Perspective

The Swiss Sleep House Bern—A New Approach to Sleep Medicine

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Abstract: Sleep is essential for health, well-being, creativity, and productivity. Sleep loss and sleep–wake circadian disorders (SWCDs) affect at least one in three individuals but are underdiagnosed and undertreated for different reasons: First, the importance of sleep health and, second, the burden of sleep loss and SWCDs are underestimated. Third, education in sleep medicine is insufficient and health care-related sleep research is underdeveloped. Fourth, the validation and implementation of tele-sleep medicine approaches and novel devices to monitor SWCDs are still insufficient. Fifth, the reimbursement of sleep medicine in most countries is inadequate and the availability of specialized care is limited to a few centers. The Swiss Sleep House Bern (SSHB) was founded in 2022 to address these challenges and eventually promote better care for patients with SWCDs and improve sleep health for the broader population. The interdisciplinary and interprofessional team of the SSHB, which is integrated in the Bernese Interdisciplinary Sleep-Wake-Epilepsy Center, links sleep specialists with primary care providers to offer a rapid and accessible triage and first-level management of sleep complaints and SWCDs. The SSHB also promotes awareness and offers educational programs on sleep health and SWCDs, performs health care research, and fosters the implementation of new technologies, data science, and telemedicine into clinical routine.

Keywords: sleep health; sleep–wake circadian disorders; prevention; wearables; cognitive behavioral therapy; education; telemedicine; technology; data science

1. Unmet Needs of Sleep Medicine

1.1. The Central Role of Sleep for Health, Well-Being, Creativity, and Productivity Is Underestimated

Good sleep promotes brain, mental, physical, occupational, and social health as well as well-being, creativity, and productivity [1–4]. Sleep is important for brain functions such as memory [5], neuroplasticity [6,7], and the clearance of toxic substances from the brain [8,9] and may modulate the development of brain disorders including dementia [10] and stroke [11]. Good sleep is also important for mental health and the prevention of mental disorders (e.g., depression, anxiety) and emotional distress [12]. Furthermore,

sleep is essential for physical health (e.g., growth and repair mechanisms, immune responses, and cardiovascular functions [13,14]). Finally, sleep has an impact on occupational health [15–17], social activities, and behavior [18].

1.2. Sleep Loss and Sleep–Wake Circadian Disorders in the General Population Are Highly Prevalent but Underdiagnosed and Undertreated despite Their High Impact on Health, Well-Being, Creativity, and Productivity

More than one-third of the Western population suffer from disturbed sleep [19–22], making sleep loss and sleep–wake circadian disorders (SWCDs) one of the most common health complaints in Western countries. SWCDs encompass six main categories defined in the International Classification System of Sleep Disorders (3rd edition) of the American Academy of Sleep Medicine [23]: (1) Insomnia disorder—referring to difficulties in falling asleep, staying asleep, or early awakening associated with daytime symptoms such as fatigue and distress. (2) Sleep-related breathing disorders of obstructive or central origin. (3) Central disorders of hypersomnolence causing daytime sleepiness and/or prolonged sleep duration. (4) Circadian rhythm sleep–wake disorders, in particular delayed and advanced sleep–wake phase disorder but also shift work and jet lag disorder. (5) Sleep-related movement disorders characterized by simple, repetitive movements during sleep or voluntary movements in the evening or before falling asleep to reduce uncomfortable sensations, mostly in the lower extremities in patients with restless legs syndrome. (6) Parasomnias, including complex movements and actions such as sleep walking that can occur during any stage of sleep or during the transition to and from sleep.

In a survey study by Dennis and colleagues in the United States, 36% of 9901 adults indicated sleep disturbances; however, only 7% were diagnosed with a SWCD by their consulting physician, 18% reported their sleep-related problem but were not diagnosed, and 11% did not even report their sleep problem [24].

In Switzerland, difficulties initiating or maintaining sleep belong to the fourth most frequently reported physical complaints [21].

Insomnia disorder is present in 9–15% of the general population, and about 10% suffer from chronic insomnia [25,26]. In a recent study, only 1% of patients with chronic insomnia who saw their general practitioner in a primary health care study in the Canton of Bern received cognitive behavioral therapy for insomnia (CBT-I) [26], which is the first-line treatment for insomnia according to international guidelines [27]. Seventy percent of the patients with insomnia were treated with medication, a little more than half of them with benzodiazepines or benzodiazepine receptor agonists, which carry a risk of dependency. This insufficient medical care has different causes: First, the lack of health care professionals providing cognitive behavioral therapy for insomnia (CBT-I). Second, general practitioners' insufficient knowledge about this guideline-compliant treatment. And third, stigmatization of this psychotherapeutic treatment approach as well as the fact that CBT-I requires the active involvement of the patient as compared to treatment with medication [26].

Insufficient treatment is also observed in restless legs syndrome (RLS), with a prevalence of 4–14% but with less than 10% correctly diagnosed or treated [20,28]. Furthermore, sleep-disordered breathing, which affects ~12–15% of the general population in its moderate to severe manifestations (Apnea–Hypopnea Index > 15/h [29,30]), remains frequently unrecognized. In addition, the long-term compliance for positive airway pressure (PAP), the first-line treatment of sleep-disordered breathing, does not exceed 50% [31,32].

Excessive daytime sleepiness resulting from a condition leading to insufficient or disturbed sleep (as in the case of untreated sleep-disordered breathing) or as a consequence of substance use (medication, legal or illegal drugs) presents a major public health issue and affects about 5–10% (with percentages ranging in the literature from 2.5 to 33% depending on definition and assessment criteria) [33]. Excessive daytime sleepiness increases the risk of traffic accidents by 30% [34] and can result in loss of workplace productivity, cardio-cerebrovascular morbidity and mortality [35], and cognitive decline in the elderly [36] (see series paper of Pérez-Carbonell and colleagues [33] for an overview on excessive daytime sleepiness and health). Social activities and behavior are also impaired by sleepiness [37].

Neurodegenerative disorders, including cognitive decline, are bi-directionally related to SWCDs. SWCDs are often the first sign of a neurodegenerative disorder and are very common in this kind of disorder [38,39]. Age-associated changes in sleep patterns such as sleep fragmentation, shortening of total sleep time, or daytime sleepiness and napping are reported to be more pronounced in patients with Alzheimer's disease [40]. Rapid eye movement (REM) sleep behavior disorder (RBD) characterized by abnormal movements and behavior during REM sleep due to a loss of muscle atonia can appear in the prodromal phase of patients with Parkinson's disease, Lewy body dementia, or multisystem atrophy [38,40]. SWCDs in patients with a neurodegenerative disorder, such as Alzheimer's disease and Parkinson's disease, have a key impact on patients' quality of life and pose a significant burden for relatives and caregivers (see [41] for an overview). The high comorbidity of SWCDs and neurodegenerative disorders, including the differential pattern of SWCDs in different neurodegenerative disorders, points to common underlying pathophysiological mechanisms [38,41]. Future research should complete our understanding of these common mechanisms to improve patients' treatment and well-being. A European study estimated that SWCDs are among the top 10 brain disorders in terms of economic burden, with estimated total costs of EUR 35.4 billion (including direct medical and non-medical costs, as well indirect costs such as productivity loss) [42]. The prevention of sleep disorders, or their adequate diagnosis and treatment, could reduce these costs. For obstructive sleep apnea, for example, estimates indicate that costs related to undiagnosed and untreated OSA exceed those for proper diagnoses and treatment by three times [43,44]. Figure 1 illustrates some relevant facts underlining the burden of SWCDs.

