The British Student Doctor, 2020;4(2):38-46
doi: 10.18573/bsdj.115
Discussion article

Should healthcare professionals be concerned about the quality of sleep their patients have?

DISCUSSION

AUTHOR

Aleksander Dawidziuk
Imperial College London

Address for Correspondence:
Aleksander Dawidziuk
Imperial College London
South Kensington Campus
London SW7 2AZ
United Kingdom

Email: amd16@ic.ac.uk

No conflicts of interest to declare.

Accepted for publication: 24.04.20

ABSTRACT

Population surveys conducted in many countries, including the United Kingdom, reported participant self-declared insufficient sleep levels. In 2017, the Centre for Disease Control and Prevention (CDC) announced sleep deprivation to be a public health problem. Sleep is essential to maintain life and the restriction of sleep time was postulated to have a negative impact on cognitive function, metabolism and the immune system. Sleep pattern alterations are associated with an increased risk of depression, type II diabetes mellitus, cardiovascular disease and carcinogenesis. Both acute and chronic sleep deprivation, as well as circadian rhythm dysregulation, can lead to adverse health consequences. Moreover, there is a number of prevalent sleep conditions, including insomnia and obstructive sleep apnoea (OSA) which need early diagnosis and appropriate treatment. This essay briefly outlines current theories of the function of sleep and summarises pathologies arising from sleep pattern alterations to argue that it is essential for healthcare professionals to address their patients' sleep hygiene and detect sleep conditions early in order to improve health outcomes.

Over 30% of adults in the United States sleep for less than seven hours in a 24 hour period, (1) failing to meet the healthy length of sleep recommended by the American Academy of Sleep Medicine. (2) In the United Kingdom, 51% of adult respondents declared insufficient sleep on workdays. (3) The Centre for Disease Control and Prevention (CDC) announced sleep deprivation to be a public health problem, (4) and popular media have even described it as an epidemic. (5) This essay will explore the consequences of sleep pattern alterations and discuss the most common sleep disorders to show how important is it for healthcare professionals to address the quality of patients' sleep in their clinical practice.

THE FUNCTION OF SLEEP

To evaluate the effects of sleep loss, it is worth exploring some of its essential functions. The role of sleep has been investigated extensively, and a number of explanations for its importance postulated. Sleep is essential to maintain life; (6,7) individuals forced to remain awake for a period of 40 hours or greater will involuntarily fall asleep. (8) Currently, there are several prominent theories of the purpose of sleep, (9–11) which are summarised in Table 1.

Inactivity theory	Evolutionary pressure promotes creatures inactive at night which are less susceptible to predators active in the dark.
Energy conservation theory	Main function of sleep is energy expenditure reduction; supported by 10% decrease in metabolism during sleep.
Restoration theory	Sleep allows for the body to repair; protein synthesis, tissue growth, muscle repair, release of growth hormone all occur during sleep.
Brain plasticity theory	Sleep is necessary for neural reorganisation and development of brain's structure and function. Theory supported by recent ultrastructural evidence for renormalisation of synapses during sleep.

Box 1
Prominent sleep function theories

THE CONSEQUENCES OF SLEEP DEPRIVATION

While trying to understand the function of sleep, researchers have learned more about its importance by studying the effects of sleep restriction rather than by investigating processes happening during sleep itself. Various neurological consequences of sleep deprivation have been identified. One of the most important is the impairment of cognitive performance. (12) It is particularly crucial not to overlook repeated sleep loss. Chronic restriction of sleep to 6 hours per night or less produces cognitive function deficits equivalent to up to two nights of total sleep deprivation. (13) Sleep loss is responsible for prolonged reaction time and, consequentially, for increased risk of road traffic accidents. (14) It also deteriorates executive function defined as an ability to plan and coordinate a wilful action in the face of an alternative. (15) Sleep can be characterised by cyclic episodes of rapid eye movement (REM) and non-REM sleep which includes lighter sleep (stages 1, 2) and deep slow-wave sleep (SWS, stages 3, 4). Slow-wave and rapid eye movement sleep is crucial for declarative memory consolidation. (16) Furthermore, sleep plays a vital role in maintaining a good mood and sleep alterations are associated with a high risk of depression. (17) To summarise, restricted sleep interferes with our work efficiency, learning, decision making, mood, and increases the risk of accidents.

