

Finnish Institute of  
Occupational Health

**16th EAOHP Conference Symposium: Between office and bed:  
Sleep research trends in occupational health psychology**

# **Stress, sleep, and productivity in hybrid knowledge workers**

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# Introduction

Office work has become more flexible

- Outside the office environment
- Outside usual office hours
- Flexible work increases autonomy of employees
  - Beneficial effects on mental health (Shiri et al. 2022, systematic review)
  - Can blur work-home boundary (Kotera & Correa Vione 2020, systematic review)
- Non-mandatory remote work can boost productivity (Hackney et al. 2022, systematic review)
  - Need for fewer breaks and sick days, less distractions...

# Introduction

## Stress

- Source of personal suffering
- Work stress is associated with an increased risk of depression (Madsen et al., 2017)
- Around 40% of sickness absence have links with work stress (Hoel et al., 2001)

## Sleep and recovery

- have a major impact on work performance and stress reduction, and
- work-related stress can have a significant impact on sleep.

*Psychological Medicine* (2017), 47, 1342–1356. © Cambridge University Press 2017  
doi:10.1017/S003329171600355X

REVIEW ARTICLE

## Job strain as a risk factor for clinical depression: systematic review and meta-analysis with additional individual participant data

I. E. H. Madsen<sup>1\*</sup>, S. T. Nyberg<sup>2</sup>, L. L. Magnusson Hanson<sup>3</sup>, J. E. Ferrie<sup>4,5</sup>, K. Ahola<sup>2</sup>, L. Alfredsson<sup>6,7</sup>, G. D. Batty<sup>4,8,9</sup>, J. B. Bjorner<sup>1</sup>, M. Borritz<sup>10</sup>, H. Burr<sup>11</sup>, J.-F. Chastang<sup>12,13</sup>, R. de Graaf<sup>14</sup>, N. Dragano<sup>15</sup>, M. Hamer<sup>4,16</sup>, M. Jokela<sup>17</sup>, A. Knutsson<sup>18</sup>, M. Koskenvuo<sup>19</sup>, A. Koskinen<sup>2</sup>, C. Leineweber<sup>3</sup>, I. Niedhammer<sup>12,13</sup>, M. L. Nielsen<sup>20</sup>, M. Nordin<sup>3,21</sup>, T. Oksanen<sup>2</sup>, J. H. Pejtersen<sup>22</sup>, J. Pentti<sup>2</sup>, I. Plaisier<sup>23</sup>, P. Salo<sup>2,24</sup>, A. Singh-Manoux<sup>4,25</sup>, S. Suominen<sup>26,27,28</sup>, M. ten Have<sup>14</sup>, T. Theorell<sup>3</sup>, S. Toppinen-Tanner<sup>2</sup>, J. Vahtera<sup>2,28,29</sup>, A. Väänänen<sup>2</sup>, P. J. M. Westerholm<sup>30</sup>, H. Westerlund<sup>3</sup>, E. I. Fransson<sup>3,6,31</sup>, K. Heikkilä<sup>2,32,33</sup>, M. Virtanen<sup>2</sup>, R. Rugulies<sup>1,34†</sup> and M. Kivimäki<sup>2,4,35†</sup> for the IPD-Work Consortium

Report Commissioned by the International Labour Organization

## The cost of violence/stress at work and the benefits of a violence/stress-free working environment

Type:	Report
Date issued:	01 January 2001
Authors:	Helge Hoel, Kate Sparks & Cary L. Cooper - University of Manchester, Institute of Science and Technology

