The impact of shift work on health

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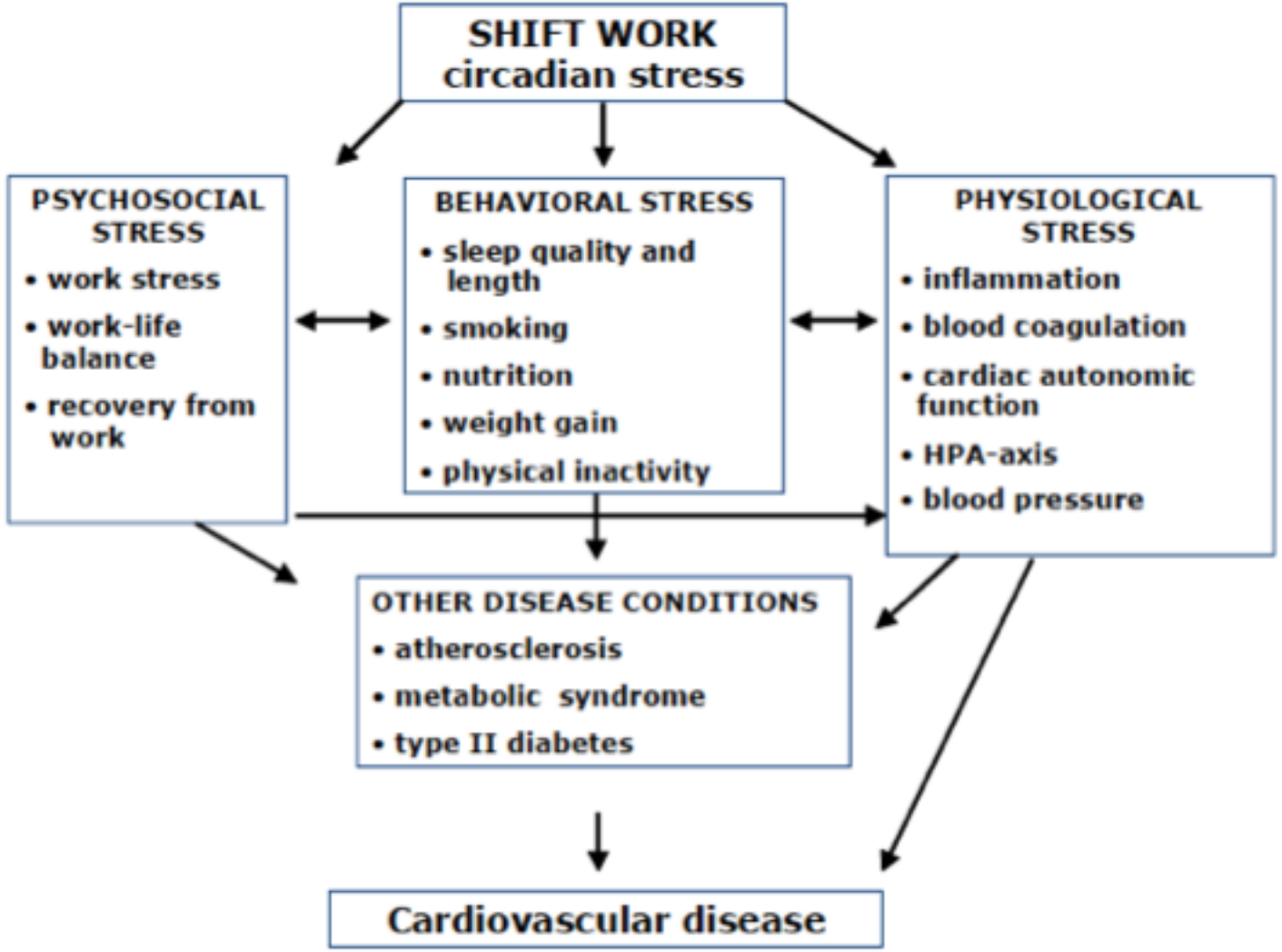
Shift Work and Health

