Adolescent Sleep Timing And Its Effects On Memory Processes And Academic Performance

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Background

- Over **50% of teenagers** sleep for less than the 8–10-hour recommendation.
- Poor **sleep quality** and increased **sleepiness** are also common.
- A multitude of biological and behavioural factors at play here:

Academic

Extracurricular

Physical Arousal

Caffeine Use

Entertainment

Emotional Arousal

Blue light

Sugar Consumption

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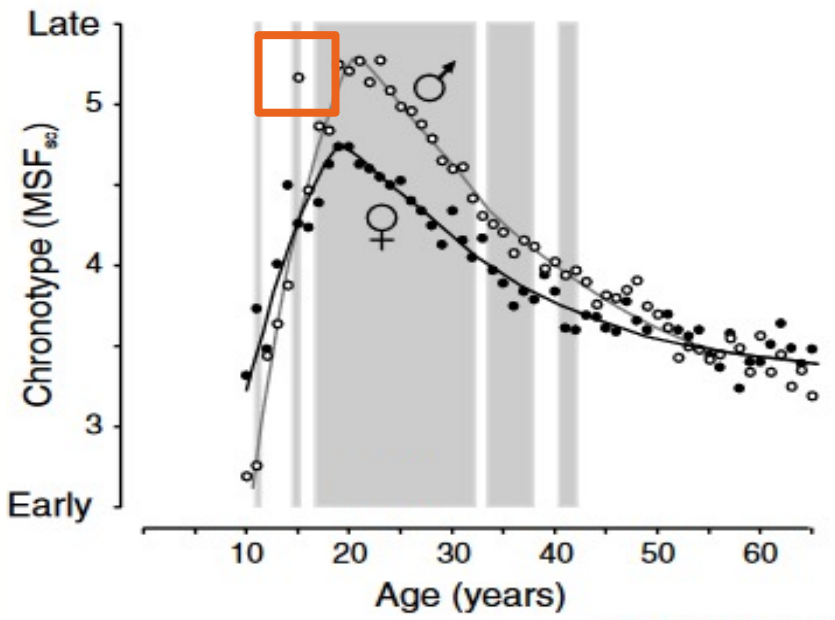

Background

- Sleep plays an important role in **memory formation.**
- What are the implications of changes to sleep across adolescence for memory?
- Sleep **before** learning benefits **encoding** AND sleep **after** learning benefits **consolidation**.

Aims

Aim 1

How are sleep changes in adolescence associated with encoding and consolidating new information?

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Aim 2

How are sleep changes in adolescence associated with educational outcomes, and how do detriments in encoding and consolidation mediate this relationship?

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How are sleep changes in adolescence associated with encoding and consolidating new information?