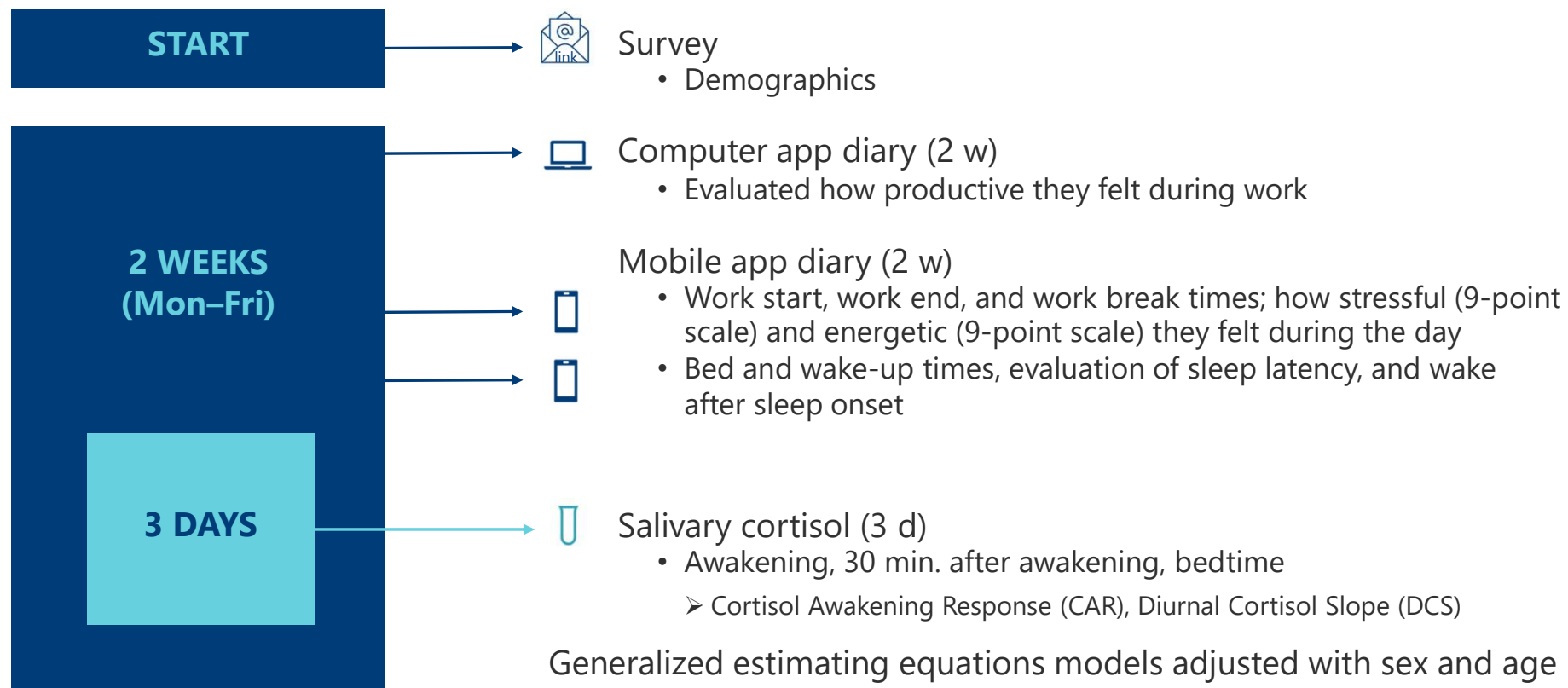
## Aims

To investigate the associations between perceived stress, energy, productivity, total sleep time (TST), and cortisol concentration

in location independent knowledge workers

1. Is perceived **stress** associated with cortisol secretion and sleep in location independent work?
2. Are perceived **energy** and **productivity** associated with cortisol secretion and sleep?

# Methods



## Characteristics of 38 location independent knowledge workers

	Mean	(SD)
Age (yr)	44.5	(9.9)
Weekly working hours (h)	38.4	(2.8)
	%	(n)
Sex (women)	82	(31)
Education (higher education)	82	(31)
Supervisory position (yes)	16	(6)
Children in household (yes)	47	(18)

Two-week field observation:

- 55% worked both from home and from office
- 42% worked only from home
- Number of observed days
  - Office=73
  - Home=258

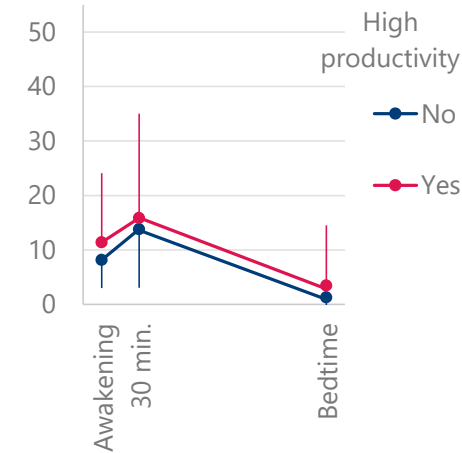
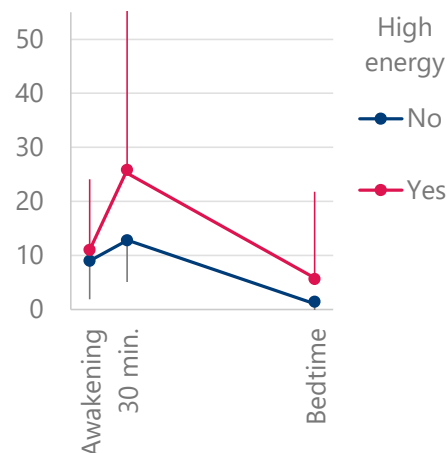
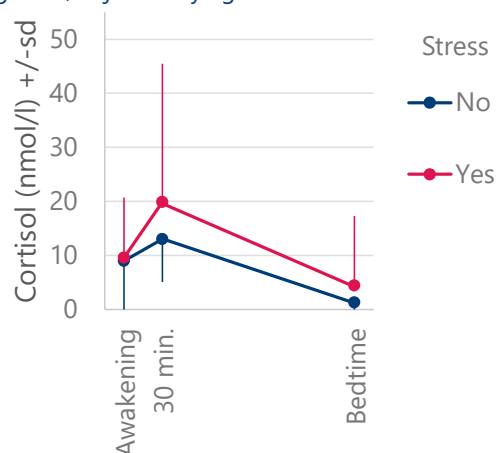