-40 Min.	**Only 1%**	**50%**	**30%**	**23%**	**16%**	**7-13%**	**40-50%**
reduction in sleep duration during the last 3 decades[1]	of insomnia patients receive guideline-compliant treatment[2]	of OSA patients are insufficiently compliant with PAP treatment[3]	increased risk of traffic accidents in sleepy drivers[4]	increased risk of sick leave in employees with sleep disorders[5]	of the workers in Switzerland do shift and/or night work[6]	of the population takes sleep medication[7]	insomnia prevalence in neurodegenerative disorders[8]

1 Tinguely et al., 2014
2 Maire et al., 2020
3 Lettieri et al., 2020
4 Moradi et al., 2019
5 Amiri et al., 2020
6 Schweizerische Arbeitskräfteerhebung (SAKE), 2022
7 Kocevska et al., 2021
8 Shen et al., 2023

Figure 1. Illustrates some facts about the high burden of SWCDs, underlining the need for preven-tion and improved access to sleep medicine care. References: 1. Tinguely et al., Th. Umschau, 2014 [45]; 2. Maire et al., J Sleep Res, 2020 [26]; 3. Lettieri et al., Sleep Med Clin, 2020 [31]; 4. Moradi et al., Transp. Res. F: Traffic Psychol. Behav., 2019 [34]; 5. Amiri et al., Sleep and Biological Rhythms, 2020 [16]; 6. © BFS, Schweizerische Arbeitskräfteerhebung (SAKE), 2022 [46]; 7. Kocevska et al., Nat Hum Behav, 2021 [22]; 8. Shen et al., Transl. Neurodegener., 2023 [39].

1.3. Education in Sleep Medicine and Health Care-Related Sleep Research Are Underdeveloped

The fact of underdiagnosis and undertreatment of SWCDs is clearly related to insufficient education in sleep medicine at medical schools/universities, as well as during residency (postgraduate medical education). This is reflected in a multinational survey including different medical schools worldwide, revealing that the average amount of time spent on sleep education is less than 2.5 h [47]. Although sleep is recognized as one of the key pillars of health besides physical exercise and healthy nutrition, the median teaching time in UK medical schools only increased from 15 min to 1.5 h over the last 20 years [48]. Sleep medicine fellowships are sparse, and it is also challenging to recruit motivated and

competent assistant doctors for postgraduate education in sleep medicine [49]. The consequence of this educational deficiency is that sleep problems are not, or only insufficiently, addressed by general physicians and other specialized physicians treating disorders that are highly intertwined with disturbed sleep (such as metabolic diseases, cerebro-cardiovascular diseases, or neurologic diseases including dementia) (see also the position paper of Ramar and colleagues [50] or Sorscher [51]).

Sleep medicine is an interdisciplinary field which includes neurology, pulmonary medicine, psychiatry, psychology, internal medicine, and otorhinolaryngology. The effective screening, triage, diagnosis, and treatment of SWCDs, as well as prevention efforts, are only possible with the interdisciplinary and high-quality education of health care professionals. In addition, new concepts of care to improve sleep health in the general population must be developed and tested. Therefore, sleep-related health care research must be promoted complementing the already existing excellent basic and clinical research in sleep medicine.

Further research is needed to implement in the community simple and cost-effective diagnostic devices, effective treatments, and new technology for monitoring treatment interventions.

1.4. The Implementation of Emerging New Technologies to Monitor Sleep and Sleep–Wake Circadian Disorders Is Insufficient

In recent years, the field of sleep medicine has experienced a significant increase in the development of wearable and nearable devices for capturing rest–activity patterns and monitoring sleep macrostructure that expand beyond the traditional sleep laboratory settings. Today, consumers already use fitness trackers, sleep radars, mattress sensors, and sleep therapy apps (such as behavioral therapy, snoring therapy, and sleep diaries for patients with narcolepsy and RLS). These devices offer numerous previously untapped possibilities: (i) comfortable and cost-effective home diagnostics; (ii) sleep medicine support for chronically ill patients via home monitoring; and (iii) the possibility of real-time and long-term monitoring of disease development as well as the effects of therapeutic interventions. Despite these new diagnostic and therapeutic possibilities, many of these developments currently do not make it to clinical application. Solid validation studies of devices suited for long-term-monitoring are rare, especially in patients with sleep disorders [52]. To ensure validity and to identify characteristic digital markers for specific sleep disorders, prospective sleep studies in well-defined patient groups are required [53]. Complementing these, the analysis of big open-source data banks with novel analysis methods promises to give new insights into sleep and health in the general population. For example, accelerometer data from the UK biobank revealed associations of sleep with sociodemographic characteristics, lifetime psychiatric diagnoses, and mortality [54–56].

In order to bring novel sleep monitoring technologies to the clinical setting, an interdisciplinary effort is required. Clinical researchers need to define the relevant objectives, data analysis experts need to translate the objectives using advanced algorithms including artificial intelligence (AI), engineers need to improve devices and associated technologies, and computer scientists need to make data and results accessible to physicians.

1.5. Reimbursement of Sleep Medicine Is Inadequate and Specialized Care Is Limited to a Few Centers

The direct and indirect costs of SWCDs are high (see Section 2). Nevertheless, the field of sleep medicine faces significant challenges in terms of reimbursement and accessibility to specialized care that is limited to a few specialized centers. There is a shortage of sleep medicine specialists, sleep laboratories, and resources for diagnosing and treating sleep disorders. Specialized centers in Switzerland typically have long waiting lists.

Only a few cost–benefit studies are available in sleep medicine, and health care systems vary from country to country, making difficult a comparison of reimbursement structures between countries. A report by the Assembly of National Sleep Societies and the European Sleep Research Society confirmed that the reimbursement and availability of sleep medicine services and compensation for treatment is highly variable across Europe [57] and insufficient to cover the costs for some of the time-consuming diagnostic procedures. In Switzerland,

periodic revisions of the national reimbursement systems have led to a reduction in the remuneration of most sleep diagnostics, as well as a reduction in the compensation for treatments with PAP devices. Only a few medical reimbursements have increased, such as the compensation for mandibular advancement devices. Similar data on reductions in reimbursement for polysomnography are available for US Medicare beneficiaries [58].

