What is the impact of poor sleep on physical and mental health?
What is the evidence on the individual interventions to improve sleep?

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25th Sept 2017
What is the impact of poor sleep on physical and mental health? What is the evidence of individual interventions to improve sleep?

Question

This briefing summarises the evidence on the impact of poor sleep on physical and mental health, and individual interventions to improve sleep, between 2007-2017.

Key messages

- The prevalence of sleep curtailment and sleep disorders is increasing and appears to correlate with a range of poor health outcomes.

- Sleep predicts cardiovascular outcomes and there is a U shape relationship between sleep and cardiovascular risk.

- There is a strong association between mental health and sleep. Sleep continuity disorders are observed in nearly all mental health conditions.

- Laboratory and epidemiological studies show that insufficient sleep and circadian misalignment have a negative impact on glucose regulation which can cause insulin resistance and diabetes.

- Sleep duration and quality are associated with an increased risk of mortality, particularly amongst the older population.

- Epidemiological studies make the link between short sleep duration and increased body mass index (BMI).

- Sleep duration and quality are associated with an increased risk of mortality.

- The mounting evidence of the health impacts warrants efforts to improve sleep amongst the general population.

- The methodological heterogeneity of studies means that it is difficult to determine the effectiveness of interventions to improve sleep.

Evidence briefings are a summary of the best available evidence that has been selected from research using a systematic and transparent method.

What doesn’t this briefing do?
The findings from research papers summarised here have not been quality assessed or critically appraised.

Who is this briefing for?
This briefing is for the Adults Team in the PHE Health Improvement Directorate, and will be used to inform policy and strategy.

Information about this evidence briefing
This briefing summarises systematic review and secondary level evidence of the effectiveness of interventions to improve sleep. It draws upon a literature search of the sources, EBSCO Discovery, Embase and Medline 2007 - 2017.

34 highly relevant citations were used to produce this evidence briefing. 44 additional papers were considered to be ‘of interest’ and details can be obtained on request.

You may request any publications referred to in this briefing from libraries@phe.gov.uk.

Disclaimer
The information in this report summarises evidence from a literature search - it may not be representative of the whole body of evidence available. Although every effort is made to ensure that the information presented is accurate, articles and internet resources may contain errors or out of date information. No critical appraisal or quality assessment of individual articles has been performed. No responsibility can be accepted for any action taken on the basis of this information.
What is the impact of poor sleep on physical and mental health? What is the evidence of individual interventions to improve sleep?

**Background**

The prevalence of sleep curtailment and sleep disorders is increasing and appears to correlate with the increased prevalence of a range of poor health outcomes (1). This has led to the hypothesis that sleep is a significant contributor to a range of physical and mental conditions. Sleep deprivation and poor quality sleep is associated with an increased risk of cancer, cardiovascular disease, diabetes, obesity, immunological disorders, poor mental health and mortality.

Whilst there is ample of evidence of the impacts of inadequate and poor quality sleep on health, the complexity of the research (due to the need to consider cofounding factors) and the methodological heterogeneity of studies, means that establishing a definite causal link between the sleep deprivation and specific health outcomes remains a challenge. In spite of this mounting research on the health impacts clearly warrants efforts to improve sleep amongst the general population.

There is literature on the range of interventions to promote sleep but as with the evidence on the impact of sleep on health, the diversity of study methodologies means that it is difficult to establish their effectiveness. Further research is required on all interventions.

**Health impacts**

According to the research sleep deprivation and poor quality sleep has an adverse impact on a range of health outcomes.

**Cancer**

One meta-analysis of prospective studies found that long, rather than short sleep duration increases the risk for total cancer mortality (2). Epidemiological studies show that exposure to artificial light at night suppresses the production of melatonin a protective, oncostatic hormone (3). The hypothesis is that increased exposure to bright light at night and the suppression of melatonin is contributing to increasing rates of breast, prostate and colorectal cancers in the developed world (4, 5). Proving that the hypothesis is true however, is inherently complex and more research is required before a causal link can be established.

**Cardiovascular disease**

There is growing evidence to show that sleep predicts cardiovascular outcomes (6-8). For most conditions where sleep is suspected of being a contributory factor in increased risk, it is insufficient sleep and poor quality sleep that is the focus of attention, but for cardiovascular disease the research shows that both short and long duration of sleep are markers for increased risk. One systematic review and meta-analysis found a U shaped relationship between sleep duration and cardiovascular risk. The study found that sleeping >9 hours may indicate sub-clinical and undiagnosed co-morbidity whilst sleeping <5 hours increases the risk of
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cardiovascular morbidity and mortality (6). However, another study suggests that prolonged sleep duration of >9 hours may be an independent predictor of mortality (9).

**Diabetes**
The research evidence suggests that the amount of sleep as well as the quality of sleep influences the metabolic function of type 2 diabetes (1). The results of laboratory and epidemiological studies show that insufficient sleep and circadian misalignment have a negative impact on glucose regulation which can cause insulin resistance and diabetes (10). As with cardiovascular disease there is a U shaped relationship, between sleep duration and the risk of type 2 diabetes, with long as well as short sleep duration increasing risk (11).

