Joint associations of physical activity and sleep duration with cognitive ageing: longitudinal analysis of an English cohort study

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Physical activity (PA) and sleep duration are thought to impact cognitive ageing and dementia risk through both independent and interacting mechanisms.\textsuperscript{1}

Sleep disturbances may also be caused by cognitive dysfunction

More time spent in moderate to vigorous PA might reduce the impact of suboptimal sleep duration (<6 or >8 hours per night) on cognitive function (or vice versa),\textsuperscript{1-5} but confirmation is needed from large-scale, longitudinal studies.

**Objective:** To examine the joint associations of self-reported PA and sleep duration with ten-year cognitive trajectories in a large-scale cognitively-healthy study population.
Data sources

Nationally representative cohort study of the English population aged ≥50 years
N=8958 cognitively healthy participants
Physical activity and sleep duration

**Physical activity**

- More than weekly
- Weekly
- 1-3 times monthly
- Rarely/never

**Summary PA score**

**Sleep duration**

- **Short sleep duration**
  Respondent reports less than 6 hours of sleep per night

- **Optimal sleep duration**
  Respondent reports 6-8 hours of sleep per night

- **Long sleep duration**
  Respondent reports more than 8 hours of sleep per night
Cognitive function

**Cognitive domain**
- Episodic memory
- Verbal fluency

**Neuropsychological test**
- Immediate recall task
- Delayed recall task
- Animal naming task

Assessed at each wave

Summary recall score

Composite cognitive score

Mean of standardised memory and fluency scores
Statistical methods

Linear mixed models (time-scale: years since baseline) used to construct 10-year cognitive trajectories from ages 50, 60, and 70 years for each PA/sleep group

Adjusted for age at baseline, sex, marital status, education, wealth, smoking status, alcohol consumption, BMI, chronic conditions, depressive symptoms

Models used to examine difference between reference PA/sleep group (high PA/optimal sleep) and other PA/sleep groups in:

1. Baseline cognitive performance
2. Rate of cognitive decline
3. Cognitive performance after 10 years of follow-up
## Results

<table>
<thead>
<tr>
<th></th>
<th>Low PA</th>
<th>High PA</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=5889</td>
<td>N=3069</td>
<td></td>
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<tr>
<td>Short sleep (&lt;6 hours)</td>
<td>943 (16.0%)</td>
<td>328 (0.7%)</td>
<td></td>
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<tr>
<td>Optimal sleep (6-8 hours)</td>
<td>3208 (54.5%)</td>
<td>1845 (60.1%)</td>
<td>&lt;0.0001</td>
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<tr>
<td>Long sleep (&gt;8 hours)</td>
<td>1738 (29.5%)</td>
<td>896 (29.2%)</td>
<td></td>
</tr>
</tbody>
</table>
Results

Ten-year cognitive trajectory from age 50 years

Ten-year cognitive trajectory from age 60 years

Ten-year cognitive trajectory from age 70 years
Results
Results
High PA groups outperform low PA groups regardless of sleep quality at baseline.
Results

Ten-year cognitive trajectory from age 50 years

Ten-year cognitive trajectory from age 60 years

Ten-year cognitive trajectory from age 70 years

-1.0

0.0

0.5

Standardised cognitive score (SD)

Physical activity

Sleep duration

High

Low

<6 hours

6-8 hours

>6 hours

Time since baseline (years)
Results

Short sleepers decline faster than optimal sleepers regardless of PA from baseline ages 50 and 60 but not 70
Results

Ten-year cognitive trajectory from age 50 years

Ten-year cognitive trajectory from age 60 years

Ten-year cognitive trajectory from age 70 years
Results
Results

From ages 50 and 60, though **high PA/short sleepers** performed similarly to **high PA/optimal sleepers** at baseline, after 10 years their scores were similar to **low PA/short sleepers**. **High PA** protective regardless of sleep duration for age 70.
More frequent, high intensity PA and 6-8 hours of sleep per night were both associated with better cognitive scores at baseline; short sleep also associated with faster cognitive decline.

Cognitive benefit afforded by PA was insufficient to blunt the more rapid cognitive decline associated with short (<6 hours) sleep for adults in middle- and early-old age.
Conclusion

Long-term cognitive benefits of PA may be reduced if not supported by sufficient sleep

WHO already identify PA as key target for maintenance of cognitive health but PA interventions should also consider sleep habits to maximise benefits for long-term cognitive health
Acknowledgements

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Prof Mark Hamer
Prof Andrew Steptoe

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See full paper in The Lancet Healthy Longevity 6 July 2023:

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Summary
Background Physical activity and sleep duration are key factors associated with cognitive function and dementia risk. How physical activity and sleep interact to influence cognitive ageing is not well explored. We aimed to examine the associations of combinations of physical activity and sleep duration with 10-year cognitive trajectories.

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