Together with the long waiting lists of specialized centers, this reflects the need for better availability of sleep medicine and inevitably more outpatient-designed approaches for the diagnosis and treatment of sleep–wake circadian disorders. This goes along with the fast-increasing development of new diagnostic technologies, the use of telemedicine, and the eventual incorporation of artificial intelligence. Unfortunately, the certification and validation of many emerging new tools, including the integration of new technologies and technology-based services into the reimbursement system, and regulations for data security and storage, are currently unable to keep up with these trends. Telemedicine has been used for more than 10 years and is increasingly applied in the treatment of the most prevalent sleep disorders such as sleep-disordered breathing [59] and insomnia. Nevertheless, there is still no good official option for its reimbursement in sleep medicine in Switzerland. For example, Internet-based cognitive behavioral therapy for insomnia is officially covered by the compulsory Swiss health care insurance, but there is currently no official reimbursement tariff position available, making it necessary to negotiate coverage and tariffs directly with the individual health care insurance.

The importance of good sleep for health and well-being and the high burden of sleep loss and SWCDs contrasts with the insufficient educational, human, technological, and financial resources available in sleep medicine. This creates a significant gap ("the sleeping valley") between specialized centers and primary care.

2. The Swiss Sleep House Bern (SSHB): A New Approach to Address the Unmet Needs of Sleep Medicine

The SSHB has been launched to address the unmet needs of sleep medicine. The SSBH, which was inaugurated in November 2022, is a new player in multidisciplinary and interprofessional sleep-related care, as well as in the education and research activities that already exist on the medical campus and at the University of Bern (see Figure 2). The main players include the Interdisciplinary Sleep-Wake-Epilepsy Center (SWEZ), the Experimental Neurology Center (ZEN), and NeuroTec [60] (a research and development platform located at the Swiss Institute of Translational and Entrepreneurial Medicine, SITEM Insel, to translate basic science discoveries into practice).
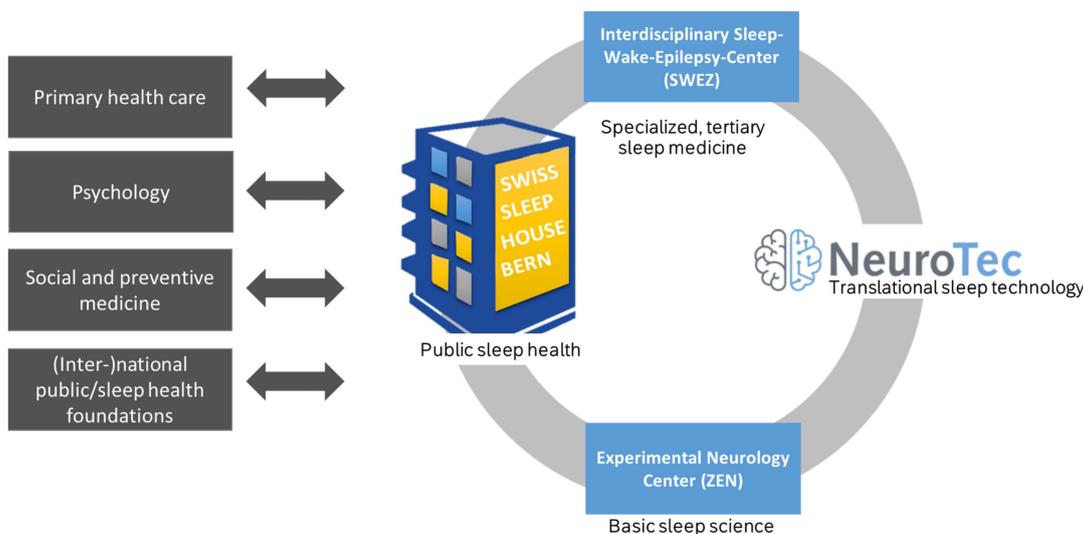

Figure 2. The Swiss Sleep House Bern (SSHB) is embedded in "Sleep Bern" (https://www.sleep.unibe.ch, accessed on 5 December 2023), a multidisciplinary and interprofessional university center, which

promotes state-of the-art care for and education and research on sleep, sleep–wake circadian disorders, and related fields. The Interdisciplinary Sleep-Wake-Epilepsy center provides specialized tertiary care for patients with sleep–wake circadian disorders and disorders of epilepsy and consciousness. Since its foundation in the 1980s, it has been interdisciplinary and interprofessional and connects specialists in neurology, pulmonary medicine, psychiatry, psychology, and pediatrics to work hand-in-hand with the same aim to lower the burden of SWCDs. NeuroTec [60] is a research and development platform located at the Swiss Institute of Translational and Entrepreneurial Medicine (SITEM Insel). It fosters the research and development of novel technologies to diagnose, monitor, and improve, among others, sleep–wake circadian disorders. In collaboration with the sleep house, new devices or technology can be directly brought to the patients. The Experimental Neurology Center (ZEN) is a leading center of basic sleep research and further contributes to translational sleep science. The SSHB collaborates with many other stakeholders including the Bern Institute of Primary Health Care (BIHAM); the Medical Society of the Canton of Bern; the Institutes of Psychology as well as the Social and Preventive Medicine of the University of Bern; the Swiss Foundation of Public Health (Gesundheitsförderung Schweiz), a private law foundation with a mission to promote the health of the Swiss population; and the European Sleep Foundation (http://www.europeansleepfoundation.ch, accessed on 5 December 2023).