Learn more about the app in this afternoon's WORKSHOP

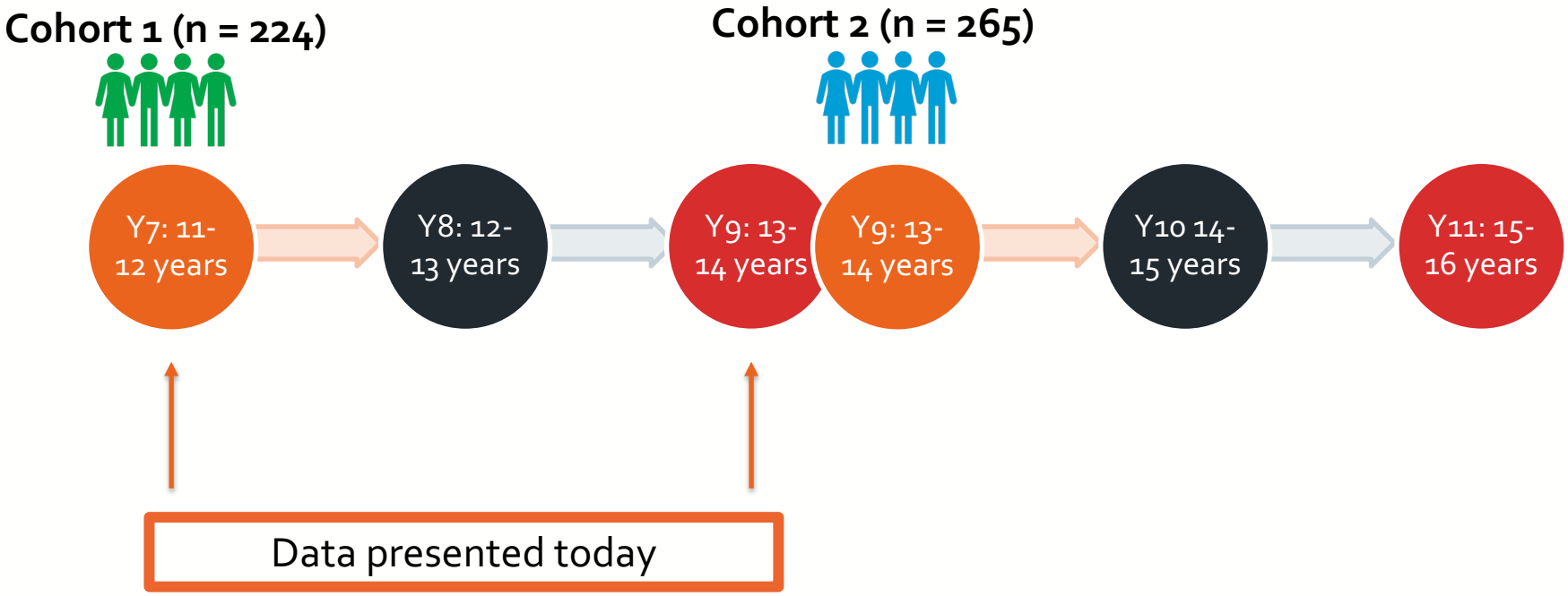
Aim 2

How are sleep changes in adolescence associated with educational outcomes, and how do detriments in encoding and consolidation mediate this relationship?

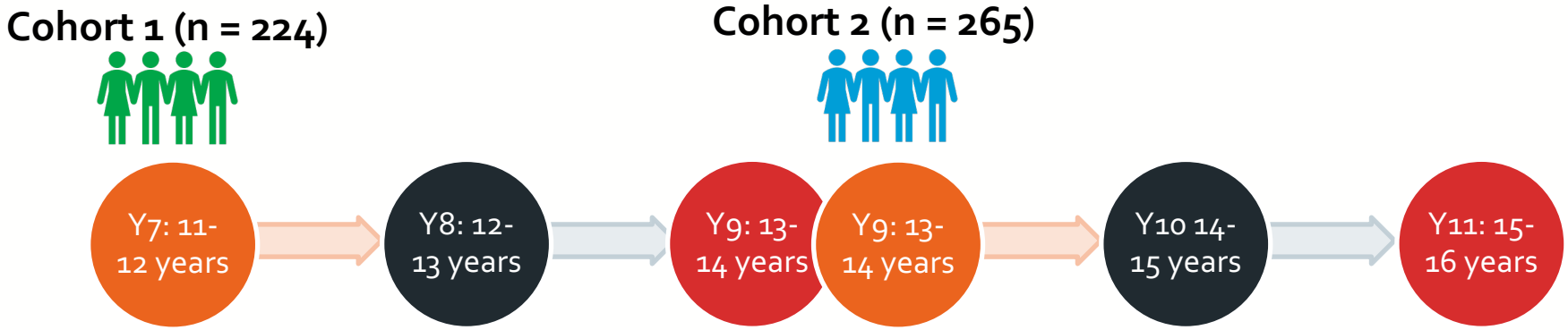
Aim 3

How does an app-based intervention to improve sleep hygiene impact encoding and consolidation ability?