Sleep is not only essential for the brain and nervous system but also metabolism, endocrine function and immunity. Sleep restriction leads to changes in appetite regulating hormones (increased ghrelin and decreased leptin) which in turn boost hunger and food intake. Also, sleep deprivation was shown by a number of well-designed sleep manipulation studies to cause insulin resistance and reduce glucose clearance resulting in obesity. (18) Alterations in growth hormone and cortisol secretion patterns, adipocyte dysfunction, triggered by irregular sleep, all contribute to pancreatic beta-cell dysfunction and in turn type II diabetes mellitus. (19) Global obesity and diabetes epidemics are major health challenges to be addressed, making education on sleep hygiene even more important.

An acute modest reduction of sleep length by four hours, in comparison to baseline measurement taken at eight hours of sleep, increases proinflammatory cytokine response and can lead to prolonged inflammation. (20,21) In contrast to that, chronic sleep deprivation, defined as less than seven hours of sleep for 14 consecutive days is likely to reduce immune function, e.g. by decreasing natural killer cells activity, and is associated with the risk of developing a common cold almost three times higher than in individuals getting more than eight hours of sleep. (22–24)

A large number of studies investigated circadian rhythm dysregulation resulting from sleep alterations. Among findings of extensive importance for public health were increased risk of cancer and cardiovascular disease. (25) The most prominent are epidemiological investigations of female shift-workers, which identified a 1.5 higher risk of developing breast cancer in a population of Norwegian radio and telegraph operators after adjusting for fertility factors. (26,27) Evidence was also provided for a link between circadian rhythm and the incidence of myocardial infarction (threefold higher frequency of onset at the peak - 9 a.m., compared to trough - 11 p.m.), (28) and stroke (highest incidence between 6 a.m. and 12 p.m.). (29) Further research is needed to confirm if modifications of the circadian rhythm can delay or prevent the occurrence of these events.

COMMON SLEEP DISORDERS

Sleep quality can be deteriorated by environmental factors, such as work pattern or light-dark imbalance, but also by internal conditions. International Classification of Sleep Disorders (ICSD-3) identifies six major categories of them. (30) This essay will focus on the most prevalent, hence important for public health: obstructive sleep apnoea (OSA) and insomnia. (31)

OSA is characterised by repeated airway collapse during sleep, causing oxygen desaturation and disruption of sleep. (32) The current OSA prevalence estimates are 9% for women and 24% for men (over 1.5 million cases in the United Kingdom, of which up to 85% are undiagnosed). (33,34) There are several diagnostic factors associated with obstructive sleep apnoea, including obesity, male sex, maxillomandibular abnormalities, excessive daytime sleepiness, episodes of apnoea, episodic gasping, restless sleep, insomnia, macroglossia and chronic snoring. Polysomnography is currently the only definitive test. Its result, the Apnoea-Hypopnoea Index (AHI) of >15 episodes/hour is confirmatory, however, AHI of >5 is sufficient for a symptomatic patient. Continuous positive airway pressure (CPAP) is the 1st line treatment of choice for severe OSA (AHI >30), while titratable devices are preferred in mild to moderate (AHI 5-30) cases. (35) OSA leads to daytime sleepiness, which can result in road traffic accidents, (36) and systemic hypertension, (37) the incidence of which can be alleviated by treatment with CPAP. (38)

10% of adults meet the criteria for chronic insomnia and almost 20% report some symptoms of it. (39) It is a widely prevalent condition, although few people seek medical care. (40) Sleep partner complaints, delayed sleep onset, multiple and long awakenings and presence of risk factors which include female sex, advancing age, chronic illnesses and use of alcohol, drugs or stimulants should be considered when taking the history. There are several questionnaires which can be administered to facilitate the diagnosis: Pittsburgh Sleep Quality Index, Insomnia Severity Index, Stanford Sleepiness Scale, Epworth Sleepiness Scale and Athens Insomnia Scale. (41) Comorbidities such as anxiety, depression, substance misuse and pain are associated with chronic insomnia. (42) When making the diagnosis it is important to differentiate between true insomnia and sleep disturbance resulting from other conditions which can be challenging. The management of acute and chronic insomnia should begin with providing guidance on sleep hygiene and relaxation techniques, however, the evidence supporting this approach is still limited. Cognitive behavioural therapy for insomnia (CBT-I) and hypnotic medications are the other two first line treatments, which have been shown to be effective remedies. (41)

Causes and consequences of sleep pattern alteration, described in this essay, are outlined in Figure 1.

