

The Night in the ICU

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Sleep Deprivation and Fatigue Management in the Intensive Care Unit

The impact of sleep deprivation and fatigue on patients and staff in the intensive care unit and how improved sleep, reduced noise disturbances, and more organised shifts could be beneficial for both patients and clinicians.

The World Health Organization (WHO) recommends that average daily sound levels in patient care areas should be around 35dBA, with peak sounds no louder than 40dBA (Berglund and Schwela 1999). The reality in the intensive care unit (ICU) is that average daily levels are between 42-69dBA, with a mean of 53dBA, and peaks can be as loud as 120dBA. Units are generally quieter overnight, but sound levels can still average 51-64dBA. There is evidence that noise levels in the ICU are increasing over time (Busch-Vishniac 2016), and that the WHO recommended level may be unachievable in the ICU (Darbyshire and Young 2013).

The idea that people need a restful environment when they are unwell is not new. In 1859, Florence Nightingale wrote "Unnecessary noise is the most cruel abuse of care which can be inflicted." Patients admitted to intensive care are at high risk of poor outcome. Approximately 20% of patients admitted to intensive care units experience delirium during their stay. This figure rises to 75% for patients who are ventilated and sedated (Page and Ely 2011). Although the number of patients

surviving to hospital discharge is increasing, long-term health of those patients who go home remains worse than the average population. Specifically, they are at higher risk of cognitive and mental health problems with almost a fifth of surviving patients reporting symptoms of anxiety,

although lowering average sound levels seems difficult, reducing the startle effect with a view to lowering stress levels in staff and patients alike may lead to a more restful environment

depression, and post-traumatic stress disorder a year after discharge (Hatch et al. 2018). It is plausible that reducing disturbance in the ICU may have a positive effect on the patient experience of intensive care.

Improving sleep for patients would seem

to be a sensible place to start. Humans, like every living thing on this planet, have a natural circadian rhythm. We have evolved to rest during hours of darkness, and most healthy adults need between 7-8 hours of sleep each night. In the ICU, this is hard to achieve. Several studies have demonstrated that patients admitted to the ICU have severely disrupted sleep (Elliott et al. 2011; Bourne et al. 2007). These patients sleep in short, fragmented bursts, often only for a few minutes at a time. This means that they don't experience a normal sleep cycle and tend to suffer both from limited REM (rapid eye movement) and slow wave (or deep) sleep (Jeffs and Darbyshire 2019). It is thought that REM sleep helps the brain make sense of the world, and that deep sleep aids recovery (Lockley and Foster 2012), so disturbance and poor sleep are thought to be avoidable triggers for delirium in the ICU. Changing sleep patterns for patients in the ICU might therefore have an effect on their longer-term outcomes. Sleep is affected by pain, discomfort, and medication as well as the environment.

It follows then that improving opportunities for sleep and good quality rest

time should be an important part of patient care. Assessing patients regularly for signs of pain and delirium should be routine in the ICU (National Institute for Health and Care Excellence, Guideline 103, 2010) and prescribing appropriate analgesia and addressing other potential causes of delirium should be part of this assessment. There are clear benefits to recognising and treating delirium early (Milbrandt et al. 2004) and there is some evidence that sleep aids (eye masks and earplugs) can be protective against delirium (Litton et al. 2016).

Noise is a known stressor that affects staff as well as patients. It is likely that high noise and disturbance levels in the ICU hinder staff and may contribute to errors that compromise patient safety.

Normal speech volume is around 50-55 decibels. For speech to be easily intelligible, conversation volume needs to be about 15dB higher than the background level. In an enclosed space, such as a hospital ward, which also has acoustic properties that amplify rather than absorb noise, sound levels associated with continuous conversation will escalate quickly (Lombard 1911). This means that anyone in the environment has to work harder both to be heard and to hear. If it is harder to understand colleagues talking to you, you will be putting more effort into paying them attention and, by definition, this will monopolise your limited cognitive capacity. Concentrating on one task makes individuals prone to developing 'tunnel vision,' whereby they can no longer notice other events (Simon and Chabris 1999). Even distractions an individual is not consciously aware of can affect performance measurably (Greig et al. 2014), and most people overestimate their ability to multi-task. This is a particular hazard for staffing a department where care must be delivered 24 hours a day, as many of these vulnerabilities are compounded by fatigue.