Aims 1 and 2


Cohort 1 (n = 224)
Cohort 2 (n = 265)
Y7: 11-12 years
Y8: 12-13 years
Y9: 13-14 years
Y9: 13-14 years
Y10 14-15 years
Y11: 15-16 years
Data presented today

Aims 1 and 2



- Sleep diary
- Media diary
- Actiwatches

- Word learning task
- Immediate cued recall
- Sleep and media diary

- Delayed cued recall
- Sleep and media diary
- Sleepiness
- Sleep quality
- Sleep hygiene
- Chronotype
- Self-rated school performance
- Puberty

- **NGRT - reading**
- Attainment data
- **Teacher-rated performance**
- **Attendance**
- **Latenesses**
- Attitude to learning
- Homework completion
- GCSE grades

Changes in sleep Y7 vs. Y9

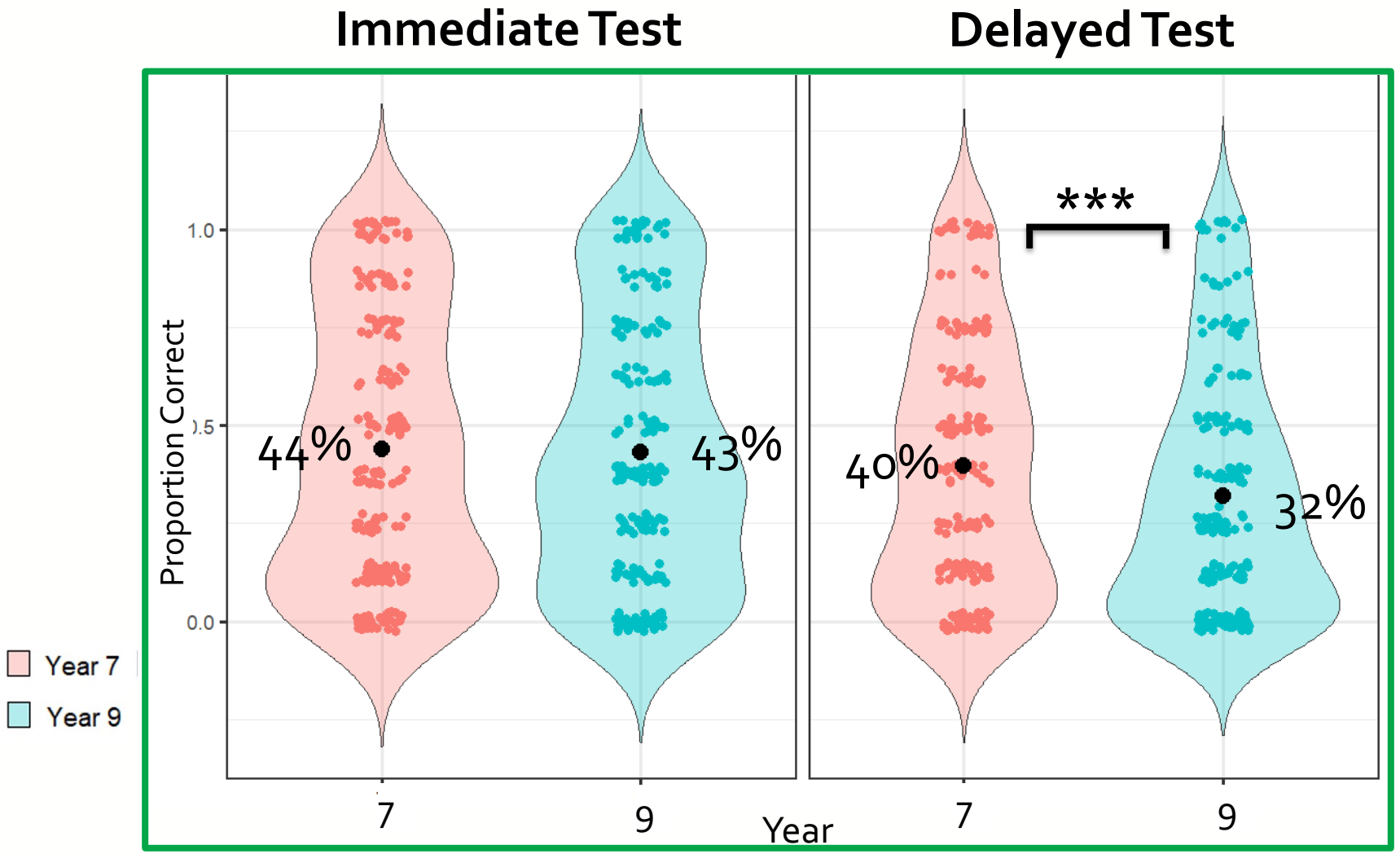
- **Chronotype:** Y9s show a greater preference for eveningness
- **Sleep diary:** Reflected in Y9s sleeping ~45 mins later (sleep onset 22:32 vs. later but all wake up ~06:45…
- …Causing Y9s to have a shorter sleep duration (8hrs 7min vs. 7hrs 17min)
- **Sleep hygiene:** Y9s have significantly worse sleep hygiene than Y7s