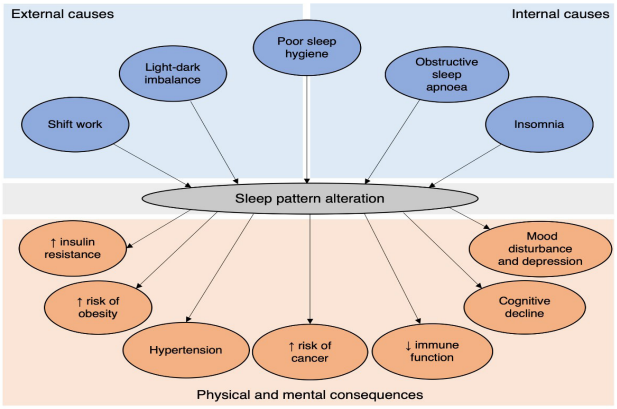

Figure 1
Causes and consequences of sleep pattern alterations.

ADDRESSING THE QUALITY OF SLEEP

Sleep alterations have a profound effect on public health, ranging from increased risk of obesity to road traffic accidents. It is very important for healthcare professionals to properly diagnose and treat underlying risk factors and comorbidities associated with these sleep disorders. However, from a public health perspective, it is even more important for healthcare professionals to raise awareness of sleep hygiene by the general public. (43,44) It is also vital to use evidence-based resources and tools for delivering this education. Currently, a variety of sleep analysis smartphone applications with a range of functionalities are available, however, the algorithms they utilise are not yet validated by the scientific literature. (45) There also is a number of applications designed to help improve the time and quality of sleep, and three of these are recommended by the National Health Service: Pzizz (uses a mix of music, voiceovers and sound effects to help people fall asleep), Sleepio (an online sleep improvement programme based on CBT techniques) and Sleepstation (a 6-week online course providing information on falling and staying asleep throughout the night). All of these applications have been clinically validated. (46)

Education on healthy sleep has the potential to improve the quality of life of millions and contribute to solving one of society's major public health issues. In its 2016 report, the Royal Society for Public Health has suggested that the government should publish a national sleep strategy and introduce sleep education into workplaces and national school curricula. (47) The experts argue that raising awareness should begin in early childhood. (48) As of writing this article, there are a number of sleep awareness campaigns run by organisations like The Sleep Council, however, there is currently no national sleep policy in the United Kingdom. (49) As a result, the task of educating the public on sleep hygiene falls to healthcare professionals, who should proactively advise their patients on improving the quality of their sleep.

REFERENCES

1. Liu Y, Wheaton AG, Chapman DP, Cunningham TJ, Lu H, Croft JB. Prevalence of Healthy Sleep Duration among Adults — United States, 2014. Atlanta: Centers for Disease Control and Prevention MMWR Morb Mortal Wkly Rep; 2016 [accessed 15 Dec 2019]. Available from: http://www.cdc.gov/mmwr/volumes/65/wr/mm6506a1.htm.

2. Watson NF, Badr MS, Belenky G, Bliwise DL, Buxton OM, Buysse D, et al. Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society on the Recommended Amount of Sleep for a Healthy Adult: Methodology and Discussion. Sleep. 2015;38(8):1161–83.

https://doi.org/10.5665/sleep.4886

PMid:26194576 PMCid:PMC4507722

3. National Sleep Foundation. 2013 International Bedroom Poll - National Sleep Foundation Washington D.C.: Sleep Foundation; 2013 [accessed 15 Dec 2019]. Available from: https://www.sleepfoundation.org/professionals/sleep-america-polls/2013-international-bedroom-poll.

4. Hafner M, Stepanek M, Taylor J, Troxel W, Stolk C. Why sleep matters -- the economic costs of insufficient sleep: A cross-country comparative analysis. Why sleep matters -- the economic costs of insufficient sleep: A cross-country comparative analysis. Santa Monica, CA: RAND Corporation; 2017.