Outline

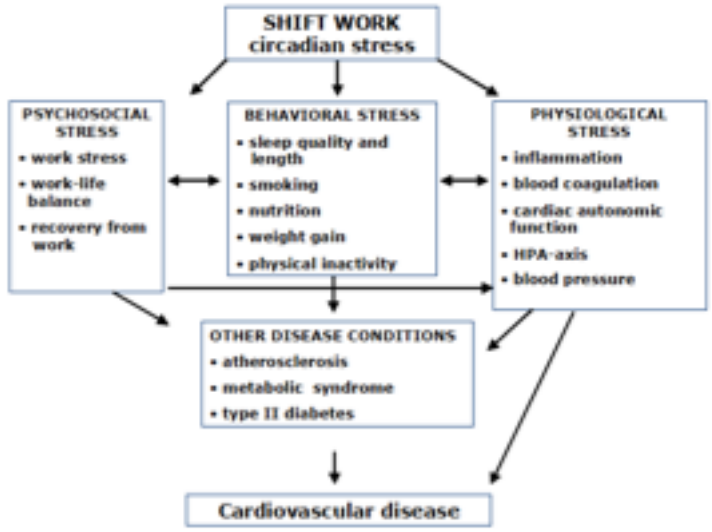
- **Mechanisms**
- Known and unknowns
- Prevention strategies

