# Optimising sleep – simple questions and goals

**Sleep quantity, quality and timing are significantly associated with the development of type 2 diabetes and have an impact on glycaemic control and cardiovascular disease risk in those with established diabetes, according to this narrative review in *Diabetes Care*. The authors are concerned that, although clinicians commonly explore physical activity and diet with people at risk of or with type 2 diabetes, they are less likely to ask about sleep. They outline normal sleep structure, share four simple questions to elicit sleep status and summarise the data supporting the role of sleep within the "5S" framework of 24-hour movement (Sleeping, Sitting, Stepping, Sweating and Strengthening) included in the ADA/EASD consensus report on the management of hyperglycaemia in type 2 diabetes. They also share the evolving evidence base supporting the association between sleep and type 2 diabetes, describe how to assess sleep and manage sleep disorders, and advise on helping people set simple goals. It is hoped this will translate into more clinicians spending time discussing sleep in future.**

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Clinicians rarely discuss sleep when exploring risk of type 2 diabetes or management of those with the condition, even though this has been included in the ADA/EASD consensus report on management of hyperglycaemia in type 2 diabetes since 2022 (Davies et al, 2022). Reasons given for reluctance to discuss sleep include lack of confidence and knowledge about which questions to ask and how to assess sleep, and lack of understanding of the significant impact on glycaemia. Lack of time in busy clinics is also likely to impact willingness to ask about sleep, and indeed other aspects of lifestyle. In this narrative review published in *Diabetes Care*, Joseph Henson and colleagues from the University of Leicester aimed to provide information which may increase sleep discussions in relation to type 2 diabetes.

Sleep has a specific architectural structure, which includes cycles of:

- Stage N1 (NREM): Falling asleep – a few minutes' duration, followed by 4–5 cycles of:
- Stage 2 (NREM): Light sleep, lasting 10–25 minutes per cycle. Heart rate and breathing slow down and body temperature drops.
- Stage 3 (NREM): Slow-wave sleep, lasting 20–40 minutes per cycle. This is the deepest sleep state and allows repair, growth and cell regeneration. Get shorter as night continues.
- REM: Dreaming stage – rapid eye movements, increased brain activity and temporary muscle paralysis. This stage is important for cognitive function. The initial phase lasts a few minutes, and it can then build up to 60 minutes as the night progresses and should account for 25% of total sleep time.

It is important to identify and manage sleep disorders such as obstructive sleep apnoea, restless leg syndrome and other sleep disrupters such as depression, pain or urinary problems that cause waking or difficulty getting to sleep.

## Sleep quantity

The review describes a U-shaped association between quantity of sleep and risk of **new-onset** type 2 diabetes, with most guidance identifying at least 7 hours per night as optimal. Sleeping less than 6 hours or more than 9 hours are both associated with up to a 50% increased risk of type 2 diabetes, including progression from non-diabetic hyperglycaemia to type 2 diabetes (Mostafa et al, 2022). Each hour over or under 7 hours is associated with a 9–14% increased risk of type 2 diabetes. However, the evidence for long sleep being associated with higher cardiometabolic risk, including diabetes, is less certain. Studies in short sleepers have demonstrated decreased insulin resistance and reduced energy intake when sleep is extended.

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In those with type 2 diabetes, sleep quantity has a U-shaped association with $HbA_{1c}$ and fasting glucose, with evidence that more than 8 hours per night and less than 6 hours per night have an adverse impact, and short sleep is also associated with increased risk of cardiovascular disease and mortality. A UK Biobank study demonstrated that 5 hours or less per night is associated with a 40–70% increased risk of ischaemic stroke and cardiovascular mortality compared to 7 hours per night (Han et al, 2023). Four hours' sleep or less is associated with a 41% increased risk of all-cause mortality and 54% increased risk cardiovascular mortality compared with 7 hours per night (Li et al, 2022).

## Sleep quality

Defined as "an individual's self-satisfaction with all aspects of the sleep experience", sleep quality is based on sleep efficiency (time asleep as a percentage of time in bed intending to sleep), sleep latency (time taken to fall asleep), sleep duration and wakefulness after sleep onset. Sleep quality can be assessed formally using the Pittsburgh Sleep Quality Index, which explores multiple aspects of sleep quality; however, the review recommends starting with a simple question: "Are you a good sleeper?". The highest risk of developing type 2 diabetes occurs in those with poor sleep quality (von Schantz et al, 2021). This is supported by meta-analyses, with a 40–84% increased risk of developing type 2 diabetes associated with poor sleep quality.