5. During EH. The Epidemic of Sleep Deprivation: A Modern Curse. New York: HuffPost; 2017 [accessed 15 Dec 2019]. Available from: https://www.huffpost.com/entry/the-epidemic-of-sleep-deprivation-a-modern-curse_b_597e836be4b09982b73765e7?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAABkpYiitRalgY1KM-HdzL19n3wJWB_u25TrZui8YNFam4evHB27t4Zul7hHaRK7p8nN.

6. Everson CA, Bergmann BM, Rechtschaffen A. Sleep Deprivation in the Rat: III. Total Sleep Deprivation. Sleep. 1989;12(1):13-21.

https://doi.org/10.1093/sleep/12.1.13

PMid:2928622

7. Cirelli C, Tononi G. Is Sleep Essential? PLoS Biol. 2008;6(8):e216.

https://doi.org/10.1371/journal.pbio.0060216

PMid:18752355 PMCid:PMC2525690

8. Adam M, Rétey J V., Khatami R, Landolt H-P. Age-Related Changes in the Time Course of Vigilant Attention During 40 Hours Without Sleep in Men. Sleep. 2006;29(1):55–7.

https://doi.org/10.1093/sleep/29.1.55

PMid:16453981

9. Brinkman JE, Sharma S. Physiology, Sleep. StatPearls. 2018.

10. De Vivo L, Bellesi M, Marshall W, Bushong EA, Ellisman MH, Tononi G, et al. Ultrastructural evidence for synaptic scaling across the wake/sleep cycle. Science. 2017;355(6324):507–10.

https://doi.org/10.1126/science.aah5982

PMid:28154076 PMCid:PMC5313037

11. Cirelli C, Tononi G. The Sleeping Brain. Cerebrum: the Dana Forum on Brain Science. New York: Dana Foundation; 2017 [accessed 15 Dec 2019]. Available from: https://dana.org/article/the-sleeping-brain.

12. Pilcher JJ, Huffcutt AI. Effects of Sleep Deprivation on Performance: A Meta-Analysis. Sleep. 1996;19(4):318–26.

https://doi.org/10.1093/sleep/19.4.318

PMid:8776790

13. Van Dongen HPA, Maislin G, Mullington JM, Dinges DF. The Cumulative Cost of Additional Wakefulness: Dose-Response Effects on Neurobehavioral Functions and Sleep Physiology From Chronic Sleep Restriction and Total Sleep Deprivation. Sleep. 2003;26(2):117–26.

https://doi.org/10.1093/sleep/26.2.117

PMid:12683469

14. Connor J, Norton R, Ameratunga S, Robinson E, Civil I, Dunn R, et al. Driver sleepiness and risk of serious injury to car occupants: population based case control study. BMJ. 2002;324(7346):1125.

https://doi.org/10.1136/bmj.324.7346.1125

PMid:12003884 PMCid:PMC107904

15. Durmer JS, Dinges DF. Neurocognitive Consequences of Sleep Deprivation. Semin Neurol. 2005;25(01):117–29.

https://doi.org/10.1055/s-2005-867080

PMid:15798944

16. Diekelmann S, Born J. The memory function of sleep. Vol. 11, Nature Reviews Neuroscience. 2010. p. 114–26.

17. Tsuno N, Besset A, Ritchie K. Sleep and Depression. J Clin Psychiatry. 2005;66(10):1254–69.

https://doi.org/10.4088/JCP.v66n1008

PMid:16259539

18. Spiegel K, Leproult R, Van Cauter E. Impact of sleep debt on metabolic and endocrine function. Lancet. 1999;354(9188):1435–9.

https://doi.org/10.1016/S0140-6736(99)01376-8

19. Reutrakul S, Van Cauter E. Sleep influences on obesity, insulin resistance, and risk of type 2 diabetes. Vol. 84, Metabolism: Clinical and Experimental. Philadelphia: W.B. Saunders; 2018. p. 56–66.