2.1. Structure and Organization of Swiss Sleep House Bern (SSHB)

The SSHB is an outpatient unit of the Department of Neurology at the Bern University Hospital (Inselspital) and is affiliated with the Interdisciplinary Sleep-Wake-Epilepsy-Center (SWEZ) as part of the same department. It covers more than just an outpatient clinic and aims to promote sleep health in the general population and lower the burden of sleep–wake circadian disorders for society across all ages and to offer individuals with SWCDs fast and easy access to appropriate and cost-effective therapy (see Figure 3). Its staff includes medical doctors specialized in psychiatry with additional qualifications in sleep medicine and psychologists trained in cognitive behavioral therapy, as well as clinical and experimental research. Physicians in sleep medicine training rotate in the sleep house during their sleep medicine fellowship. Furthermore, it employs a neuroscientist responsible for prevention, public courses, and business consulting.
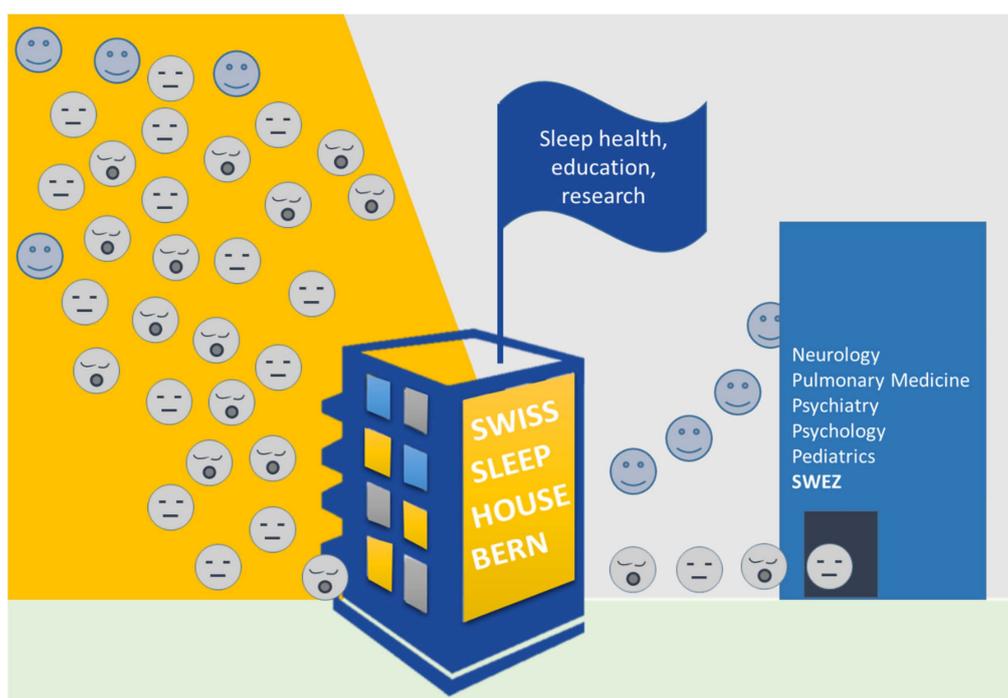

Figure 3. Swiss Sleep House Bern (SSHB) as a contact and interface point. More individuals with sleep–wake circadian disorders (SWCDs) should have faster and easier access to effective, appropriate,

and cost-effective therapy. Patients can receive a free screening for SWCDs via a walk-in offer (and soon also virtually with a "tap in" offer). All diagnostic measures can be performed at patients' homes. Sleep–wake behavior is tracked with wearable and nearable devices. Simple cases can be advised on-site, while more complex cases are referred to suitable institutions such as the Interdisciplinary Sleep-Wake-Epilepsy Center (SWEZ) of the University Hospital in Bern that unites different specialists (neurologists, pulmonary doctors, psychiatrists, psychologists and pediatricians). Information and prevention campaigns are developed in a multidisciplinary team. Campaigns aim to raise population-wide awareness about the significant health risks posed by untreated or improperly treated SWCDs and pinpoint immediate effective measures that can be taken. Under its roof, the SSHB unites consulting of companies, education of health care professionals, and health care sleep research to improve individuals' sleep health.

In the following, we briefly describe the five strategic pillars of SSHB (Figure 4).

Prevention	Patient Care	New Technology	Education	Research
Free walk-in	Fast triage	Wearables	MAS in sleep medicine	Health care research
Public information events	First-level management	Home polysomnography	Education of professionals	Validation of new technologies
Consulting	CBT for SWCD, shift work and deprescribing	Internet-based CBT-I	CBT-I training	Translational research

Figure 4. Public health and care offer at the Swiss Sleep House Bern.

2.2. Promotion of Sleep Health and Prevention of Sleep Loss in Sleep–Wake Circadian Disorders

Public lectures and courses, as well as individual coaching and consulting, are part of the prevention activities at the SSHB. During a free walk-in, an individual is screened for the major classes of SWCDs, supporting the decision for further consultations. Visitors can obtain valuable information brochures on healthy sleep behavior and the different types of SWCDs.

Besides individual coaching and consulting, the SSHB offers professional scientific–medical advice for companies and employers, especially with regard to increasing shift and night work. For employers and team leaders, it is important to bear in mind that any given company also bears responsibility for the sleep–wake rhythm of their employees! Moreover, investing in employees' sleep health is an investment in work productivity and helps reduce workplace errors and accidents.

Preventive efforts are developed in collaboration with the Bern Institute of Primary Health Care (BIHAM), the Institute of Preventive and Social Medicine of the University of Bern, the Swiss Foundation of Public Health ("Gesundheitsförderung Schweiz"), and the Swiss Brain Health Plan initiative [3].

2.3. Lowering the Burden of Undiagnosed and Insufficiently Treated Sleep–Wake Circadian Disorders

The SSHB offers fast triage and first-level management of patients with SWCDs who are referred by a medical doctor (MD) or present at the sleep house via walk-in. Walk-in patients are prescreened for the presence of a SWCD by a medical assistant. In the case of a suspected SWCD, diagnostically simple or clear cases may be advised on-site. More complex cases are referred to suitable institutions such as the SWEZ or to

other tertiary care units of the Bern University Hospital. A simplified screening and treatment decision tree is illustrated in Figure 5. This includes mainly outpatient but also inpatient treatment by the Departments of Neurology (including Psychosomatics), Pulmonary Medicine, Pediatrics, Gynecology, Internal Medicine, ENT, and Psychiatry in collaboration with the Bern University Services of Psychiatry (UPD Bern).
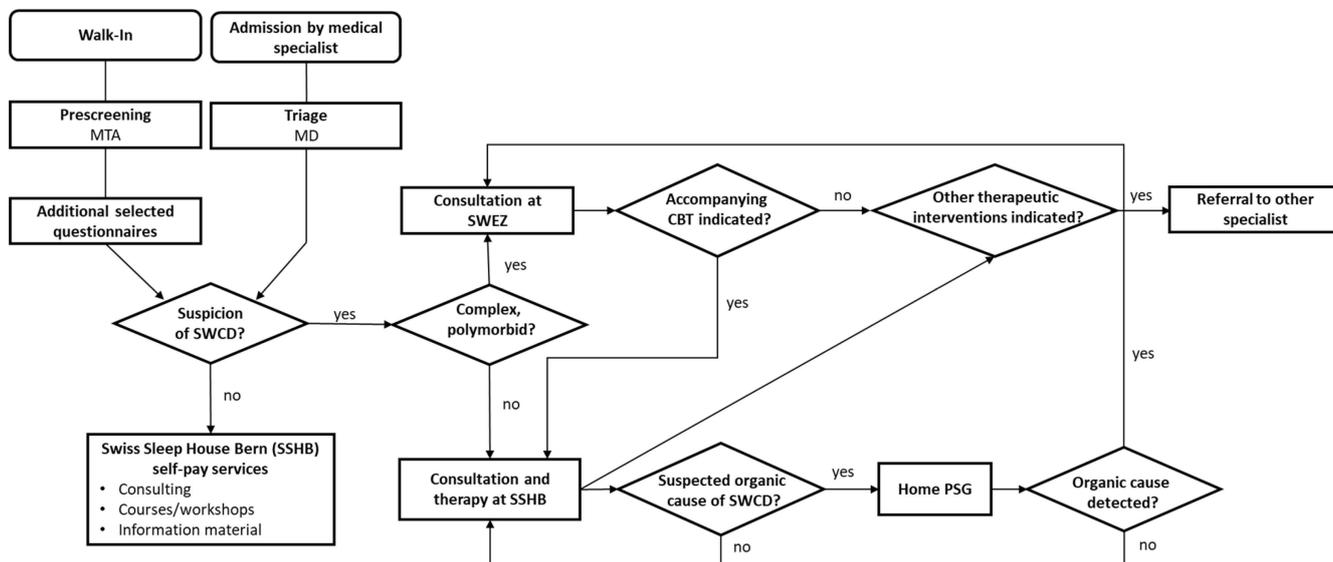

Figure 5. Screening and treatment decision tree. Abbreviations: MTA, Medical Technical Assistant; MD, medical doctor; PSG, polysomnography; SWCD, sleep–wake circadian disorder; SWEZ, Interdisciplinary Sleep-Wake-Epilepsy-Center.

