut-off values for the Ru_SATED questionnaire in respect to cardio-metabolic morbidity were validated [69].

Sleep health can be reliably assessed through actigraphy. Wallace et al., 2021 performed a factor analysis of actigraphy sleep health dimensions [66] and found the highest factor loadings for the following metrics: Timing (midpoint from sleep onset to wake-up), Efficiency (mean sleep maintenance), Duration (mean time from sleep onset to wake up), Alertness/Sleepiness (mean minutes napping per day), and Regularity (standard deviation of midpoint from sleep onset to wake-up). In the future, sleep health might be reliably measured and tracked via consumer fitness trackers; the recent knowledge on sleep health merely has to be implemented and reasonably displayed to the consumer.

Polysomnography (PSG) is widely regarded as the definitive method for measuring sleep as it uniquely allows the assessment of sleep architecture. However, its metrics may not always accurately represent an individual's typical sleep pattern for the following reasons: (i) PSG is usually only performed for a single night, thus does not account for high day-to-day variability, for example, in regards to the Apnea Hypopnea Index [100]. (ii) PSG is usually performed in a clinical setting very different from the home environment (i.e., different sleeping position due to a different mattress; the 'first night effect'; different bedtime and bedtime procedure, without alcohol, smoking and snacking; attached to cables), that is able to change the number of arousals and habitual composition of sleep stages. (iii) PSG is often not performed at the individuals preferred circadian sleep time, especially in respect to late-type people, which might affect sleep latency as well as the composition of sleep stages.

While only PSG is able to accurately measure sleep stages, arousals, breathing, ECG, potential muscle loss during REM, and much more, PSG falls short to measure some crucial domains of sleep health, especially regularity, rhythmicity, and overall sleep satisfaction. Still, polysomnography is essential for diagnosing sleep disorders like narcolepsy, REM sleep behavior disorder, or sleep-related hypermotor epilepsy. In contrast, sleep diaries and questionnaires offer a consistent daily tracking of a person's subjective sleep and thus the habitual sleep pattern of a person. This makes them well-suited to comprehensively capture all sleep health dimensions. These tools are also more accessible and cost-effective compared to actigraphy.

In recent years, several independent dimensions of sleep health have been described and their independent impact validated by several independent groups: Regularity, Satisfaction, Alertness/Sleepiness, Timing, Efficiency (Continuity/Fragmentation), Duration, Breathing (Snoring), and Disordered Sleep [54,63,64,92].

2.7. The Bernese Sleep Health Questionnaire

It is recommended that sleep dimensions and sleep–wake disorders are assessed in routine assessments at the same time [7]. For this purpose, a new questionnaire, the Bernese Sleep Health Questionnaire (Figure 4), which is currently being validated, has been developed as a simple tool to rapidly assess sleep health and screen for sleep–wake circadian disorders in clinical practice (see supplemental material, Figure S1, for official version in German, Italian and French, Figure S1.)

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Universitätsklinik für Neurologie
Direktor und Chefarzt:
Prof. Dr. med. Claudio L. Bassetti

BERNESE SLEEP HEALTH QUESTIONNAIRE (BSHQ)

Date: *Filled by:* □ Patient □ Relative □ Physician/Nurse Patient ID:

Last Name: First Name: Date of Birth: _____/_____/_____

H1: How much sleep do you typically get per night? _____ hours (e.g. 8.5 hrs)
H2: How much time do you typically spend in bed per night? _____ hours (e.g. 9.5 hrs)

H3: I consider myself to be:
□ definitely a 'morning' type □ more a 'morning' than 'evening' type
□ definitely an 'evening' type □ more an 'evening' than 'morning' type

H4: Shift-Work: □ Yes, currently □ Previously, in the past 7 years □ No, never

H5: Do you have the impression you might suffer from a sleep disorder? □ Yes □ No

Answer all questions for what has been typical for you in the last 3 months

	NEVER or RARELY	1-3 TTIMES A MONTH	1-2 TIMES A WEEK	3-5 TIMES A WEEK	> 5 TIMES A WEEK
1. I snore					
2. I doze off or fall asleep during the daytime when you don't mean to? (e.g. when working, reading or driving)					
3. I feel tired, fatigued, exhausted or lack energy during the day					
4. I have problems to fall asleep or awake for 30 minutes or more during the night					
5. I take substances to help me sleep					
6. I take naps during the day					
7. My bedtime or waketime varies by more than 2 hours from one day to to the other					
8. When I try to relax in the evening or sleep at night, I have unpleasant, restless feelings in my legs that can be relieved by walking or movement					
9. I have been told that I walk, talk, eat, act strangely or violently when asleep					
10. I have nightmares					
11. My daily activities are hindered by sleep difficulties					

Sex: □ M □ F □ div
Age: _____
Neck circumference:_____ cm
Height: _____ cm
Weight: _____ kg => BMI = □ <25 □ 25-30 □ >30
Hypertension: □ Yes □ No
Smoking: □ Yes, more than 5 cigarettes a day
□ No □ Yes, occasionally
Alcohol: □ Every day □ 3-6 times a week
□ 1-2 times a week □ Rarely/never