What is sleep hygiene?

Modifiable behaviours and environmental adjustments that can be used to improve sleep quality and duration. For example:

- alcohol/caffeine/smoking/exercise at bedtime
- daytime napping
- light/noise/temperature levels in bedroom
- sleep regularity and wind-down routine

Recall of word meanings



Is sleep associated with memory?

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- **Better sleep hygiene predicts better memory for words in both age groups**
- Which aspects of sleep hygiene show strongest associations?

Physiological factors

Sleep environment

Behavioural arousal

Sleep stability

Cognitive/Emotional factors

Daytime sleep

Bedtime routine

Substance use

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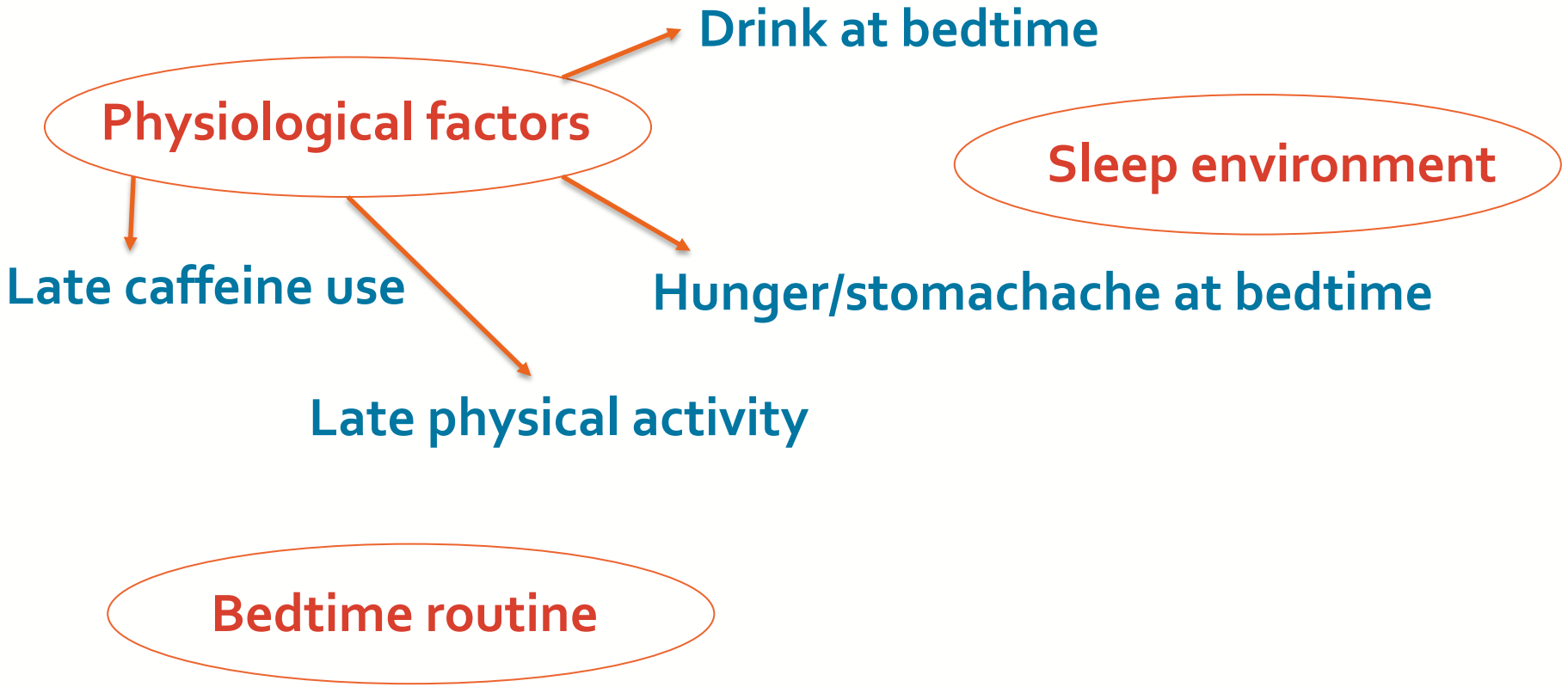