20. Irwin MR, Wang M, Campomayor CO, Collado-Hidalgo A, Cole S. Sleep deprivation and activation of morning levels of cellular and genomic markers of inflammation. Arch Intern Med. 2006;166(16):1756–62.

https://doi.org/10.1001/archinte.166.16.1756

PMid:16983055

21. Lange T, Dimitrov S, Born J. Effects of sleep and circadian rhythm on the human immune system. Ann N Y Acad Sci. 2010;1193(1):48–59.

https://doi.org/10.1111/j.1749-6632.2009.05300.x

PMid:20398008

22. Irwin M, Mcclintick J, Costlow C, Fortner M, White J, Christian Gillin J. Partial night sleep deprivation reduces natural killer and cellular immune responses in humans. FASEB J. 1996;10(5):643–53.

https://doi.org/10.1096/fasebj.10.5.8621064

PMid:8621064

23. Haus EL, Smolensky MH. Shift work and cancer risk: Potential mechanistic roles of circadian disruption, light at night, and sleep deprivation. Sleep Medicine Reviews. 2013;17:273–84.

https://doi.org/10.1016/j.smrv.2012.08.003

PMid:23137527

24. Cohen S, Doyle WJ, Alper CM, Janicki-Deverts D, Turner RB. Sleep habits and susceptibility to the common cold. Arch Intern Med. 2009;169(1):62–7.

https://doi.org/10.1001/archinternmed.2008.505

PMid:19139325 PMCid:PMC2629403

25. Abbott SM, Malkani RG, Zee PC. Circadian Dysregulation in Mental and Physical Health. In: Principles and Practice of Sleep Medicine. Amsterdam: Elsevier; 2017. p. 405-413.

26. Tynes T, Hannevik M, Andersen A, Vistnes AI, Haldorsen T. Incidence of breast cancer in Norwegian female radio and telegraph operators. Cancer Causes Control. 1996;7(2):197–204.

https://doi.org/10.1007/BF00051295

PMid:8740732

27. Schernhammer ES, Laden F, Speizer FE, Willett WC, Hunter DJ, Kawachi I, et al. Rotating Night Shifts and Risk of Breast Cancer in Women Participating in the Nurses' Health Study. JNCI J Natl Cancer Inst. 2001;93(20):1563–8.

https://doi.org/10.1093/jnci/93.20.1563

PMid:11604480

28. Muller JE, Stone PH, Turi ZG, Rutherford JD, Czeisler CA, Parker C, et al. Circadian Variation in the Frequency of Onset of Acute Myocardial Infarction. N Engl J Med. 1985;313(21):1315–22.

https://doi.org/10.1056/NEJM198511213132103

PMid:2865677

29. Argentino C, Toni D, Rasura M, Violi F, Sacchetti ML, Allegretta A, et al. Circadian variation in the frequency of ischemic stroke. Stroke. 1990;21(3):387–9.

https://doi.org/10.1161/01.STR.21.3.387

PMid:2309262

30. Sateia MJ. International classification of sleep disorders-third edition highlights and modifications. Chest. 2014;146(5):1387–94.

https://doi.org/10.1378/chest.14-0970

PMid:25367475

31. Amara AW, Maddox MH. Epidemiology of Sleep Medicine. In: Principles and Practice of Sleep Medicine. Amsterdam: Elsevier; 2017. p. 627-637.

32. Jordan AS, McSharry DG, Malhotra A. Adult obstructive sleep apnoea. The Lancet. 2014;383:736–47. https://doi.org/10.1016/S0140-6736(13)60734-5

33. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The Occurrence of Sleep-Disordered Breathing among Middle-Aged Adults. N Engl J Med. 1993;328(17):1230–5.

https://doi.org/10.1056/NEJM199304293281704

PMid:8464434

34. British Lung Foundation. Obstructive sleep apnoea: Toolkit for commissioning and planning local NHS services in the UK. London: British Lung Foundation; 2015 [accessed 23 Dec 2019]. Available from: https://www.blf.org.uk/sites/default/files/OSA_Toolkit_2015_BLF_0.pdf.

35. BMJ Best Practice. Obstructive sleep apnoea in adults. London: BMJ Group; 2018 [accessed 23 Dec 2019]. Available from: https://bestpractice.bmj.com/topics/en-gb/215/pdf/215.pdf.

