Sleep, circadian rhythms, and cognitive function

Rebecca M. C. Spencer, PhD
Associate Professor of Psychological & Brain Sciences
Disclosures

- **Current funding:**
  - University of Massachusetts
  - National Institutes of Health
    - National Heart, Lung & Blood Institute (NIH R01 HL111695)
    - National Institute on Aging (NIH R01 AG040133)

- **Other financial relationships:**
  - Past funding from: Avery Dennison, Jawbone

- **Conflicts of interest:**
  - National Institute on Aging and University of Massachusetts funds contributed directly to the work presented in this talk.
- Sleep impairments are prevalent in normal aging
Sleep impairments are prevalent in normal aging

Cognitive impairments (e.g., long-term memory, executive functions) are prevalent as well

Parallel trajectories with aging and evidence from young adults suggest that age-related changes in sleep and cognition may be related
Chronotype changes with age

Percent evening-type

Percent morning-type

Age (yrs)

10-17\textsuperscript{a} 19-31\textsuperscript{b} 30-49\textsuperscript{c} 59-79\textsuperscript{d}
Shift in chronotype affects performance

Performance is more equated when individuals are tested at their preferred time with respect to chronotype (see Schmidt et al., 2007).
Sleep also contributes to cognitive performance

Young adult

Older adult
Sleep benefits cognition in young adults

State-of-the-art knowledge
Sleep benefits cognition in young adults

![Graph showing accuracy comparison between wake and sleep stages.](image)
Sleep benefits cognition in young adults

- Correlations between slow wave sleep (SWS) and change in declarative memory over sleep
- Parahippocampal gyrus activity during SWS

![Image showing brain activity during SWS with correlation graph]
Declarative memories
Mood regulation and emotional processing
Procedural/skill memories
Sleep contributes to cognitive performance

**Do changes in sleep change the function of sleep on cognition?**

**State-of-the-art knowledge**

Young adult

- decay
- consolidate

Older adult

- ↑ decay
- ?

REM
SWS
N2
N1
Is sleep-dependent cognitive processing reduced with age?

...it depends

Consolidation of declarative memories largely preserved

Consolidation of procedural memories is reduced

Consolidation of positive memories is preserved

Consolidation of negative memories is absent
Knowledge gaps

- What are the implications of the deficit in procedural memory consolidation?
- Would an intervention to improve sleep (CBT, nap intervention) improve cognitive processing?
Thank you.

Cognition & Action Lab

rspencer@umass.edu
Is sleep-dependent cognitive processing reduced with age?

...it depends

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