Sleep

Christiana Kartsonaki

Nuffield Department of Population Health, University of Oxford

LSHTM

March 28, 2017
Sleep is encountered everywhere.
Sleep is encountered everywhere.
Sleep is encountered everywhere.
Sleep is encountered everywhere.

All animals sleep, sleep very tightly biologically controlled (Campbell and Tobler, 1984).

Why have we evolved to sleep?
What can go wrong?

- Mice that are completely sleep deprived die.

- Humans that are completely sleep deprived also die – fatal familiar insomnia.

- Circadian rhythm disorders: advanced sleep phase disorder (high penetrance genetic variants known), delayed sleep phase disorder, non-24-hour disorder.

- Other sleep disorders: insomnia, hypersomnias, parasomnias (including REM behaviour disorder), sleep apnea, narcolepsy.
What can go wrong?

- Mice that are completely sleep deprived die.

- Humans that are completely sleep deprived also die – fatal familiar insomnia.

- Circadian rhythm disorders: advanced sleep phase disorder (high penetrance genetic variants known), delayed sleep phase disorder, non-24-hour disorder.

- Other sleep disorders: insomnia, hypersomnias, parasomnias (including REM behaviour disorder), sleep apnea, narcolepsy.
What can go wrong?

- Mice that are completely sleep deprived die.

- Humans that are completely sleep deprived also die – fatal familiar insomnia.

- Circadian rhythm disorders: advanced sleep phase disorder (high penetrance genetic variants known), delayed sleep phase disorder, non-24-hour disorder.

- Other sleep disorders: insomnia, hypersomnias, parasomnias (including REM behaviour disorder), sleep apnea, narcolepsy.
What can go wrong?

- Mice that are completely sleep deprived die.

- Humans that are completely sleep deprived also die – fatal familiar insomnia.

- Circadian rhythm disorders: advanced sleep phase disorder (high penetrance genetic variants known), delayed sleep phase disorder, non-24-hour disorder.

- Other sleep disorders: insomnia, hypersomnias, parasomnias (including REM behaviour disorder), sleep apnea, narcolepsy.
What can go wrong?

- Poor sleep causes disease, unhealthy people develop sleep problems.

- Insufficient sleep is associated with increased risks of depression, anxiety, suicide, accidents, cardiovascular disease, diabetes, obesity, hypertension, ... 

- Less serious & more well known effects: poor performance at work, low mood, impaired reaction time and judgement.

- Consuming caffeine does not help with most of these – it just masks the effects of sleep deprivation.

- Our sleep changes over time, but only for the worse.
What can go wrong?

- Poor sleep causes disease, unhealthy people develop sleep problems.

- Insufficient sleep is associated with increased risks of depression, anxiety, suicide, accidents, cardiovascular disease, diabetes, obesity, hypertension, ...

- Less serious & more well known effects: poor performance at work, low mood, impaired reaction time and judgement.

- Consuming caffeine does not help with most of these – it just masks the effects of sleep deprivation.

- Our sleep changes over time, but only for the worse.
What can go wrong?

- Poor sleep causes disease, unhealthy people develop sleep problems.

- Insufficient sleep is associated with increased risks of depression, anxiety, suicide, accidents, cardiovascular disease, diabetes, obesity, hypertension, ...

- Less serious & more well known effects: poor performance at work, low mood, impaired reaction time and judgement.

  - Consuming caffeine does not help with most of these – it just masks the effects of sleep deprivation.

- Our sleep changes over time, but only for the worse.
What can go wrong?

- Poor sleep causes disease, unhealthy people develop sleep problems.

- Insufficient sleep is associated with increased risks of depression, anxiety, suicide, accidents, cardiovascular disease, diabetes, obesity, hypertension, ...

- Less serious & more well known effects: poor performance at work, low mood, impaired reaction time and judgement.

- Consuming caffeine does not help with most of these – it just masks the effects of sleep deprivation.

- Our sleep changes over time, but only for the worse.
What can go wrong?

- Poor sleep causes disease, unhealthy people develop sleep problems.

- Insufficient sleep is associated with increased risks of depression, anxiety, suicide, accidents, cardiovascular disease, diabetes, obesity, hypertension, ...

- Less serious & more well known effects: poor performance at work, low mood, impaired reaction time and judgement.

- Consuming caffeine does not help with most of these – it just masks the effects of sleep deprivation.

- Our sleep changes over time, but only for the worse.
Clever sleep calculator tells you EXACTLY what time you should be in bed based on when you start work (and it isn't as early as you think)

- Calculator picks best time to drop off linked to body's 90-minute sleep 'cycles'
- If you start work at 9am, ideally you should try and go to bed around 10:46pm
- Tool is designed to ensure you don't wake mid-way through a cycle, which can leave you feeling groggy - even if you've had eight hours' sleep

By JO TWEEDY FOR MAILONLINE
PUBLISHED: 09:33, 22 March 2017 | UPDATED: 08:58, 22 March 2017
To wake up at 7am...
Humans who are sleep deprived in experiments show a decrease in glucose clearance rate in the range of pre-diabetes (Spiegel et al., 1999).

There is evidence that relatively short sleep and disordered sleep may be associated with an increased risk of diabetes (Cappuccio et al., 2010).

In China the incidence of diabetes has increased significantly in recent decades.

Little is known about the relevance of sleep for diabetes risk in China.
China Kadoorie Biobank

Prospective cohort study in China

open-ended

baseline survey done in 2004–2008
China Kadoorie Biobank

Design

- 0.5 million adults, aged 30–79 years, from 10 areas.
- Baseline survey: questionnaire, physical measurements and collection of blood sample.
- Resurveys of a sample of participants.
- Morbidity and mortality follow up for decades through registries and health record systems.