**Immunological disorders**
Sleep deprivation is known to have an adverse impact on the body’s immune system. There is evidence to show that poor sleep impairs adaptive immunity and this impairment is associated with reduced effectiveness of vaccines and increased susceptibility to infectious diseases. Researchers have measured the extent to which poor quality sleep affects vaccine efficacy (12).

**Mental health**
There is a strong association between mental health and sleep. Sleep continuity disorders are observed in nearly all mental health conditions with the exception of Attention Deficit Hyperactive Disorder (ADHD) and Seasonal Affective Disorder (SAD) (13). Insomnia, the most common sleep continuity disorder is known to increase the of the risk of some mental health conditions, in particular depression. Non depressed people with insomnia have a twofold risk of developing depression compared with those not suffering from insomnia (14). Conversely, insomnia is highly prevalent amongst those suffering from depression.

**Mortality**
Sleep duration and quality are associated with an increased risk of mortality, particularly amongst the older population (9, 15). According to one systematic review and meta-analysis there is a statistically significant association between sleep duration and all-cause mortality(9). Pooled analyses of data from 29 cohort studies showed that sleep duration exceeding 8 hours, compared with an average sleep duration of 7-8 hours, was associated with an approximately 33% increased risk of all-cause mortality. Similar pooled analyses of data from 27 cohort studies showed that short sleep duration of less than 7 hours was associated with a 6% increase in all-cause mortality (9).
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**Obesity**
The relationship between sleep and overweight and obesity is well recognised. Many epidemiological studies make the link between short sleep duration and increased body mass index (BMI) (16). The possible pathways that link sleep and weight gain include, increased food intake, decreased energy expenditure, and changes to appetite-regulating hormones such as leptin and ghrelin (1, 7). These pathways appear to be largely determined by lifestyle and individual behaviours. Long working hours and shift work are associated with metabolic disturbance and increased food consumption whilst the use of multimedia, such as television, computers and mobile phones, can exacerbate sedentary behaviour and increase calorie intake (16, 17).

**Interventions**
The heterogeneity of studies means that it is difficult to determine the effectiveness of interventions to improve sleep.

**Aromatherapy**
There is some evidence to show that aromatherapy can improve and promote sleep amongst adult populations (18, 19). Essential oils such as lavender are inhaled to relieve stress and aid sleep. Aromatherapy is a safe, relatively cheap and readily available self-help intervention. Its effectiveness appears to be enhanced when used in conjunction with sleep hygiene (20).

**Cognitive behavioural therapy**
There is consensus amongst the literature that cognitive behavioural therapy (CBT) is an effective intervention for the treatment of sleep disorders such as insomnia (21, 22). Poor sleep is comorbid with a range of mental health conditions and the use of CBT to improve sleep can in turn improve symptoms of poor mental health, such as depression (23, 24). CBT can be delivered face-to-face or via the internet and there is evidence to show that both methods of delivery are effective (25). Despite its effectiveness CBT is currently underutilised as an intervention to improve sleep, leading to the conclusion that there needs to be greater awareness and availability of CBT to reduce the prevalence of sleep disorders (25). Of all the interventions, the evidence on the effectiveness of cognitive behavioural therapy is the strongest. Whether CBT is considered an individual intervention is debateable - it may depend on the method of delivery.

**Dietary adjustments**
There is a paucity of evidence on diet and nutritional adjustments as an intervention to improve sleep. What there is focusses on changing diet to reduce the obstructive sleep apnoea severity, and on improving the diets of shift workers to promote their health (26, 27). The heterogeneity of studies means that establishing the effectiveness of dietary interventions is problematic (28). There is little evidence on
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the use of dietary adjustments at an individual level to improve sleep in the adult population.

**Exercise**

Research shows that exercise can reduce the severity of obstructive sleep apnoea (OSA) and improve clinical outcomes for sufferers (29, 30). For those with OSA regular exercise programs have shown a reduction in daytime sleepiness and an increase in sleep efficiency due to cardiorespiratory fitness, regardless of weight loss (31, 32). A systematic review of previous meta-analyses on exercise and sleep concludes that exercise appears to improve sleep outcomes in adults and whilst further research is needed, current and broad guidelines for exercise are recommended (33).

**Sleep hygiene**

Sleep hygiene is a series of habits or behaviours used to promote sleep. According to a review of empirical evidence whilst there is some evidence to suggest that individual sleep hygiene components can promote sleep, the current evidence of effectiveness is weak because there are few direct evaluations of the effects of following sleep hygiene recommendations, and because the recommendations are generally vague and inconsistent (34). The review found that the existing evidence consists largely of laboratory studies and there are insufficient studies that consider sleep hygiene behaviours in a naturalistic context. The review calls for more studies on sleep hygiene recommendations that take account of natural behaviours and habituation, and more research aimed at substantiating and improving the efficacy of specific sleep hygiene recommendations (34).

In spite of the need for more research, the available evidence is clear that sleep has a significant impact on health and that more needs to be done to improve sleep at both population and individual levels.
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Endnote database matrix showing the highly relevant papers with key information

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References

20. Lillehei AS. Effect of Lavender Aromatherapy via Inhalation and Sleep Hygiene on Sleep in College Students with Self-reported Sleep Issues: University of Minnesota; 2014.
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