Cognitive behavioral therapy, a method of psychotherapy focusing on the identification of and change in dysfunctional beliefs, attitudes, and behavior in patients, is an important pillar of the current therapeutic strategies offered at the SSHB. Although some SWCDs (e.g., insomnia disorder, nightmare disorder, or circadian rhythm disorders) are best treated primarily with psychotherapeutic interventions and others with primarily medical approaches (e.g., sleep-disordered breathing, RLS, narcolepsy), both treatment approaches should be combined to ensure the most effective and sustainable treatment outcome. In a study by Crönlein and colleagues of primary insomnia patients, polysomnography outcome changed the initial therapeutic management of 23% of the cases [61], although clinical history alone did not pinpoint an underlying somatic SWCD. On the other hand, patients with primarily somatically caused SWCDs can generally benefit from adhering to a good sleep–wake schedule and to the basic rules of good sleep hygiene. In addition, in narcolepsy disorder, fatigue, and sleep-disordered breathing, disease management and adherence to treatment are crucial to patients' level of functioning and well-being. Therefore, the SSHB also offers coaching for patients with difficulties adhering to PAP therapy and for chronically ill patients with comorbid SWCDs (such as patients with stroke, multiple sclerosis, or Parkinson's disease).

The SSHB also offers optimizing guidance in discontinuing some medications (mainly hypnotics or stimulants) for SWCDs. This is especially an issue in the elderly population, since the prescription prevalence of benzodiazepines is increasing with age, and long-term use of benzodiazepine, especially in high dosages, is associated with falls, cognitive dysfunction, dementia, and even mortality. According to a recent Swiss study including over 69,005 individuals, about 20% of the population $\geq$ 65 years of age had received at least one prescription in 2017 [62].

2.4. Application of Novel Technologies, Telemedicine, and Data Science in Sleep Medicine

All technical or diagnostic assessments at the SSHB are performed in the patients' home environment: we offer home polysomnography to assess patients' sleep architecture and track their activity–rest pattern using actigraphy. We also implement new medical devices (e.g., sleep monitoring with rings, headbands, mattresses) in clinical care to better evaluate their validity and track sleep–wake patterns over longer observation periods, as well as to monitor the efficacy of interventions. In addition to face-to-face treatment, cognitive behavioral therapy sessions can also be attended via video, and we complement cognitive behavioral therapy for patients with insomnia with online therapy materials. This form of blended care allows us to focus on specific problems in cognitive behavioral therapy and supplements psychoeducation [63].

2.5. Education of Health Care Professionals

The SSHB educates sleep fellows, general practitioners, and psychologists in close collaboration with the Interdisciplinary Sleep-Wake-Epilepsy-Center of the Bern University Hospital and Bern Institute of Primary Health Care (BIHAM). The SSHB core team is involved in the curriculum of the International Master Program in Sleep Medicine (Academy of Sleep and Consciousness, https://www.asc.unibe.ch, accessed on 5 December 2023). This is a postgraduate master's course at the University of Bern and the Università della Svizzera italiana in collaboration with 15 international partner universities on sleep–wake circadian physiology, SWCDs, sleep-related epilepsy, disorders of consciousness, and related disorders.

2.6. Interdisciplinary Health Care Sleep Research

The SSHB supports health care research in sleep medicine aiming to better understand and address various sleep–wake circadian disorders (SWCDs) and their impact on overall health and well-being. Members of the core team investigate the relationship between sleep and other health conditions, such as cardiovascular diseases, mental disorders (including depression), and brain disorders (including stroke and neurodegenerative disorders [11,64,65]). With its partners, it aims to develop and evaluate new interventions, therapies, and technologies to improve sleep health. Only recently, it assessed the feasibility of a blended treatment combining face-to-face cognitive behavioral therapy and Internet-based cognitive behavioral therapy for insomnia [58].

In the summer of 2023, a study on the burden of excessive daytime sleepiness (EDS) and insomnia started in Bern with the support of the European Academy of Neurology, the European Sleep Research Society, the European Psychiatric Association, the European Pediatric Neurology Society, and the European Federation of Neurological Associations and of Alzheimer Europe. This pilot study is conducted in the primary care setting and assesses the prevalence and progression of insomnia and EDS, but also health care consequences and related quality of life and costs, over a period of 12 months (trial registration: BASEC Number 2023-00569) [66].

3. Concluding Remarks

The Swiss Sleep House Bern (SSHB) is a new center for "Sleep Bern", a multidisciplinary and interprofessional university center which has promoted since the 1980s state-of-the-art care for and education and research on sleep, sleep–wake circadian disorders (SWCDs), and related fields.

The SSHB was founded in 2022 to promote sleep health in the general population and to provide individuals with sleep loss and SWCDs faster and easier access to effective, appropriate, and cost-effective therapy.

The SSHB is a key player in "Sleep Bern" to meet major challenges in sleep medicine, including the high prevalence and insufficient treatment of SWCDs, the lack of prevention efforts, and the shortage of specialized health care professionals in sleep medicine. The SSHB is also involved in the implementation in clinical practice of modern technology and

data science to assess sleep–wake functions and SWCDs at home (in the individual's natural environment). Finally, the SSHB also promotes education (of health care professionals and the general population) and (health care) sleep research.