Putative mechanisms for the association between work and health

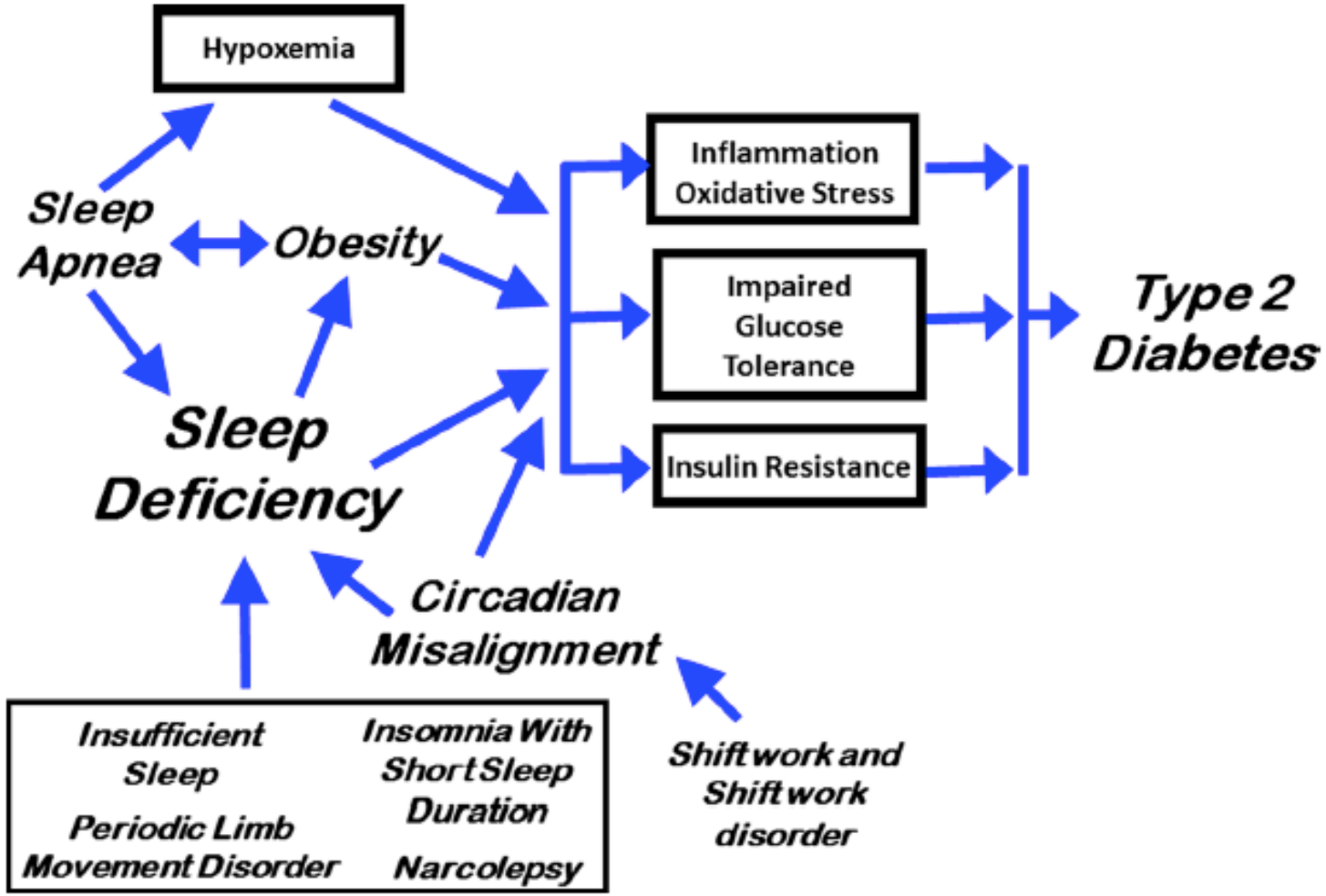


Puttonen et al., 2010, SJWEH

Putative mechanisms for the association between work and health



Puttonen et al., 2010, SJWEH



Depner, Stothard, & Wright, 2014, Curr Diab Rep

Shift Work and Health

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Overall, shift work increases the risk of chronic disease

BMJ. 2012 Jul 26;345:e4800. doi: 10.1136/bmj.e4800.

Shift work and vascular events: systematic review and meta-analysis.

Vyas MV[1], Garg AX, Iansavichus AV, Costella J, Donner A, La

Occup Med (Lond). 2011 Mar;61(2):78-89. doi: 10.1093/occmed/kqr001.

Shift work and chronic disease: the epidemiological evidence.

Wang XS[1], Armstrong ME, Cairns BJ, Key TJ, Travis RC.

Sleep Med. 2015 Nov;16(11):1381-7. doi: 10.1016/j.sleep.2015.02.543. Epub 2015 May 11.

Night-shift work increases morbidity of breast cancer and all-cause mortality: a meta-analysis of 16 prospective cohort studies.

Lin X[1], Chen W[2], W

Breast Cancer Res Treat. 2013 Feb;138(1):291-301. doi: 10.1007/s10549-013-2433-1. Epub 2013 Feb 12.

Night-shift work and risk of breast cancer: a systematic review and meta-analysis.

Kamdar BB[1], Tergas AI, Mateen FJ, Bhayani NH, Oh J.

Scand J Work Environ Health. 2013 Sep 1;39(5):431-47. doi: 10.5271/sjweh.3371. Epub 2013 Jun 26.

Night-shift work and breast cancer--a systematic review and meta-analysis.

Ijaz S[1], Verbeek J, Seidler A, Lindbohm ML, Ojajärvi A, Orsini N, Costa G, Neuvonen K.

Occup Environ Med. 2015 Jan;72(1):72-8. doi: 10.1136/oemed-2014-102150. Epub 2014 Jul 16.

Shift work and diabetes mellitus: a meta-analysis of observational studies.

Gan Y[1], Yang C[1], Tong X[1], Sun H[1], Cong Y[1], Yin X[1], Li L[2], Cao S[1], Dong X[1], Gong Y[1], Shi O[1], Deng J[1], Bi H[1], Lu Z[1].

