

# Sleep disturbance in hospital – What can be done for a quiet night?

## Abstract

Sleep is important. When we are not in a hospital bed, we devote 36% of our lives to it - time not spent eating, moving or reproducing. Things that our biology textbooks tell us are needed for life. So why do we do it? There is no theory of everything when it comes to sleep but it underpins all of our biopsychosocial functions. We will cover some of these and how they relate to inpatients along with what we can do to improve their sleep.

## Why does sleep matter?

**S**leep is needed to maintain physical and mental homeostasis with a bidirectional relationship between sleep disturbance and ill-health. Sleep, or lack thereof, has direct impacts on emotional processing and mood making it both a symptom and risk factor for psychiatric illness with 80% of people with depression reporting poor sleep [1,2]. The increased activity in the amygdala, striatum and prefrontal cortex in REM sleep combined with reduced noradrenaline levels could indicate a causal pathway [3].

People sleeping less than 6 hours have increased levels of impaired glucose tolerance and diabetes compared to those getting 7-8 hours, affecting inpatients and public health overall [4]. Surgical patients share the burden of circadian rhythm disruption. Actin is a key protein involved within cell migration in fibroblasts and needed for wound healing. It responds to the circadian clock meaning that burns occurring during the day heal 60% faster than those that occur at night. Disturbing the circadian rhythm shifts this “active period”, delaying wound healing [5]. Growth hormone pulses within slow wave sleep account for 70% of total daily GH, vital for childhood growth and development [6]. Close relation-

ships have also been shown between poor sleep and increased inflammatory response during chemotherapy [7] with studies showing worse chemotherapy outcomes in patients with circadian rhythm disruption [8]. All of these factors should make us realise that for those in hospital, some of the most unwell and vulnerable, we should be doing everything to protect and preserve sleep as part of recovery.

## What goes wrong?

Like a Vegas casino, hospitals are full of artificial lights and noise at night and little physical activity in the day. Unfortunately, in this case the gamble leads to poorer outcomes for patients, who report significantly worse sleep of around 5.5 hours versus 7.0 hours at home. Not only is sleep shorter but the quality of the sleep is worse [9]. One of the main factors that patients report disturbing sleep is noise [9]. The World Health Organisation recommends that the mean overnight noise in a hospital should be less than 35 dB with peaks of noise less than 40 dB. A study by Padmakumar is one of many showing that noise levels in Intensive Care Units were much higher with peaks of 60dB occurring regularly at night. The noise next to the nurses stations was loudest, highlighting the impact staff and conversation has on noise disruption, but environmental sounds such as machine alarms and items being dropped caused the largest increase in sound pressures [10]. Other studies [9,11] also show that overnight nursing observations and interventions such as medication administration are a major cause of disruption to patient sleep for obvious reasons. Conversely bundling care, rather than repeated visits to the patient has been shown to lead to better sleep, less need for both painkillers and hypnotics and shorter hospital stays [12].

Not much about modern hospital systems

is natural and this includes the lighting. In some areas the requirement for bed space means natural light comes as an afterthought. Unfortunately, our circadian rhythms, co-ordinated by the suprachiasmatic nucleus (SCN), are heavily entrained by the 24 hour light-dark cycles [13]. The lack of these natural light cycles in hospital can lead to a “free running” sleep cycle which is asynchronous to the light/dark cycle and more than 24hrs, leading to delayed sleep, excessive daytime sleepiness and impaired daytime function [14]. A study into the impact of daylight on length of stay for 2319 patients in a coronary care unit showed those with direct light from windows had shorter length of stay than those without, with the biggest impact on patients with dementia, anxiety or prior delirium [15].

Aside from light, exercise helps with circadian rhythm entrainment. Individuals who exercise between 7am-3pm wake earlier with those exercising later doing the opposite, leading to a reduction in circadian disruption. This improves both sleep and metabolic health in general [16], while lack of activity in the inpatient setting helps neither. Not all will benefit from bed rest in the day.

## What can we do about it?

Many of the above factors are modifiable and both individual and organisational change could improve sleep outcomes for patients and staff, the methods for doing this vary and this section will discuss some of the changes that can be made.

A recent systematic review and metanalysis included 76 studies with 5675 patients involved. The conclusions were that physical sleep aids, relaxation techniques and music interventions all had medium to large effect on sleep quality and for some studies, length of stay in hospital was shorter. Physical sleep

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**Provenance and Peer Review:**  
Submitted and externally reviewed.

