# Occupational sitting time and autonomic regulation

**David Hallman**

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**Contact: david.hallman@hig.se**

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# Background

- Prolonged sitting (or sedentary behavior) is an emerging risk factor for cardiovascular diseases and mortality (Van der Ploeg et al 2012; Lee et al 2012; Katzmarzyk et al 2009; Chrysant et al 2015; Chomistek et al 2013).

- The physiological mechanism remains poorly understood.

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# Involvement of the autonomic nervous system (ANS)?

- Inactivity may increase cardiovascular disease risks due to changes in central pathways involved in autonomic regulation (Mueller et al 2010).

- Autonomic alterations induced by prolonged bed-rest (Hughson et al 2015).

- Prolonged sitting may result in alterations of cardiovascular biomarkers (e.g. Thosar et al 2015; Larsen et al 2014).

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# Lack of research

## Important to:

- Assess sitting time using objective methods.
- Investigate the separate effects of occupational and leisure-time sitting.
- Determine whether sitting influences ANS regulation regardless of physical activity.

# Aim

- To determine the extent to which occupational and leisure-time sitting are associated with nocturnal heart rate variability (HRV) in blue-collar workers.

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# Design: Cross sectional sample of blue-collar workers (n=138)

**Questionnaire**
**Health check**

→

**Ambulatory monitoring**

- ***Physical activity***
- ***Heart rate***



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# Ambulatory recordings

- **Sitting time**
  - Assessed using two accelerometers (Actigraph) across 1-5 days
  - analyzed during work and leisure (Acti4 software).
- **ANS activity: Heart rate variability (HRV)**
  - Assessed using a heart rate monitor (Actiheart) across 1-5 days
  - Analyzed according to Task Force (1996).
  - Determined during sleep



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# Possible confounders

- **Individual factors**
  - Age, gender and BMI
- **Diagnoses**
  - Hypertension, cardiovascular disease, diabetes, depression
- **Medication**
- **Life style**
  - Smoking, moderate-to-vigorous physical activity
- **Occupational factors**
  - Lifting/carrying at work, Job seniority, influence at work

# Association between sitting and HRV

| | Primary adjusted model* (N=126) | | | | |
|---|---|---|---|---|---|
| **Outcomes** | Sitting domain | B | 95%CI Low | High | p |
| **IBI (ms)** | Work | -24.24 | -46.98 | -1.50 | 0.04 |
| | Leisure | 0.41 | -14.43 | -15.25 | 0.96 |
| **RMSSD (ms)** | Work | -4.96 | -8.88 | -1.05 | 0.01 |
| | Leisure | 1.83 | -0.73 | 4.38 | 0.16 |
| **SDNN (ms)** | Work | -5.07 | -8.48 | -1.67 | <0.001 |
| | Leisure | 1.10 | -1.12 | 3.33 | 0.33 |

*Adjusted for age, gender, BMI, smoking, lifting/carrying at work, seniority, influence at work, and total moderate-to-vigorous physical activity (PA)*

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# Hierarchical regression model

**Proportion of explained variance (adjusted $r^2$ change) in HRV**

| HRV index | Individual factors $r^2$ | Occupational factors and total PA $r^2$ | Sitting time $r^2$ | Total $r^2$ |
|---|---|---|---|---|
| IBI | 0.18 | -0.01 | 0.02 (p=.04) | 0.19 |
| RMSSD | 0.21 | 0.00 | 0.05 (p=.01) | 0.26 |
| SDNN | 0.14 | 0.00 | 0.06 (p<.01) | 0.20 |

*Age, gender, BMI, smoking, lifting/carrying at work, seniority, influence at work, and total moderate-to-vigorous physical activity (PA)*

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# Conclusion

- More occupational sitting was associated with increased heart rate and reduced HRV during sleep, regardless of several individual and occupational factors and physical activity.
- This implies reduced parasympathetic cardiac activity with more sitting time at work.
- Larger longitudinal studies are needed to address possible causal relationships

# Publication

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*Article*

## Prolonged Sitting is Associated with Attenuated Heart Rate Variability during Sleep in Blue-Collar Workers

**David M Hallman [1,*], Tatiana Sato [2], Jesper Kristiansen [3], Nidhi Gupta [3], Jørgen Skotte [3] and Andreas Holtermann [3]**

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# Thanks for listening!

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