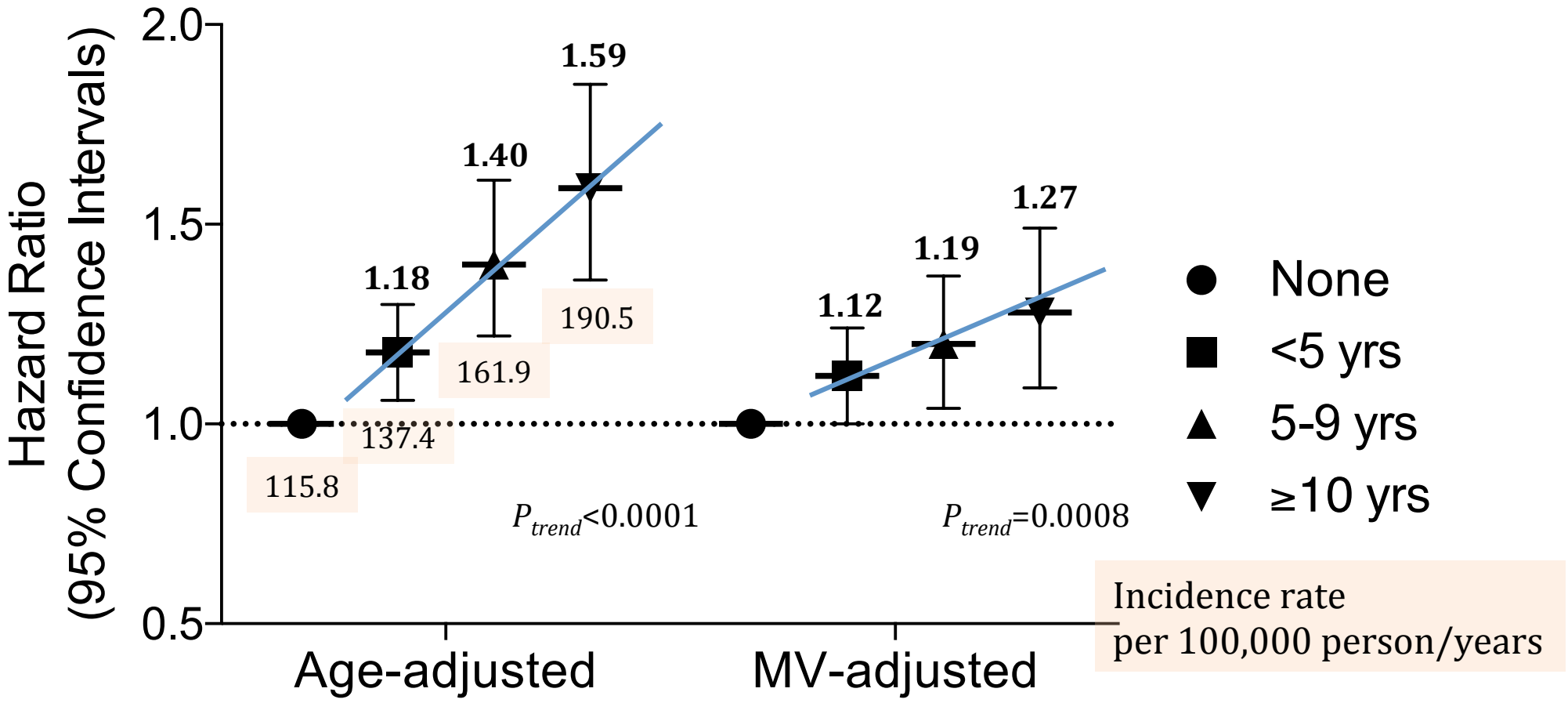
A meta-analysis including dose-response relationship between night shift work and the risk of colorectal cancer.

Wang X[1], Ji A[1], Zhu Y[1], Liang Z[1], Wu J[1], Li S[1], Meng S[1], Zheng X[1], Xie L[1].