Consent for long-term storage of blood samples and follow-up through all health records.
China Kadoorie Biobank

Data

- mean age at baseline: 52
- 41% male
- 60% rural

- **baseline**: a range of physical measurements (e.g. height, weight, adiposity, blood pressure, lung function) together with a 10mL non-fasting blood sample (with last meal time recorded) were collected

- two **resurveys** in 2008 and 2013–14 → a representative 5% sample of survivors
  - repeat interview
  - physical measurements (e.g. 12-lead ECG, carotid IMT, bone density)
  - collection of biological samples

- samples stored at facilities in Beijing and Oxford
mean age at baseline: 52

41% male

60% rural

**baseline**: a range of physical measurements (e.g. height, weight, adiposity, blood pressure, lung function) together with a 10mL non-fasting blood sample (with last meal time recorded) were collected

**two resurveys** in 2008 and 2013–14 → a representative 5% sample of survivors

- repeat interview
- physical measurements (e.g. 12-lead ECG, carotid IMT, bone density)
- collection of biological samples

samples stored at facilities in Beijing and Oxford
Laptop-based questionnaire

- socioeconomic status
- tobacco
- alcohol
- food
- tea
- indoor air pollution
- physical activity
- reproductive history for women
- medical history
- mental health
China Kadoorie Biobank
Data sources for disease outcomes

- Death registries
- National health insurance databases
- Disease registries
- Self-reported

Event adjudication For vascular disease, cancer and other major diseases, event information is checked from medical notes and/or re-assessed by a doctor.
China Kadoorie Biobank
Data sources for disease outcomes

- Death registries
- National health insurance databases
- Disease registries
- Self-reported

**Event adjudication** For vascular disease, cancer and other major diseases, event information is checked from medical notes and/or re-assessed by a doctor.
Assessment of sleep characteristics

During the past month, did you have any of the following for ≥ 3 days each week?

- Taking >30 minutes to fall asleep after going to bed or waking up in the middle of the night.
- Waking up early and not being able to go back to sleep.
- Needing to take medication (including herbal or sleeping pills) at least once a week to help sleep.
- Having difficulty staying alert while at work, eating or meeting people during daytime.

Individuals who answered 'yes' to any of the above were considered to have disordered sleep.
Assessment of sleep characteristics

During the past month, did you have any of the following for ≥ 3 days each week?

- Taking >30 minutes to fall asleep after going to bed or waking up in the middle of the night.
- Waking up early and not being able to go back to sleep.
- Needing to take medication (including herbal or sleeping pills) at least once a week to help sleep.
- Having difficulty staying alert while at work, eating or meeting people during daytime.

Individuals who answered ‘yes’ to any of the above were considered to have disordered sleep.
Assessment of sleep characteristics

- Do you usually take a daytime nap? [Yes, usually; Yes, but only in summer; No]
- Do you snore during sleep? [Yes, frequently; Yes, sometimes; No/Don’t know]
- How many hours do you typically sleep per day (including naps)? (in whole hours)

Participants were classified as taking daytime naps if they selected ‘Yes, usually’ and they were classified as snoring if they selected ‘Yes, frequently’ or ‘Yes, sometimes’.
Assessment of sleep characteristics

- Do you usually take a daytime nap? [Yes, usually; Yes, but only in summer; No]

- Do you snore during sleep? [Yes, frequently; Yes, sometimes; No/Don’t know]

- How many hours do you typically sleep per day (including naps)? (in whole hours)

Participants were classified as taking daytime naps if they selected ‘Yes, usually’ and they were classified as snoring if they selected ‘Yes, frequently’ or ‘Yes, sometimes’.
Assessment of prevalent diabetes

- Immediate on-site testing of random plasma glucose (RPG) level.

- Participants with glucose levels $\geq 7.8$ mmol/L and $<11.1$ mmol/L were invited to return for a fasting plasma glucose (FPG) test the next day.

- Previously diagnosed diabetes was defined by the answer to the question 'Has a doctor ever told you that you had diabetes?'.

- Among participants without previously diagnosed diabetes, screen-detected diabetes was defined as RPG $\geq 7.0$ mmol/L and time since last eating $\geq 8$ h, or $\geq 11.1$ mmol/L with time since last eating $<8$ h, or a FPG $\geq 7.0$ mmol/L on subsequent testing.
Sleep duration decreased and prevalence of sleep disorder increased with age.

Poor health and especially poor mental health status were associated with shorter sleep and higher prevalence of sleep disorder.

Short sleep was associated with an increased risk of developing diabetes.

Difficulty falling asleep, waking too early, needing medication to fall asleep, difficulty staying alert during daytime, daytime napping and snoring were associated with an increased risk of developing diabetes.

Relative risks not very large, but given how common diabetes is they correspond to substantial absolute risks.

Sleep duration subjective. Self-reported sleep duration may be affected by perceived sleep quality and other factors. Accelerometers.
Acknowledgements

Dr Yiping Chen

China Kadoorie Biobank Collaborative Group

*International Steering Committee:* Junshi Chen, Zhengming Chen (principal investigator), Rory Collins, Liming Li (principal investigator), Richard Peto.


*National Co-ordinating Centre, Beijing:* Zheng Bian, Ge Chen, Yu Guo, Bingyang Han, Can Hou, Jun Lv, Pei Pei, Shuzhen Qu, Yunlong Tan, Canqing Yu, Huiyan Zhou.

*10 Regional Co-ordinating Centres*

The study is funded by the Kadoorie Charitable Foundation in Hong Kong and Wellcome Trust in UK. Further support is also provided by the Chinese Ministry of Science and Technology and Natural Science Foundation, and the UK MRC, BHF and CR-UK.
References


http://www.ckbiobank.org/