Is sleep associated with memory?

- **Better sleep hygiene predicts better memory for words in both age groups**
- Which aspects of sleep hygiene show strongest associations?

Physiological factors

Sleep environment

YES / NO

Bedtime routine

Is sleep associated with memory?

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Physiological factors

Sleep environment

Fall asleep while…

- **Listening to music**
- **Watching TV**
- **In a hot or brightly lit room**
- **In one place and move elsewhere later**

Bedtime routine

Do sleep behaviours predict educational outcomes?

Sleep Hygiene

- Better = better **reading ability and teacher ratings**

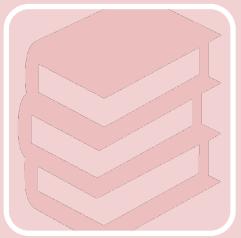
Chronotype

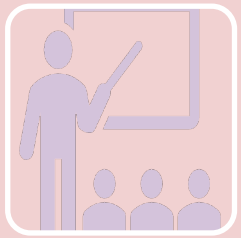
- Morningness = better self-reported **school engagement.**
- Eveningness = better **reading ability** (within-year maturation?)

Sleep Onset Latency (length of time to fall asleep)

- Shorter = better **teacher ratings** (proxy for quality/hygiene?).

Drivers of Sleep Hygiene Effect on Education





Reading Ability

- Better sleep environment (e.g., TV, bright lights).
- Better pre-sleep physiology (e.g., caffeine, active).
- Better bedtime routines.
- Worse pre-sleep emotion (e.g., worry, upset).

Teacher Ratings

- Better sleep environment.
- Better pre-sleep physiology.
- Worse pre-sleep emotion.

Summary

- Children's sleep patterns and behaviours change substantially from Year 7 to Year 9
  - Time-of-day preference shifts later, bedtime shifts later, sleep duration shortens, and sleep hygiene declines
- Sleep hygiene is associated with ability to encode new memories
  - Worse sleep hygiene associated with lower ability to create new memories in both age groups
- Sleep hygiene is associated with educational outcomes
  - Better sleep hygiene associated with better scores in the NGRT (reading) test and higher teacher ratings of school performance

Next steps

- Analysis of the full data set from Year 7 to Year 11
  - We expect the declines in sleep to continue in the older groups
  - Additional sleep effects may emerge in the older children, especially if they struggle more with sleep than younger groups
- Analysis of the teen sleep intervention app
  - Come to the workshop to learn more about current results!

Thank you!

Dr Becky Crowley

Prof Jessie Ricketts

Prof Gareth Gaskell

Prof Lisa Henderson

Help shape our future research!

Do teachers struggle with their sleep? What impact might this have on their teaching? How might we help teachers with their sleep?

Please share your thoughts in this short survey and let us know how our research could benefit you! Use QR code or link:
https://forms.office.com/e/HQhwR8ZaWb