**Date First Submitted:** 26/3/2024  
**Acceptance Date:** 28/7/2024  
**Published Online:** 4/11/2024

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**To cite:** 37,175.50  
<https://doi.org/10.47795/LTFX1152>

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**Conflict of Interest Statement:** Kirstie Anderson is ACNR's Sleep editor. This article has been subject to our normal peer review process, being peer reviewed by two expert, external reviewers prior to acceptance by the editors of ACNR.

aids, especially eye masks, seemed to have the largest effect with their relatively low cost and easy application making them practical within the NHS [17]. Redesigning entire wards may be a bigger task; identifying those patients more likely to benefit from sunlight exposure and placing them in beds which reflect this ie. closer to windows may be a more easily attainable intervention [15]. Preoperative sleep loss was significantly associated with postoperative delirium [18], with 91% of those experiencing sleep loss being first on the theatre list. Perhaps those with risk factors for delirium such as cognitive impairment could be placed later in the day or sleep aids should be considered in preoperative evaluations.

The SleepWell project in a UK mental health trust personalised night time nursing observations by having a 6hr protected sleep period when safe, identified sleep disorders and provided patient and staff education around sleep and insomnia [19]. This resulted in 50% of patients getting protected sleep, a 41% reduction in the number of hypnotic medications administered per patient and positive feedback from patients and staff with no serious adverse events [20,21]. This and other studies have shown that simple interventions led at ward level and by nursing staff can improve length of sleep and reduce unnecessary and potentially harmful prescribing.

### Looking to the future

Along with efforts from individuals and organisations, technology could provide the tools to help in-patients sleep better. Although physical sleep aids can provide relief from the artificial hospital environments, soft closing bins and alarms turned down at night are often even more effective [22]. Simple noise monitoring and visual warning devices such as the SoundEar (Figure 1) have been shown to modify staff behaviours and reduce ambient noise. Pairing these with a more targeted bundle of sleep promoting interventions could provide the behavioural changes required [23]. Along with sound monitoring, smart lighting could be implemented to better replicate the natural environment. The introduction of cycled light reflecting what would occur outside hospital has significant benefits to preterm babies in NICU, leading to increased weight and reduced length of stay compared to those in constant light conditions [24]. Blue depleted light was used in the lighting systems of a psychiatric hospital in Norway and showed higher melatonin levels at night and improved sleep quality. The authors suggested new hospital designs could include these chronobiological principles to benefit patients' sleep and circadian rhythm without additional burden to staff or patients [25].

Although they may help in the future, we



Figure 1. The SoundEar3 monitoring system. An example of a decibel meter used within the hospital environment, it can be set to flash red as a warning at a certain decibel level. This can be adjusted depending on the time of day <http://www.soundear.com>

don't need the robots used in Japanese care homes and advanced Artificial Intelligence to measure and personalise sleep advice before we've got the basics right. The first step to improving sleep for our patients is by asking everyone a simple question on the morning ward round. How did you sleep last night?