Ideal state of exposure assessments

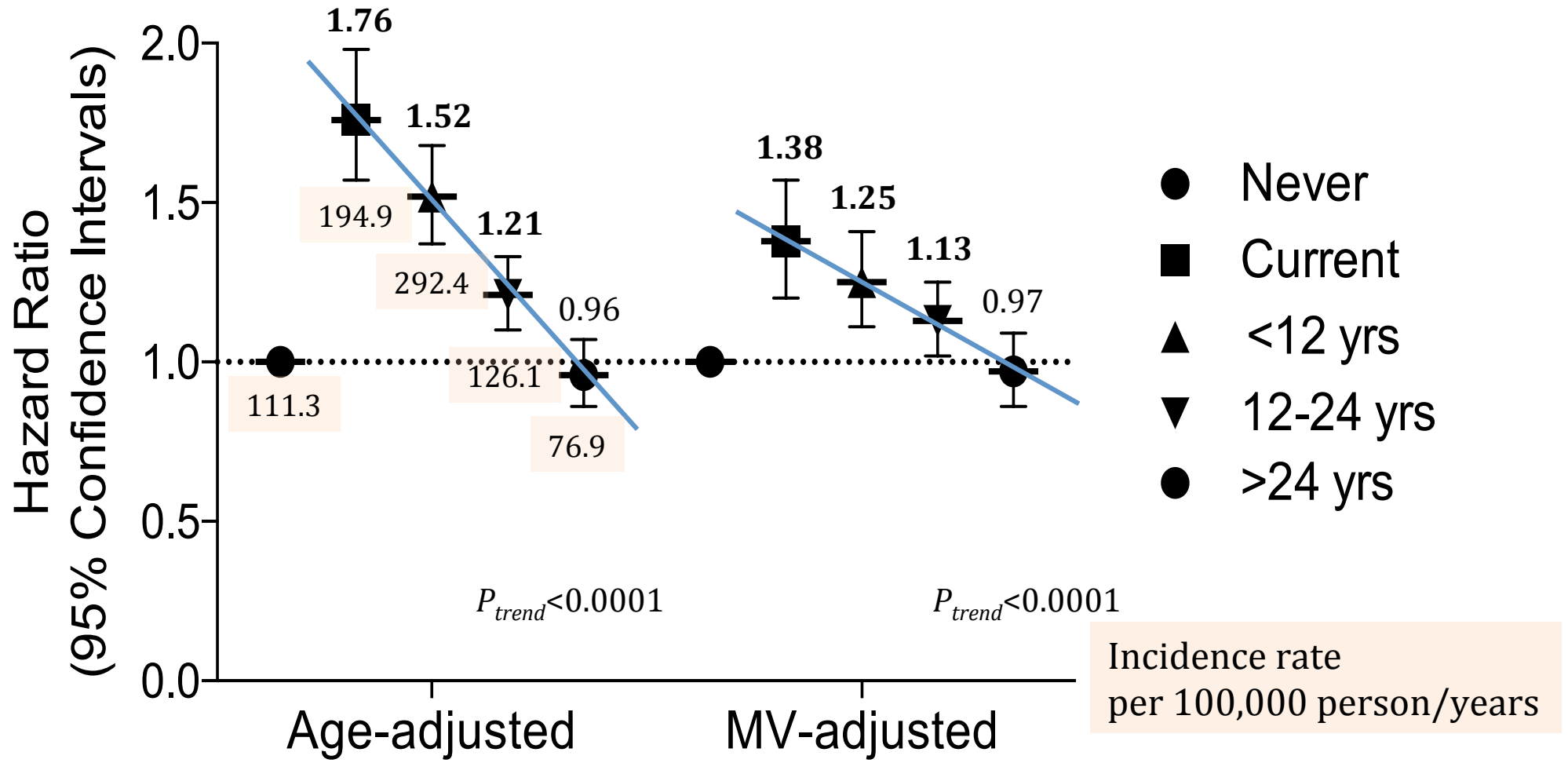
Stevens et al., 2011, OEM

In the Nurses' Health Study II, longer exposure to rotating night shift work was associated with an increased risk of coronary heart disease