There have been a number of initiatives trialled to reduce noise disturbances in

the ICU (Li et al. 2011; Boyko et al. 2017; Johansson et al. 2017; Darbyshire et al. 2018; Riemer et al. 2015). Many interventions focus on reducing activity and patient disturbance overnight or during 'quiet periods' during the day. Overall, sound level reductions have been limited, but other benefits such as reduced stress levels in nursing staff have been identified.

That overall sound levels have not changed significantly is perhaps not surprising. Environmental sound is measured as an average over a 24 hour period. With high peak sounds up to 16 times every hour (Darbyshire and Young 2013), it is

12 hour shifts are common, despite a wealth of evidence that this increases the risk of error and workplace accidents

easy to see how these can affect a mean value. In the hospital environment, simple volume averages may not be the most appropriate measures of noise. Humans interpret sounds as they hear them, and disturbance is not limited to volume. Context and quality of sounds are also important. Alarms share sound characteristics with a human scream or a baby's cry (Darbyshire et al. 2019) and are designed to attract attention. Patients in the ICU are likely to be in a state of hyper-vigilance. This will accentuate their likelihood of arousal which makes them more susceptible to disturbance from sound (Matthews 1990). Although lowering average sound levels seems difficult, reducing the startle effect with a view to lowering stress levels in staff and patients alike may lead to a more restful environment.

Working overnight places a significant

physiological and psychological burden on staff. It is arguable whether people can ever fully adapt even to 'permanent' night shift work. The ICU is a 24 hour environment and shift work is essential. In the short-term fatigue affects risk-assessment and decision-making abilities and, whilst people are reasonably good at judging how tired they feel, generally individuals are poor at judging how fatigue affects their performance. After 18 hours awake some responses can be as impaired as when drunk. It would be unthinkable to work under the influence of alcohol but it is common for clinical staff to care for patients after only a few hours sleep. It is known that shift-workers sleep very poorly during the daytime, perhaps only managing around five hours on average (Johnson et al. 2002). In the long-term, fatigue can also affect staff health and morale, with effects on cardiovascular outcomes, depression, and burnout (Ryherd et al. 2008; Topf and Dillon 1998; Tompkins 2009).

The Health and Safety Executive in the UK publishes guidance for industry about fatigue management, noting for example that shifts be '...not longer than 8 hours if work is monotonous, requires concentration or vigilance, is isolated, is safety-critical, and/or there is exposure to work-related physical or chemical hazards' (Health and Safety Executive 2006). Arguably all these risk-factors apply to routine ICU work, and yet 12 hour shifts are common, despite a wealth of evidence that this increases the risk of error and workplace accidents (Dall'ora et al. 2016; Folkard and Lombardi 2006). Two 12 hour night shifts carry the same risk as six 8 hour shifts, and it is worth remembering that bus drivers in the UK would not be permitted to these hours (gov.uk/guidance/drivers-hours-passenger-vehicles). It is hard to argue that ICU staff carry less responsibility.

As well as the risk to patients, there are personal risks to working fatigued. A recent survey of anaesthetic trainees

in the UK noted that falling asleep at the wheel whilst driving home after night shifts is not uncommon (McClelland et al. 2017), and globally there are reports of hospital workers being killed in motor-accidents attributable at least in part to fatigue (idealmedicalcare.org/sleep-deprived-doctors-dying/). Motorists who have caused accidents driving whilst fatigued have also been held criminally responsible for consequences (Rajaratnam and Jones 2004).

It is unrealistic to expect a dramatic change to working hours, but that does not mean risks cannot be better managed within the existing constraints of staff numbers and unit demands. The way shifts are organised affects the risks of fatigue, and controlling the way people transition from days to nights and back again is crucial. Shifts should always be organised so that people's days lengthen. It is much easier to cope with a transition from days, to long days, to nights, then take a few days off. Rapid cycling between shift type is also desirable. Full weeks of nights are not recommended and an ideal pattern would see staff work no more than three or four night shifts at a time (CAA 2002). ■

Key Points

- The WHO recommends that average daily sound levels in patient care areas should be around 35dBA, with peak sounds no louder than 40dBA.
- Noise levels in the ICU are increasing over time and WHO recommended level may be unachievable.
- Noise is a known stressor that affects staff as well as patients.
- Working overnight places a significant physiological and psychological burden on staff.
- The way shifts are organised affects the risks of fatigue, and controlling the way people transition from days to nights and back again is crucial.

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