References

1. Buysse, D.J. Sleep health: Can we define it? Does it matter? *Sleep* **2014**, *37*, 9–17. [CrossRef]
2. Vorster, A.P.A.; van Someren, E.; Pack, A.; Huber, R.; Schmidt, M.H.; Bassetti, C.L.A. Sleep Health. *Clin. Transl. Neurosci.* **2024**, *8*, 8. [CrossRef]
3. Bassetti, C.L.A.; Heldner, M.R.; Adorjan, K.; Albanese, E.; Allali, G.; Arnold, M.; Bègue, I.; Bochud, M.; Chan, A.; do Cuénod, K.Q.; et al. The Swiss Brain Health Plan 2023–2033. *Clin. Transl. Neurosci.* **2023**, *7*, 38. [CrossRef]
4. Lim, D.C.; Najafi, A.; Afifi, L.; Bassetti, C.L.A.; Buysse, D.J.; Han, F.; Högl, B.; Melaku, Y.A.; Morin, C.M.; Pack, A.I.; et al. The need to promote sleep health in public health agendas across the globe. *Lancet Public Health* **2023**, *8*, e820–e826. [CrossRef] [PubMed]
5. Brodt, S.; Inostroza, M.; Niethard, N.; Born, J. Sleep—A brain-state serving systems memory consolidation. *Neuron* **2023**, *111*, 1050–1075. [CrossRef] [PubMed]
6. Gorgoni, M.; D'Atri, A.; Lauri, G.; Rossini, P.M.; Ferlazzo, F.; De Gennaro, L. Is sleep essential for neural plasticity in humans, and how does it affect motor and cognitive recovery? *Neural Plast.* **2013**, *2013*, 103949. [CrossRef] [PubMed]
7. Yang, G.; Lai, C.S.; Cichon, J.; Ma, L.; Li, W.; Gan, W.B. Sleep promotes branch-specific formation of dendritic spines after learning. *Science* **2014**, *344*, 1173–1178. [CrossRef] [PubMed]
8. Xie, L.; Kang, H.; Xu, Q.; Chen, M.J.; Liao, Y.; Thiyagarajan, M.; O'Donnell, J.; Christensen, D.J.; Nicholson, C.; Iliff, J.J.; et al. Sleep drives metabolite clearance from the adult brain. *Science* **2013**, *342*, 373–377. [CrossRef] [PubMed]
9. Fultz, N.E.; Bonmassar, G.; Setsompop, K.; Stickgold, R.A.; Rosen, B.R.; Polimeni, J.R.; Lewis, L.D. Coupled electrophysiological, hemodynamic, and cerebrospinal fluid oscillations in human sleep. *Science* **2019**, *366*, 628–631. [CrossRef] [PubMed]
10. Wennberg, A.M.V.; Wu, M.N.; Rosenberg, P.B.; Spira, A.P. Sleep Disturbance, Cognitive Decline, and Dementia: A Review. *Semin. Neurol.* **2017**, *37*, 395–406. [CrossRef]
11. Bassetti, C.L.A.; Randerath, W.; Vignatelli, L.; Ferini-Strambi, L.; Brill, A.; Bonsignore, M.R.; Grote, L.; Jennum, P.; Leys, D.; Minnerup, J.; et al. EAN/ERS/ESO/ESRS statement on the impact of sleep disorders on risk and outcome of stroke. *Eur. J. Neurol.* **2020**, *27*, 1117–1136. [CrossRef]
12. Scott, A.J.; Webb, T.L.; Martyn-St James, M.; Rowse, G.; Weich, S. Improving sleep quality leads to better mental health: A meta-analysis of randomised controlled trials. *Sleep Med. Rev.* **2021**, *60*, 101556. [CrossRef]
13. Fan, M.; Sun, D.; Zhou, T.; Heianza, Y.; Lv, J.; Li, L.; Qi, L. Sleep patterns, genetic susceptibility, and incident cardiovascular disease: A prospective study of 385,292 UK biobank participants. *Eur. Heart J.* **2020**, *41*, 1182–1189. [CrossRef]
14. Li, X.; Xue, Q.; Wang, M.; Zhou, T.; Ma, H.; Heianza, Y.; Qi, L. Adherence to a Healthy Sleep Pattern and Incident Heart Failure: A Prospective Study of 408,802 UK Biobank Participants. *Circulation* **2021**, *143*, 97–99. [CrossRef] [PubMed]
15. Fietze, I.; Rosenblum, L.; Salanitro, M.; Ibatov, A.D.; Eliseeva, M.V.; Penzel, T.; Brand, D.; Westermayer, G. The Interplay Between Poor Sleep and Work-Related Health. *Front. Public Health* **2022**, *10*, 866750. [CrossRef] [PubMed]
16. Amiri, S.; Behnezhad, S. Sleep disturbances and risk of sick leave: Systematic review and meta-analysis. *Sleep Biol. Rhythm.* **2020**, *18*, 283–295. [CrossRef]
17. Wu, Q.J.; Sun, H.; Wen, Z.Y.; Zhang, M.; Wang, H.-Y.; He, X.-H.; Jiang, Y.-T.; Zhao, Y.-H. Shift work and health outcomes: An umbrella review of systematic reviews and meta-analyses of epidemiological studies. *J. Clin. Sleep Med.* **2022**, *18*, 653–662. [CrossRef]
18. Beattie, L.; Kyle, S.D.; Espie, C.A.; Biello, S.M. Social interactions, emotion and sleep: A systematic review and research agenda. *Sleep Med. Rev.* **2015**, *24*, 83–100. [CrossRef] [PubMed]
19. Kerkhof, G.A. Epidemiology of sleep and sleep disorders in The Netherlands. *Sleep Med.* **2017**, *30*, 229–239. [CrossRef]
20. Ohayon, M.M. Epidemiological Overview of sleep Disorders in the General Population. *Sleep Med. Res.* **2011**, *2*, 1–9. [CrossRef]
21. Bundesamt für Statistik. *Gesundheitsstatistik 2019*; Bundesamt für Statistik (BFS): Neuchâtel, Switzerland, 2019.

22. Kocevska, D.; Lysen, T.S.; Dotinga, A.; Koopman-Verhoeff, M.E.; Luijk, M.P.C.M.; Antypa, N.; Biermasz, N.R.; Blokstra, A.; Brug, J.; Burk, W.J.; et al. Sleep characteristics across the lifespan in 1.1 million people from the Netherlands, United Kingdom and United States: A systematic review and meta-analysis. *Nat. Hum. Behav.* **2021**, *5*, 113–122. [CrossRef] [PubMed]

23. American Academy of Sleep Medicine (Ed.) *International Classification of Sleep Disorders*, 3rd ed.; American Academy of Sleep Medicine: Darien, IL, USA, 2014.