### References

- Armitage R. Sleep and circadian rhythms in mood disorders. *Acta Psychiatrica Scandinavica*. 2007 Jan 15;115(s433):104-15. <https://doi.org/10.1111/j.1600-0447.2007.00968.x>
- Vandekerckhove M, Wang Y. Emotion, emotion regulation and sleep: An intimate relationship. *AIMS Neuroscience*. 2018;5(1):1-17. <https://doi.org/10.3934/Neuroscience.2018.1.1>
- Goldstein AN, Walker MP. The role of sleep in emotional brain function. *Annual Review of Clinical Psychology*. 2014;10(1):679-708. <https://doi.org/10.1146/annurev-clinpsy-032813-153716>
- Gottlieb DJ, Punjabi NM, Newman AB, Resnick HE, Redline S, Baldwin CM, et al. Association of Sleep Time with diabetes mellitus and impaired glucose tolerance. *Archives of Internal Medicine*. 2005 Apr 25;165(8):863. <https://doi.org/10.1001/archinte.165.8.863>
- Hoyle NP, Seinkmane E, Putker M, Feeney KA, Krogager TP, Chesham JE, et al. Circadian actin dynamics drive rhythmic fibroblast mobilization during wound healing. *Science Translational Medicine*. 2017 Nov 8;9(415). <https://doi.org/10.1126/scitranslmed.aal2774>
- Kaiser U, Ho KKY. Pituitary physiology and diagnostic evaluation. *Williams Textbook of Endocrinology*. 2016;176-231. <https://doi.org/10.1016/B978-0-323-29738-7.00008-3>
- Liu L, Mills PJ, Rissling M, Fiorentino L, Natarajan L, Dimsdale JE, et al. Fatigue and sleep quality are associated with changes in inflammatory markers in breast cancer patients undergoing chemotherapy. *Brain, Behavior, and Immunity*. 2012 Jul;26(5):706-13. <https://doi.org/10.1016/j.bbi.2012.02.001>
- Innominato PF, Spiegel D, Ulusakarya A, Giacchetti S, Bjarnason GA, Lévi F, et al. Subjective sleep and overall survival in chemotherapy-naïve patients with metastatic colorectal cancer. *Sleep Medicine*. 2015 Mar;16(3):391-8. <https://doi.org/10.1016/j.sleep.2014.10.022>
- Dobing S, Frolova N, McAlister F, Ringrose J. Sleep quality and factors influencing self-reported sleep duration and quality in the general inpatient medicine inpatient population. *PLOS ONE*. 2016 Jun 9;11(6). <https://doi.org/10.1371/journal.pone.0156735>
- Padmakumar AD, Bhasin V, Venham TN, Bodenham AR. Evaluation of noise levels in intensive care units in two large teaching hospitals - a prospective observational study. *Journal of the Intensive Care Society*. 2013 Jul;14(3):205-10. <https://doi.org/10.1177/175114371301400306>
- Astin F, Stephenson J, Wakefield J, Evans B, Rob P, Joanna G, et al. Night-time noise levels and patients' sleep experiences in a medical assessment unit in Northern England. *The Open Nursing Journal*. 2020 Jun 18;14(1):80-91. <https://doi.org/10.2174/1874434602014010080>
- Williams KM. Sleep protocol-Use of evidence-based practice (EBP) to improve patient outcomes and patient satisfaction while hospitalized. *Worldviews Evid Based Nurs*. 2022;19(5):423-425. <https://doi.org/10.1111/wvn.12562>
- Hughes S, Jagannath A, Hankins MW, Foster RG, Peirson SN. Photoc regulation of clock systems. *Methods in Enzymology*. 2015;125-43. <https://doi.org/10.1016/bs.mie.2014.10.018>
- Brown MA, Quan SF, Eichling PS. Circadian rhythm sleep disorder, free-running type in a sighted male with severe depression, anxiety, and Agoraphobia. *Journal of Clinical Sleep Medicine*. 2011 Feb 15;07(01):93-4. <https://doi.org/10.5664/jcsm.28047>
- Jafarifiroozabadi R, Joseph A, Bridges W, Franks A. The impact of daylight and window views on length of stay among patients with heart disease: A retrospective study in a cardiac intensive care unit. *Journal of Intensive Medicine*. 2023 Apr;3(2):155-64. <https://doi.org/10.1016/j.jointm.2022.11.002>
- Youngstedt SD, Elliott JA, Kripke DF. Human circadian phase-response curves for exercise. *The Journal of Physiology*. 2019 Mar 18;597(8):2253-68. <https://doi.org/10.1113/jp276943>
- Beswick AD, Wylde V, Bertram W, Whale K. The effectiveness of non-pharmacological sleep interventions for improving inpatient sleep in hospital: A systematic review and meta-analysis. *Sleep Medicine*. 2023 Jul;107:243-67. <https://doi.org/10.1016/j.sleep.2023.05.004>
- Leung JM, Tang C, Do Q, Sands LP, Tran D, Lee KA. Sleep loss the night before surgery and incidence of postoperative delirium in adults 65-95 years of age. *Sleep Medicine*. 2023 May;105:61-7. <https://doi.org/10.1016/j.sleep.2023.03.015>
- <https://www.cntw.nhs.uk/resource-library/smarter-sleep/> [cited 2024 Mar 3].
- Novak C, Packer E, Paterson A, Roshi A, Locke R, Keown P, et al. Feasibility and utility of enhanced sleep management on in-patient psychiatric wards. *BJPsych Bulletin*. 2020 Apr 24;44(6):255-60. <https://doi.org/10.1192/bjbb.2020.30>
- Paterson A, Khundakar M, Young A, Ling J, Chakraborty S, Rathbone AP, et al. The Smarter Sleep educational interventions: an initiative to reduce hypnotic prescribing in in-patient psychiatric care. *BJPsych Bulletin*. 2022;46(4):242-50. <https://doi.org/10.1192/bjbb.2021.41>
- DuBose JR, Hadi K. Improving inpatient environments to support patient sleep. *International Journal for Quality in Health Care*. 2016 Aug 10;28(5):540-53. <https://doi.org/10.1093/intqhc/mzw079>
- Plummer NR, Herbert A, Blundell JE, Howarth R, Baldwin J, Laha S. Soundear noise warning devices cause a sustained reduction in ambient noise in adult critical care [Internet]. *U.S. National Library of Medicine*; 2019 [cited 2024 Mar 18]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6475996/>
- Hazelhoff EM, Dudink J, Meijer JH, Kervezee L. Beginning to see The light: Lessons learned from the development of the circadian system for optimizing light conditions in the Neonatal Intensive Care Unit. *Frontiers in Neuroscience*. 2021 Mar 18;15. <https://doi.org/10.3389/fnins.2021.634034>
- Vethe D, Scott J, Engström M, Salvesen Ø, Sand T, Olsen A, et al. The evening light environment in hospitals can be designed to produce less disruptive effects on the circadian system and improve sleep. *Sleep*. 2020 Sept 21;44(3). <https://doi.org/10.1093/sleep/zsaa194>