

The Importance of Sleep

(This article is complementary material for tutorial 2)

Sleep: Are Bad Sleeping Habits Driving us Mad?

TAKE anyone with a psychiatric disorder and the chances are they don't sleep well. The result of their illness, you might think. Now this long-standing assumption is being turned on its head, with the radical suggestion that poor sleep might actually cause some psychiatric illnesses or lead people to behave in ways that doctors mistake for mental problems. The good news is that sleep treatments could help or even cure some of these patients. Shockingly, it also means that many people, including children, could be taking psychoactive drugs that cannot help them and might even be harmful.

No one knows how many people might fall into this category. "That is very frightening," says psychologist Matt Walker from the University of California, Berkeley. "Wouldn't you think that it would be important for us as a society to understand whether 3 per cent, 5 per cent or 50 per cent of people diagnosed with psychiatric problems are simply suffering from sleep abnormalities?"

First, we'd need to know how and to what extent sleep disorders could be responsible for psychiatric problems. In the few years since sleep researchers identified the problem, they have made big strides in doing just that.

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Doctors studying psychiatric disorders noticed long ago that erratic sleep was somehow connected. Adults with depression, for instance, are five times as likely as the average person to have difficulty breathing when asleep, while between a quarter and a half of children with attention-deficit hyperactivity disorder (ADHD) suffer from sleep complaints, compared with just 7 per cent of other children.

Until recently, however, the assumption that poor sleep was a symptom rather than a cause of mental illness was so strong that nobody questioned it. "It was just so easy to say about a patient, well, he's depressed or schizophrenic, of course he's not sleeping well - and never to ask whether there could be a causal relationship the other way," says Robert Stickgold, a sleep researcher at Harvard University. Even when studies did seem to point in the other direction, the findings were largely overlooked, he says.

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In 1987, for example, Patricia Chang and colleagues at Johns Hopkins University in Baltimore reported a study of 1053 male medical students who had been followed for an average of 34 years after graduation. During that time, 101 of them developed clinical depression and 13 of these committed suicide. It turned out that students who had reported suffering from insomnia were twice as likely to develop depression as those with no trouble sleeping. The team concluded cautiously that insomnia was "indicative of a greater risk" of problems later. Stickgold goes further. He believes the study shows that insomnia can predispose people to depression.

He's not the only one to be persuaded both by findings such as Chang's and by the growing realisation that some sleep problems generate symptoms that mimic those of certain psychiatric disorders.

In 2006, Paul Peppard at the University of Wisconsin-Madison and his team studied the relationship between depression and sleep-disordered breathing. In sleep apnoea, the most common form of SDB, a blockage or narrowing of the windpipe causes a steep drop in oxygen levels, temporarily waking the sleeper. The team randomly selected about 800 men and 600 women from a working population and evaluated them in the lab for SDB and depression. There are four categories of SDB and for each increase in a person's SDB category - from "minimal" to "mild", for example - their odds of getting depressed almost

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doubled, the team found (Archives of internal medicine, vol 16, p 1709). Depression cannot have been the main cause of the poor sleep, since we know SDBs stem from physical factors such as excess fat thickening the windpipe or a large tongue or tonsils relative to the size of the windpipe opening. Instead, this work suggests that sleep disorders lead to the depression.

Indeed, Daniel Buysse, medical director of the Sleep and Chronobiology Program at the University of Pittsburgh, Pennsylvania, has found that treating depressed patients' sleep problems can produce a dramatic turnaround in their mood disorder. Buysse does not provide an estimate for the proportion of depressed patients who fall into this category - but he has gone on the record saying that for some patients insomnia seems to cause depression.

Poor sleep may also explain some of the characteristic behaviours associated with other mental illnesses. For example, there is plenty of evidence to suggest that impaired sleep can induce the manic episodes suffered by people with bipolar disorder, according to a review published last May (American Journal of Psychiatry, vol 165, p 830). Stickgold even thinks that it can cause a common problem associated with schizophrenia, namely, the failure to master rote tasks such as how to use a piece of machinery. While healthy people improve overnight on tasks that require such motor skills, Stickgold's team has found that people with chronic schizophrenia do not. "We have identified a failure specifically of the sleep-dependent component of procedural learning," the researchers write (Biological Psychiatry, DOI: 10.1016/j.bps.2004.09.012). So, in theory, improved sleep should help with this symptom.