NoSAS Score	Pt	Apnea Score
♂	2	
age>55	4	
neck >40cm	4	
BMI 25-30 // >30	3//5	
snoring=2	2	
Total	**≥8**	

cm/Kg	155	160	165	170	175	180	185	190	195
>25 BMI =>	60	65	70	75	80	85	90	95	95
>30 BMI =>	75	80	85	90	95	100	105	110	115

SLEEP HEALTH SCORE	1pt/item
Duration: H1 = 6-8h	
Morning type: H3	
Snoring: ① ≤1	
Sleepiness: ② ≤1	
Insomnia: ④&⑤ ≤1	
Regularity: ⑦ ≤1 & H4 = no	
Sleep Disorder: ⑧&⑨&⑩ ≤1	
Satisfaction: ⑪ ≤1	
Total	

Figure 4. The Bernese Sleep Health Questionnaire for the rapid assessment of sleep health and screening of sleep–wake circadian disorders. Assessment of sleep health—Duration: H1; Efficiency: H1/H2 × 100 and Q4; Timing: H3; Regularity: Q7; Satisfaction: Q11. Screening of sleep disorders—sleep apnea: NoSAS score ≥ 8; insomnia: Q4, low sleep efficiency H1/H2; fatigue: Q3 or Q11, often supported by sleep-aiding consumption, Q5, and napping, Q6; restless leg syndrome: Q8; shift work: H4; parasomnias: Q9; nightmare disorder: Q10. Screening of wake disorders/consequences of sleep–wake circadian disorders—daytime sleepiness: Q2; fatigue: Q3; daytime impairments of activities: Q11.

The BSHQ considers the central dimensions of sleep (Duration, Efficiency, Timing, Regularity, and Satisfaction) and also screens for sleep–wake disorders (insomnia, sleep

apnea, hypersomnolence (excessive daytime sleepiness, napping), restless legs, shift work, and parasomnias), and fatigue. The patient's sleep apnea risk is assessed using the validated NoSAS score [101]. The questionnaire uses graded, quantifiable answers (Never/Rarely, 1–3 times a month, 1–2 times a week, 3–5 times a week, more than 5 times a week) and can be filled within 2 min by a patient. All questions are posed in the first person and are derived from validated questionnaires [102,103].

2.8. Recommendations to Improve Sleep Health

The dimensions of sleep health can be used as a guideline in taking preventive measures, in order to increase overall health in a population rather than merely treating diseased people. The following eight simple recommendations will increase awareness and improve sleep health:

1. Duration: Get 6–8 h of sleep daily.
2. Efficiency: Restrict time in bed to the average sleep duration and leave bed during the night if awake for more than 30 min.
3. Regularity: Go to bed and get up at the same time every day (±30 min) and keep a bedtime routine.
4. Timing: Sleep at night according to your chronotype (early bird/night owl). Go to bed only when sleepy. Go to bed later when sleep latency is >30 min.
5. Alertness: Get enough sleep at night and seek professional help to treat causes of fatigue and daytime sleepiness (e.g., sleep apnea, sleep insufficiency).
6. Satisfaction: Seek professional help if you do not feel refreshed after sleep.
7. Breathing: Treat snoring and sleep-related breathing disorders.
8. Disordered Sleep: Seek professional help for sleep–wake disorders. Explore the triggers of parasomnias and secure the bedroom accordingly if needed.

3. Conclusions

Although up to one third of our lives is spent asleep, sleep remains insufficiently assessed or managed to promote good health. Increasing evidence suggests that sleep health should be given the same level of attention as diet, exercise, and other behavioral interventions. New and simple tools (such as the Bernese Sleep Health Questionnaire introduced in this paper) are needed for rapid and reliable assessments of sleep health and screening for sleep–wake disorders in clinical practice. A systematic promotion of sleep health, including the assessment and treatment of sleep–wake circadian disorders, is expected to promote health and well-being, as well as reduce the burden of brain, mental, metabolic, and cardiovascular disorders and cancer, and their associated costs.

Key Summary Points

- Sleep is as central as exercise, diet, and social interactions for brain, mental, and bodily health. Good sleep quality is related to sleep duration, sleep continuity, adequate timing, and night-by-night regularity of bedtime and wake-up times.
- Sleep–wake disorders including insomnia and sleep apnea are known to be risk factors for body, brain, and mental disorders such as depression, dementia, stroke, hypertension, obesity, diabetes, and cancer. Most sleep–wake disorders can be screened using accurate short questionnaires.
- Sleep health involves various dimensions like duration, efficiency, regularity, timing, alertness, satisfaction, sleep breathing, and disordered sleep, and can be assessed using questionnaires, sleep diaries, actigraphy, or polysomnography and other sleep–wake tests.
- Measuring and enhancing sleep health should become an important strategy for disease prevention and improving overall health.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ctn8010008/s1, Figure S1: Bernese Sleep Health Questionnaire in German, French and Italiantitle.

Author Contributions: Conceptualization, A.P.A.V. and C.L.A.B.; writing—original draft preparation, A.P.A.V.; visualization, A.P.A.V., writing—review and editing, A.P.A.V., C.L.A.B., E.J.W.v.S., A.I.P., R.H. and M.H.S.; supervision, C.L.A.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: No new data were created in this study. Data sharing is not applicable to this article.

Acknowledgments: We thank Julia van der Meer, Stefan Bauer-Gambelli and Elena Wenz for helpful discussion for the design of the BSHQ.

Conflicts of Interest: The authors declare no conflict of interest.

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