24. Dennis, J.A.; Alazzeh, A.; Kumfer, A.M.; McDonald-Thomas, R.; Peiris, A.N. The Association of Unreported Sleep Disturbances and Systemic Inflammation: Findings from the 2005–2008 NHANES. *Sleep Disord.* **2018**, *2018*, 5987064. [CrossRef] [PubMed]

25. Ohayon, M.M. Epidemiology of insomnia: What we know and what we still need to learn. *Sleep Med. Rev.* **2002**, *6*, 97–111. [CrossRef] [PubMed]

26. Maire, M.; Linder, S.; Dvorak, C.; Merlo, C.; Essig, S.; Tal, K.; Del Giovane, C.; Syrogiannouli, L.; Duss, S.B.; Heinzer, R.; et al. Prevalence and management of chronic insomnia in Swiss primary care: Cross-sectional data from the "Sentinella" practice-based research network. *J. Sleep Res.* **2020**, *29*, e13121. [CrossRef] [PubMed]

27. Riemann, D.; Espie, C.A.; Altena, E.; Arnardottir, E.S.; Baglioni, C.; Bassetti, C.L.A.; Bastien, C.; Berzina, N.; Bjorvatn, B.; Dikeos, D.; et al. The European Insomnia Guideline: An update on the diagnosis and treatment of insomnia 2023. *J. Sleep Res.* **2023**, *32*, e14035. [CrossRef] [PubMed]

28. Ohayon, M.M.; O'Hara, R.; Vitiello, M.V. Epidemiology of restless legs syndrome: A synthesis of the literature. *Sleep Med. Rev.* **2012**, *16*, 283–295. [CrossRef] [PubMed]

29. Arnardottir, E.S.; Bjornsdottir, E.; Olafsdottir, K.A.; Benediktsdottir, B.; Gislason, T. Obstructive sleep apnoea in the general population: Highly prevalent but minimal symptoms. *Eur. Respir. J.* **2016**, *47*, 194–202. [CrossRef]

30. Bauters, F.; Debuyzere, M.; Chirinos, J.; Hertegonne, K.; Rietzschel, E. The prevalence of sleep-disordered breathing in the general population: Results of the Asklepios Cohort. *Eur. Respir. J.* **2018**, *52* (Suppl. S62), PA4357. [CrossRef]

31. Lettieri, C.J.; Williams, S.G.; Collen, J.F.; Wickwire, E.M. Treatment of Obstructive Sleep Apnea: Achieving Adherence to Positive Airway Pressure Treatment and Dealing with Complications. *Sleep Med. Clin.* **2020**, *15*, 227–240. [CrossRef]

32. Schoch, O.D.; Baty, F.; Niedermann, J.; Rudiger, J.J.; Brutsche, M.H. Baseline predictors of adherence to positive airway pressure therapy for sleep apnea: A 10-year single-center observational cohort study. *Respir. Int. Rev. Thorac. Dis.* **2014**, *87*, 121–128. [CrossRef]

33. Perez-Carbonell, L.; Mignot, E.; Leschziner, G.; Dauvilliers, Y. Understanding and approaching excessive daytime sleepiness. *Lancet* **2022**, *400*, 1033–1046. [CrossRef]

34. Moradi, A.; Nazari, S.S.H.; Rahmani, K. Sleepiness and the risk of road traffic accidents: A systematic review and meta-analysis of previous studies. *Transp. Res. Part F Traffic Psychol. Behav.* **2019**, *65*, 620–629. [CrossRef]

35. Blachier, M.; Dauvilliers, Y.; Jaussent, I.; Helmer, C.; Ritchie, K.; Jouven, X.; Tzourio, C.; Amouyel, P.; Besset, A.; Ducimetiere, P.; et al. Excessive daytime sleepiness and vascular events: The Three City Study. *Ann. Neurol.* **2012**, *71*, 661–667. [CrossRef] [PubMed]

36. Jaussent, I.; Bouyer, J.; Ancelin, M.L.; Berr, C.; Foubert-Samier, A.; Ritchie, K.; Ohayon, M.M.; Besset, A.; Dauvilliers, Y. Excessive sleepiness is predictive of cognitive decline in the elderly. *Sleep* **2012**, *35*, 1201–1207. [CrossRef] [PubMed]

37. Holding, B.C.; Sundelin, T.; Schiller, H.; Akerstedt, T.; Kecklund, G.; Axelsson, J. Sleepiness, sleep duration, and human social activity: An investigation into bidirectionality using longitudinal time-use data. *Proc. Natl. Acad. Sci. USA* **2020**, *117*, 21209–21217. [CrossRef]

38. Bassetti, C.L.M. Sleep and Neurology Stroke. 1. Overview. In *Sleep Medicine Textbook*, 2nd ed.; Bassetti, C., McNicholas, W., Paunio, T., Peigneux, P., Eds.; European Sleep Research Society (ESRS): Regensburg, Germany, 2021.

39. Shen, Y.; Lv, Q.-K.; Xie, W.-Y.; Gong, S.-Y.; Zhuang, S.; Liu, J.-Y.; Mao, C.-J.; Liu, C.-F. Circadian disruption and sleep disorders in neurodegeneration. *Transl. Neurodegener.* **2023**, *12*, 8. [CrossRef] [PubMed]

40. Steele, T.A.; St Louis, E.K.; Videnovic, A.; Auger, R.R. Circadian Rhythm Sleep-Wake Disorders: A Contemporary Review of Neurobiology, Treatment, and Dysregulation in Neurodegenerative Disease. *Neurotherapeutics* **2021**, *18*, 53–74. [CrossRef]

41. Voysey, Z.J.; Barker, R.A.; Lazar, A.S. The Treatment of Sleep Dysfunction in Neurodegenerative Disorders. *Neurotherapeutics* **2021**, *18*, 202–216. [CrossRef]

42. Gustavsson, A.; Svensson, M.; Jacobi, F.; Allgulander, C.; Alonso, J.; Beghi, E.; Dodel, R.; Ekman, M.; Faravelli, C.; Fratiglioni, L.; et al. Cost of disorders of the brain in Europe 2010. *Eur. Neuropsychopharmacol.* **2011**, *21*, 718–779. [CrossRef] [PubMed]

43. Watson, N.F. Health Care Savings: The Economic Value of Diagnostic and Therapeutic Care for Obstructive Sleep Apnea. *J. Clin. Sleep Med.* **2016**, *12*, 1075–1077. [CrossRef]

44. American Academy of Sleep Medicine (Ed.) *Hidden Health Crisis Costing America Billions. Underdiagnosing and Undertreating Obstructive Sleep Apnea. Draining Healthcare System*; American Academy of Sleep Medicine: Darien, IL, USA, 2016.

45. Tinguely, G.; Landolt, H.P.; Cajochen, C. Schlafgewohnheiten, Schlafqualität und Schlafmittelkonsum der Schweizer Bevölkerung–Ergebnisse aus einer neuen Umfrage bei einer repräsentativen Stichprobe. *Therapeutische Umschau* **2014**, *71*, 637–646. [CrossRef]

46. Bundesamt für Statistik. *Schichtarbeitende in der Schweiz 2002–2022*; Bundesamt für Statistik (BFS): Neuchâtel, Switzerland, 2024.