It also seems that behavioral problems resulting from lack of sleep may be misdiagnosed as attention-deficit disorder (ADD) and ADHD. In 2005, Clifford Risk, director of the Marlborough Center for Sleep Disorders in Massachusetts, presented a study to the annual meeting of the American College of Chest Physicians. Of 34 adults with sleep apnoea that he investigated, 16 had scores that suggested a moderate or severe impairment of attention. Subsequent treatment for the apnoea led to substantial improvements in attention scores for 60 per cent of these individuals - suggesting that for this sub group, at least, the sleep apnoea caused the difficulties with attention.

Likewise, in an analysis of 83 children with ADHD, David Gozal from the University of Louisville, Kentucky, and colleagues found that a quarter of those diagnosed with mild ADHD suffered from sleep apnoea, compared with just 5 per cent of those with strong ADHD and 5 per cent of healthy controls. "SDB can lead to mild ADHD-like behaviours that can be readily misperceived and potentially delay the diagnosis and appropriate treatment," the team concluded (Pediatrics, 2007, vol 111, p 554). Mark Kohler from the Women's and Children's Hospital in Adelaide, Australia, who has studied links between ADHD and sleep, suspects that

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some children are being treated with drugs such as Ritalin while their true problem, a sleep disorder, goes unrecognised.

So how does poor sleep lead to behavioural and psychological problems? Some of the links are apparent. For example, every parent knows that tired children usually become hyperactive rather than sleepy. Sleep disruption also bumps up stress hormone levels, which could contribute to daytime anxiety, a component of many psychiatric disorders. More intriguingly, it now seems sleep disruption can fundamentally interfere with the brain's ability to process emotion and to respond to an emotional stimulus in an appropriate way.

While it is common knowledge anecdotally that a poor night's sleep is likely to make you more irritable the next day, Walker and his colleagues uncovered key evidence for why this should be so. The team showed a set of increasingly disturbing images to people who had slept normally and people deprived of sleep for 35 hours. In the sleep-deprived group, the gruesome images produced 60 per cent more activity in the amygdala - an emotionally responsive part of the brain - than in well-rested people. Further scans revealed that in those deprived of sleep the amygdala was failing to communicate with the prefrontal lobe, which normally controls and sends inhibitory signals down to the emotional brain. A loss of communication between the amygdala and the prefrontal lobe is one way that sleep loss could create psychiatric symptoms, Walker thinks. "In a number of psychiatric disorders, such as depression, it has been demonstrated that the frontal lobe's activity becomes disrupted. There's also preliminary evidence [of this] for ADHD and post-traumatic stress disorder."

In another strand of research, evidence is plentiful that sleep - and dreaming, REM sleep, in particular - helps the brain to process memories. Disrupt this mechanism, and you could end up with psychological problems such as PTSD.

In August 2008, Stickgold and colleagues reported that when people are presented with pictures of an emotional or neutral object or scene, their memory for these scenes decreases during the day. After a night's sleep, their memories improve (Psychological Science, vol 19, p 781). Cast your mind back, says Walker, and you will appreciate that almost all of your memories are emotional ones. He thinks this is because emotions act as a red flag for important things that we should be remembering. But, crucially, if you recall them now you don't re-experience the visceral response that you had at the time. This consolidation process occurs during REM sleep.

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They note that during REM, production of serotonin and noradrenalin shuts down in the brain. Noradrenalin is the neurochemical associated with stress, fear and the flight response; it translates to adrenalin in the body. Serotonin modulates anger and aggression. "You get this beautiful biological theatre during REM sleep, where the brain can go back over experiences it has learned in days past, but can do so in a situation where there are none of these hyping-up neurochemicals," Walker says.

In PTSD this process seems to fail, so that traumatic memories are recalled in all their emotional detail. There is evidence that people with PTSD have higher waking levels of noradrenalin and serotonin. This might mean that neurotransmitters cannot be damped down sufficiently during REM sleep for the emotional intensity of the memories to be adjusted.

Clearly there is still a lot of work to be done in untangling the ways in which sleep disruption might create psychiatric symptoms. Nevertheless, when it comes to exactly how and to what extent sleep disorders could be responsible for psychiatric problems, Walker says: "We're getting there. Five years ago, that question wasn't on the radar for anyone - scientists or lay people. The fact that we're aware of it now and asking those questions means it's inevitable we'll find out."