In those with existing diabetes, sleep quality is significantly associated with $HbA_{1c}$, but there is less evidence on the associations between poor sleep quality and risk of cardiovascular disease. A single cohort study in people with new type 2 diabetes (<6 months) demonstrated a 24% increased risk of all cardiovascular disease and development of coronary heart disease compared to those with good-quality sleep. All-cause mortality was also increased in those with diabetes and poor-quality sleep in a Biobank study, which showed a hazard ratio of 1.87 compared to those who had neither or only one of these conditions (von Schantz et al, 2021).

## Timing and chronotype

Circadian rhythm in humans depends on the master clock in the suprachiasmatic nucleus and additional clocks in the peripheral tissues. Sleep timing is dependent on sleep debt, our body clock and neurohormonal pathways including melatonin levels. Small amounts of day-to-day variability are built into our systems, but larger amounts will result in "social jetlag". If we consider the midpoint of our sleep on different nights, a significant difference, as will occur with shift work, is likely to trigger social jetlag. "Night owls" have a 2.5-fold increased risk of developing type 2 diabetes compared with "larks", independent of the quantity and quality of sleep. A recent cohort study of middle-aged nurses demonstrated a 19% increased diabetes risk in those who were self-declared night owls compared with larks (Kiamersi et al, 2023). Those who have experienced shift work are 10% more likely to develop type 2 diabetes, whilst those with diabetes working night shifts generally have higher $HbA_{1c}$ than those working day shifts alone. There is also an interaction between night shifts and chronotype, with larks' diabetes risk impacted more by night working.

Amongst those with type 2 diabetes, social jetlag was associated with slightly higher $HbA_{1c}$, and a significant relationship was seen between later chronotypes and $HbA_{1c}$, but only for social jetlag of >90 minutes. Increased cardiovascular risk, including mortality, was also associated with disrupted circadian rhythm and sleep rest cycles, including in those with type 2 diabetes. A UK Biobank study including people with type 2 diabetes demonstrated higher all-cause mortality in those who were definite night owls versus larks (Knutson and von Schantz, 2018).

## Mechanisms

The review explores potential mechanisms behind these risks, including the impact of short sleep on cortisol (higher in evenings and slower decline) resulting in lowered response of beta-cells to glucose and lower insulin sensitivity. Short sleep can increase levels of pro-inflammatory cytokines and increase hunger and appetite, driven by the lowering of leptin and raising of ghrelin. Polymorphisms of some

of the clock genes are also known to increase type 2 diabetes risk.

## Implications for practice

Asking four simple questions can identify whether sleep is likely to be impacting a person's risk of type 2 diabetes, or glycaemia in those who already have the condition:

- "How many hours of sleep did you get last night?"
- "Are you a good sleeper?"
- "Do you have regular sleep timing across work days and non-work days?"
- "Would you say you are an early bird, who prefers mornings, a night owl who prefers evenings or neither?"

More in-depth information may be gathered using questionnaires; wearable devices including headbands, rings, watches and apps; and polysomnography.

The Epworth Sleepiness Scale and the STOP-BANG questionnaire can be self-administered and may highlight daytime sleepiness and increased risk of obstructive sleep apnoea, respectively. Either of these should prompt referral for confirmation of the diagnosis and consideration for continuous positive airway pressure (CPAP) or other management, including weight loss. Restless leg syndrome may have a significant detrimental impact on sleep, and ropinirole can be discussed. Cognitive behaviour therapy (CBT) and CBT for Insomnia (CBTi) are recommended as first-line therapy for insomnia.

Simple education about the importance of sleep, sleep hygiene and pragmatic goals (7 hours' sleep per night, 85% time in bed asleep, keeping the midpoint of sleep within a 90-minute window every night when possible) and fast-tracking those with a sleep disorder to receive appropriate assessment could change practice.

## Conclusions

As with other aspects of lifestyle, clinicians often perceive they lack knowledge and time to explore sleep. It is hoped that improved understanding of the associations between sleep, risk of developing type 2 diabetes, glycaemic control and cardiovascular risk, combined with simple goals to share for management, will empower clinicians to discuss sleep more often. It should also make us look at our own sleep and the likely future impact of this. ■

### Resources

- At a glance factsheet: Sleep and type 2 diabetes – *Diabetes & Primary Care*
- STOP-BANG questionnaire for assessing obstructive sleep apnoea risk – *GPnotebook*
- Epworth sleepiness scale – *GPnotebook*

Davies MJ, Aroda VR, Collins BS et al (2022) Management of hyperglycaemia in type 2 diabetes, 2022. A consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetologia* **65**: 1925–66

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