47. Mindell, J.A.; Bartle, A.; Wahab, N.A.; Ahn, Y.; Ramamurthy, M.B.; Huong, H.T.D.; Kohyama, J.; Ruangdaraganon, N.; Sekartini, R.; Teng, A.; et al. Sleep education in medical school curriculum: A glimpse across countries. *Sleep Med.* **2011**, *12*, 928–931. [CrossRef] [PubMed]

48. Romiszewski, S.; May, F.E.K.; Homan, E.J.; Norris, B.; Miller, M.A.; Zeman, A. Medical student education in sleep and its disorders is still meagre 20 years on: A cross-sectional survey of UK undergraduate medical education. *J. Sleep Res.* **2020**, *29*, e12980. [CrossRef]

49. Quan, S.F. Graduate medical education in sleep medicine: Did the canary just die? *J. Clin. Sleep Med.* **2013**, *9*, 101. [CrossRef]

50. Ramar, K.; Malhotra, R.K.; Carden, K.A.; Martin, J.L.; Abbasi-Feinberg, F.; Aurora, R.N.; Kapur, V.K.; Olson, E.J.; Rosen, C.L.; Rowley, J.A.; et al. Sleep is essential to health: An American Academy of Sleep Medicine position statement. *J. Clin. Sleep Med.* **2021**, *17*, 2115–2119. [CrossRef] [PubMed]

51. Sorscher, A.J. How is your sleep: A neglected topic for health care screening. *J. Am. Board Fam. Med.* **2008**, *21*, 141–148. [CrossRef] [PubMed]

52. Gnarra, O.; Wulf, M.A.; Schäfer, C.; Nef, T.; Bassetti, C.L.A. Rapid eye movement sleep behavior disorder: A narrative review from a technological perspective. *Sleep* **2023**, *46*, zsad030. [CrossRef] [PubMed]

53. Dietmann, A.; Wenz, E.; van der Meer, J.; Ringli, M.; Warncke, J.D.; Edwards, E.; Schmidt, M.H.; Bernasconi, C.A.; Nirkko, A.; Strub, M.; et al. The Swiss Primary Hypersomnolence and Narcolepsy Cohort study (SPHYNCS): Study protocol for a prospective, multicentre cohort observational study. *J. Sleep Res.* **2021**, *30*, e13296. [CrossRef] [PubMed]

54. Zhu, G.; Catt, M.; Cassidy, S.; Birch-Machin, M.; Trenell, M.; Hiden, H.; Woodman, S.; Anderson, K.N. Objective sleep assessment in >80,000 UK mid-life adults: Associations with sociodemographic characteristics, physical activity and caffeine. *PLoS ONE* **2019**, *14*, e0226220. [CrossRef]

55. Wainberg, M.; Jones, S.E.; Beaupre, L.M.; Hill, S.L.; Felsky, D.; Rivas, M.A.; Lim, A.S.P.; Ollila, H.M.; Tripathy, S.J. Association of accelerometer-derived sleep measures with lifetime psychiatric diagnoses: A cross-sectional study of 89,205 participants from the UK Biobank. *PLoS Med.* **2021**, *18*, e1003782. [CrossRef]

56. Yuan, H.; Plekhanova, T.; Walmsley, R.; Reynolds, A.; Maddison, K.; Bucan, M.; Gehrman, P.; Rowlands, A.; Ray, D.; Bennett, D.; et al. Self-supervised learning of accelerometer data provides new insights for sleep and its association with mortality. *medRxiv* **2023**. [CrossRef]

57. Gjerstad, D.M.; Puertas, J.; Goncalves, M.; Mihaicuta, S.; Dogas, Z.; Grote, L. Reimbursement of Sleep Procedures across Europe. Executive Committee, Assembly of National Sleep Societies, European Sleep Research Society. 2019. Available online: https://esrs.eu/wp-content/uploads/2019/01/Reimbursement_of_Sleep_Procedures_across_Europe_latest_version_june2014.pdf (accessed on 5 March 2024).

58. Chiao, W.; Durr, M.L. Trends in sleep studies performed for Medicare beneficiaries. *Laryngoscope* **2017**, *127*, 2891–2896. [CrossRef]

59. Fietze, I.; Laharnar, N.; Bargiotas, P.; Basoglu, O.K.; Dogas, Z.; Drummond, M.; Fanfulla, F.; Gislason, T.; Gouveris, H.; Grote, L.; et al. Management of obstructive sleep apnea in Europe—A 10-year follow-up. *Sleep Med.* **2022**, *97*, 64–72. [CrossRef] [PubMed]

60. Schindler, K.A.; Nef, T.; Baud, M.O.; Tzovara, A.; Yilmaz, G.; Tinkhauser, G.; Gerber, S.M.; Gnarra, O.; Warncke, J.D.; Schütz, N.; et al. NeuroTec Sitem-Insel Bern: Closing the Last Mile in Neurology. *Clin. Transl. Neurosci.* **2021**, *5*, 13. [CrossRef]

61. Cronlein, T.; Geisler, P.; Langguth, B.; Eichhammer, P.; Jara, C.; Pieh, C.; Zulley, J.; Hajak, G. Polysomnography reveals unexpectedly high rates of organic sleep disorders in patients with prediagnosed primary insomnia. *Sleep Breath. Schlaf Atm.* **2012**, *16*, 1097–1103. [CrossRef] [PubMed]

62. Luta, X.; Bagnoud, C.; Lambiris, M.; Decollogny, A.; Eggli, Y.; Le Pogam, M.-A.; Marques-Vidal, P.; Marti, J. Patterns of benzodiazepine prescription among older adults in Switzerland: A cross-sectional analysis of claims data. *BMJ Open* **2020**, *10*, e031156. [CrossRef] [PubMed]

63. Schmid, D.; Duss, S.B.; Hertenstein, E.; Nissen, C.; Schneider, C.L.; Urech, A.; Vorster, A.; Berger, T. SLEEPexpert+: Blending Internet-Based Cognitive Behavioral Therapy for Insomnia with In-Person Psychotherapy; A Feasibility Study in Routine Care. *Clin. Transl. Neurosci.* **2023**, *7*, 27. [CrossRef]

64. Duss, S.B.; Bauer-Gambelli, S.A.; Bernasconi, C.; Dekkers, M.P.; Gorban-Peric, C.; Kuen, D.; Seiler, A.; Oberholzer, M.; Alexiev, F.; Lippert, J.; et al. Frequency and evolution of sleep-wake disturbances after ischemic stroke: A 2-year prospective study of 437 patients. *Sleep Med.* **2022**, *101*, 244–251. [CrossRef] [PubMed]

65. Duss, S.B.; Bernasconi, C.; Steck, A.; Brill, A.; Manconi, M.; Dekkers, M.; Schmidt, M.H.; Bassetti, C.L.A. Multiple sleep-wake disturbances after stroke predict an increased risk of cardio-cerebrovascular events or death: A prospective cohort study. *Eur. J. Neurol.* **2023**, *30*, 1696–1705. [CrossRef]

66. Tüzün, M.; Kallweit, U.; Seidel, S.; Endrich, O.; Trelle, S.; Leone, M.A.; Bruni, O.; Dodel, R.; Fiorillo, A.; Holmerová, I.; et al. The Burden of Insomnia and Excessive Daytime Sleepiness: Switzerland's pilot study preliminary results. In Proceedings of the ePoster Session at the 10th EAN Congress, Helsinki, Finland, 29 June–2 July 2024.