36. Terán-Santos J, Jimenez-Gomez A, Cordero-Guevara J. The Association between Sleep Apnea and the Risk of Traffic Accidents. N Engl J Med. 1999;340(11):847–51.

https://doi.org/10.1056/NEJM199903183401104

PMid:10080847

37. Peppard PE, Young T, Palta M, Skatrud J. Prospective Study of the Association between Sleep-Disordered Breathing and Hypertension. N Engl J Med. 2000;342(19):1378–84.

https://doi.org/10.1056/NEJM200005113421901

PMid:10805822

38. Montesi SB, Edwards BA, Malhotra A, Bakker JP. Effect of continuous positive airway pressure treatment on blood pressure: A systematic review and meta-analysis of randomized controlled trials. Journal of Clinical Sleep Medicine. 2012;8:587–96.

https://doi.org/10.5664/jcsm.2170

PMid:23066375 PMCid:PMC3459209

39. Morin CM, LeBlanc M, Daley M, Gregoire JP, Mérette C. Epidemiology of insomnia: Prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. Sleep Med. 2006;7(2):123–30.

https://doi.org/10.1016/j.sleep.2005.08.008

PMid:16459140

40. Morin CM, LeBlanc M, Bélanger L, Ivers H, Mérette C, Savard J. Prevalence of insomnia and its treatment in Canada. Can J Psychiatry. 2011;56(9):540–8.

https://doi.org/10.1177/070674371105600905

PMid:21959029

41. BMJ Best Practice. Insomnia. London: BMJ Group; 2019 [accessed 23 Dec 2019]. Available from: https://bestpractice.bmj.com/topics/en-gb/227/pdf/227.pdf.

42. Morin CM, Benca R. Chronic insomnia. The Lancet. 2012;379(9821):1129–41.

https://doi.org/10.1016/S0140-6736(11)60750-2

43. Irish LA, Kline CE, Gunn HE, Buysse DJ, Hall MH. The role of sleep hygiene in promoting public health: A review of empirical evidence. Sleep Medicine Reviews. 2015;22:23–36.

https://doi.org/10.1016/j.smrv.2014.10.001

PMid:25454674 PMCid:PMC4400203

44. Mukherjee S, Patel SR, Kales SN, Ayas NT, Strohl KP, Gozal D, et al. An Official American Thoracic Society Statement: The Importance of Healthy Sleep. Recommendations and Future Priorities. Am J Respir Crit Care Med. 2015;191(12):1450–8.

https://doi.org/10.1164/rccm.201504-0767ST

PMid:26075423 PMCid:PMC5442970

45. Ong AA, Gillespie MB. Overview of smartphone applications for sleep analysis. World J Otorhinolaryngol Neck Surg. 2016;2(1):45–9.

https://doi.org/10.1016/j.wjorl.2016.02.001

PMid:29204548 PMCid:PMC5698521

46. NHS. Sleep apps. London: NHS England; 2019 [accessed 23 Dec 2019]. Available from: https://www.nhs.uk/apps-library/category/sleep.

47. Royal Society for Public Health. Waking up to the health benefits of sleep. London: Royal Society for Public Health; 2016 [accessed 23 Dec 2019]. Available from: https://www.rsph.org.uk/uploads/assets/uploaded/50220c8f-febb-416e-8f3f7a4d2f973897.pdf.

48. Grandner MA. Sleep, Health, and Society. Sleep Medicine Clinics. 2017;12:1–22

https://doi.org/10.1016/j.jsmc.2016.10.012

PMid:28159089 PMCid:PMC6203594

49. Awareness Campaigns - The Sleep Council. Skipton, North Yorkshire: The Sleep Council; 2019 [accessed 23 Dec 2019]. Available from: https://sleepcouncil.org.uk/press/awareness-campaigns.

bsdj.org.uk

/thebsdj

@thebsdj

@thebsdj

Journal DOI
10.18573/issn.2514-3174

Issue DOI
10.18573/bsdj.v4i2

The **British Student Doctor** is published by **The Foundation for Medical Publishing**, a charitable incorporated organisation registered in England and Wales (Charity No. 1189006), and a subsidary of **The Academy of Medical Educators.**

Cardiff University Press
Gwasg Prifysgol Caerdydd

The British Student Doctor is an imprint of Cardiff University Press, an innovative open-access publisher of academic research, where 'open-access' means free for both readers and writers.

cardiffuniversitypress.org