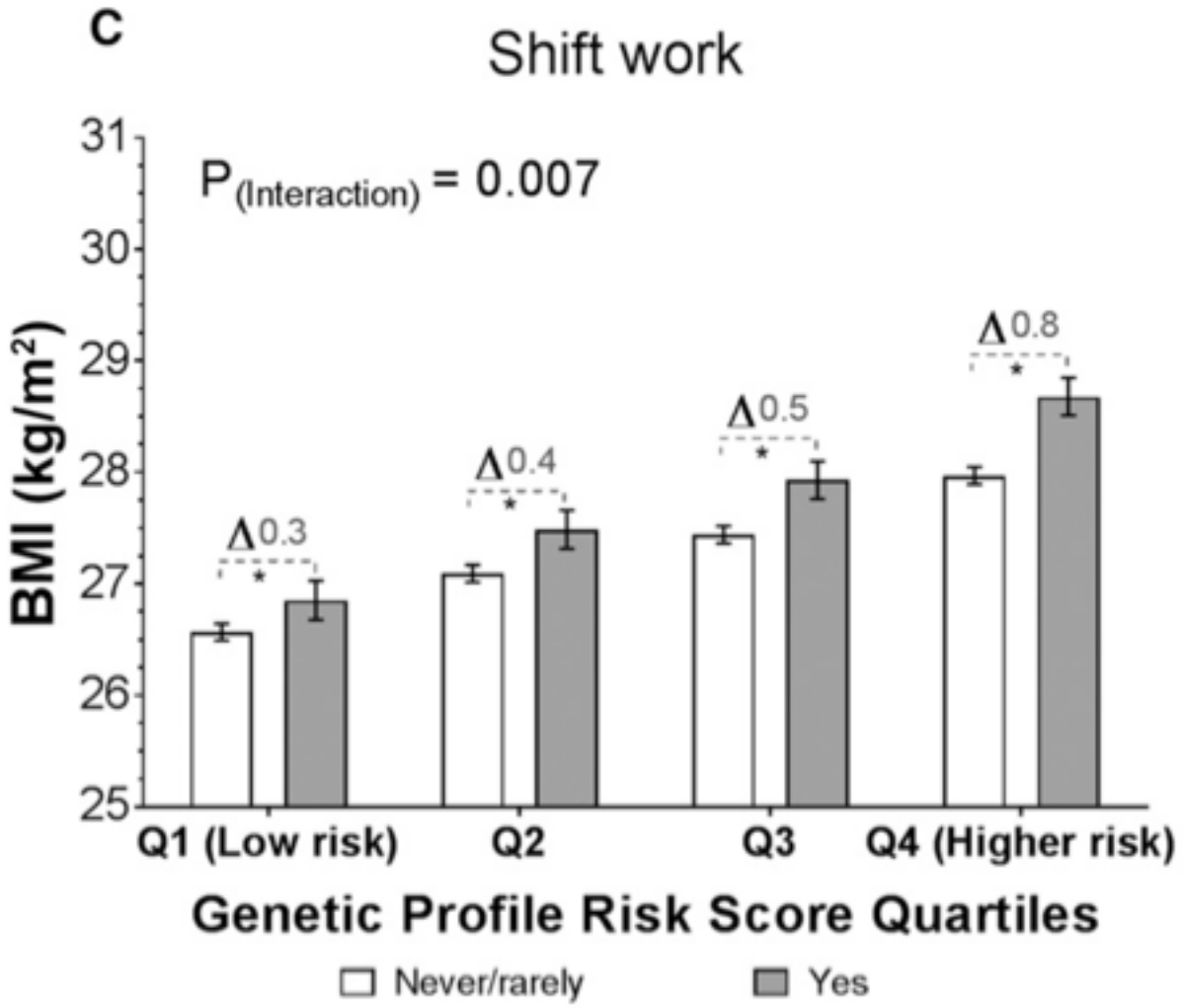
Vetter et al., JAMA, 2016

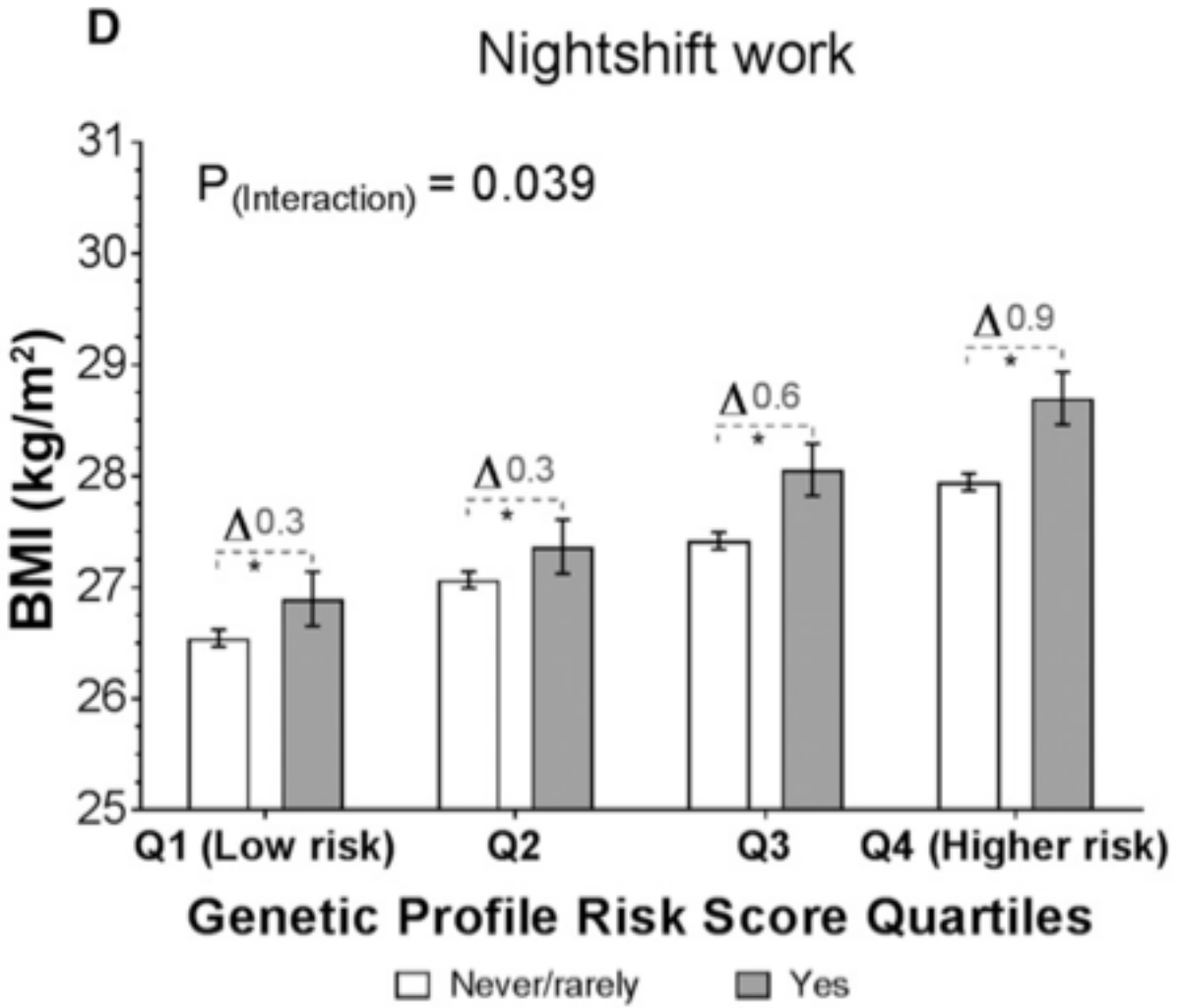
Stopping shift work decreased the likelihood of a CHD event over time



Vetter et al., JAMA, 2016