# Associations with stress, high energy and productivity

	Stressful day			High energy day			Productive during work		
	OR	95% CI		OR	95% CI		OR	95% CI	
Working time (h)	<b>1.62</b>	<b>1.45</b>	<b>1.82</b>	1.01	0.74	1.38			
Productive working day	<b>2.25</b>	<b>1.38</b>	<b>3.66</b>	<b>2.79</b>	<b>1.03</b>	<b>7.52</b>			
Stressful day				1.68	0.78	3.63			
Cortisol (nmol/l)									
CAR	<b>1.05</b>	<b>1.01</b>	<b>1.09</b>	<b>1.08</b>	<b>1.04</b>	<b>1.12</b>	<b>0.41</b>	<b>0.19</b>	<b>0.90</b>
Awakening	1.00	0.96	1.03	1.03	0.97	1.10	<b>7.61</b>	<b>1.46</b>	<b>39.75</b>
30 min after	<b>1.03</b>	<b>1.01</b>	<b>1.06</b>	<b>1.05</b>	<b>1.02</b>	<b>1.08</b>	1.28	0.22	7.57

GEE models, binominal type with logit link, adjusted by age and sex

- CAR was negatively
- cortisol at awakening was positively associated with increased odds for high perceived productivity



## Associations with bedtime cortisol and sleep

	DCS*			Bedtime cortisol <sup>^</sup>		
	$\beta$	95% CI		$\beta$	95% CI	
Working time (h)	0.00	-0.01	0.01	0.02	-0.04	0.08
Productive working day	0.01	-0.04	0.06	<b>0.23</b>	<b>0.08</b>	<b>0.39</b>
Energy level	-0.01	-0.02	0.01	<b>0.08</b>	<b>0.02</b>	<b>0.15</b>
Stressful day	<b>-0.05</b>	<b>-0.09</b>	<b>-0.01</b>	<b>0.22</b>	<b>0.05</b>	<b>0.39</b>

Linear GEE models, adjusted by age and sex; \*lg10rev-transformation; ^lg10-transformation

- Perceived stress was associated with slower decrease in cortisol
- Perceived productivity, energy, and stress were associated with higher bedtime cortisol



## Associations with sleep

	Total sleep time (h)		
	$\beta$	95% CI	
Working time (h)	-0.05	-0.12	0.03
Productivity (dik)	0.06	-0.21	0.34
Energy level	-0.04	-0.11	0.03
Stressful day	<b>-0.49</b>	<b>-0.81</b>	<b>-0.16</b>
Cortisol (nmol/l)			
CAR	-0.00	-0.01	0.01
Awakening	<b>0.02</b>	<b>0.01</b>	<b>0.03</b>
30 min after	0.00	-0.01	0.02
Bedtime	0.01	-0.00	0.03
DCS/h	-0.25	-0.57	0.09

Linear GEE models, adjusted by age and sex

- Participants slept  $7.3 \pm 1.1$  h (mean  $\pm$  sd)
- Perceived stress was associated with shorter TST
- Cortisol at awakening was associated with longer TST

## Limitations

- Small sample size
- Subjective evaluation of salivary sample times
- Only two sampling times of saliva after awakenings
- Generalizability to knowledge workers after the Covid-19 pandemic

## Conclusion

- Stress, energy and productivity were positively associated with bedtime cortisol
  - Only stress was negatively associated with TST
- CAR was associated with stress and energy
- Higher cortisol at awakening was associated with
  - longer sleep
  - high productivity during work
- Further studies are needed to verify the results in hybrid work

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**Thank you!**

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