Shift Work, Genetic Risk, and Obesity





N=119,859, Celis-Morales et al., 2017, Am J Clin Nutr

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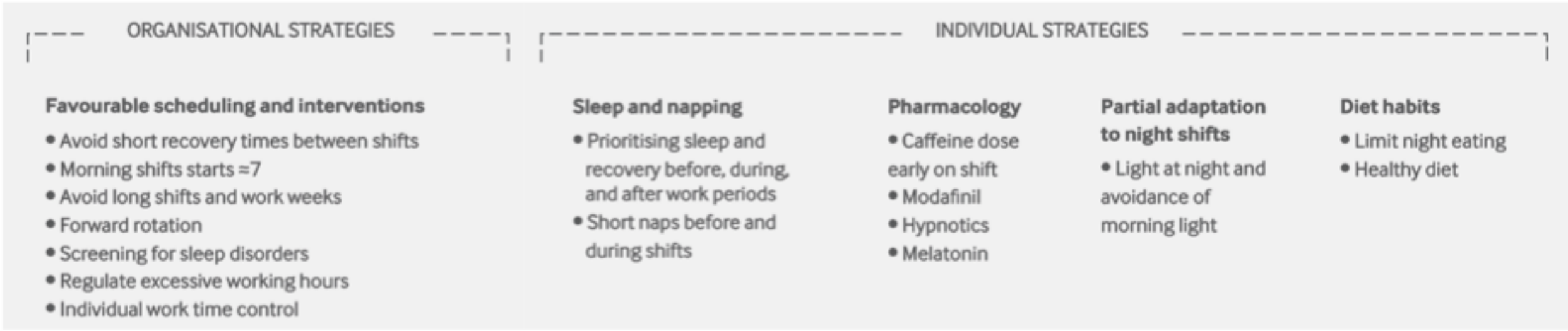
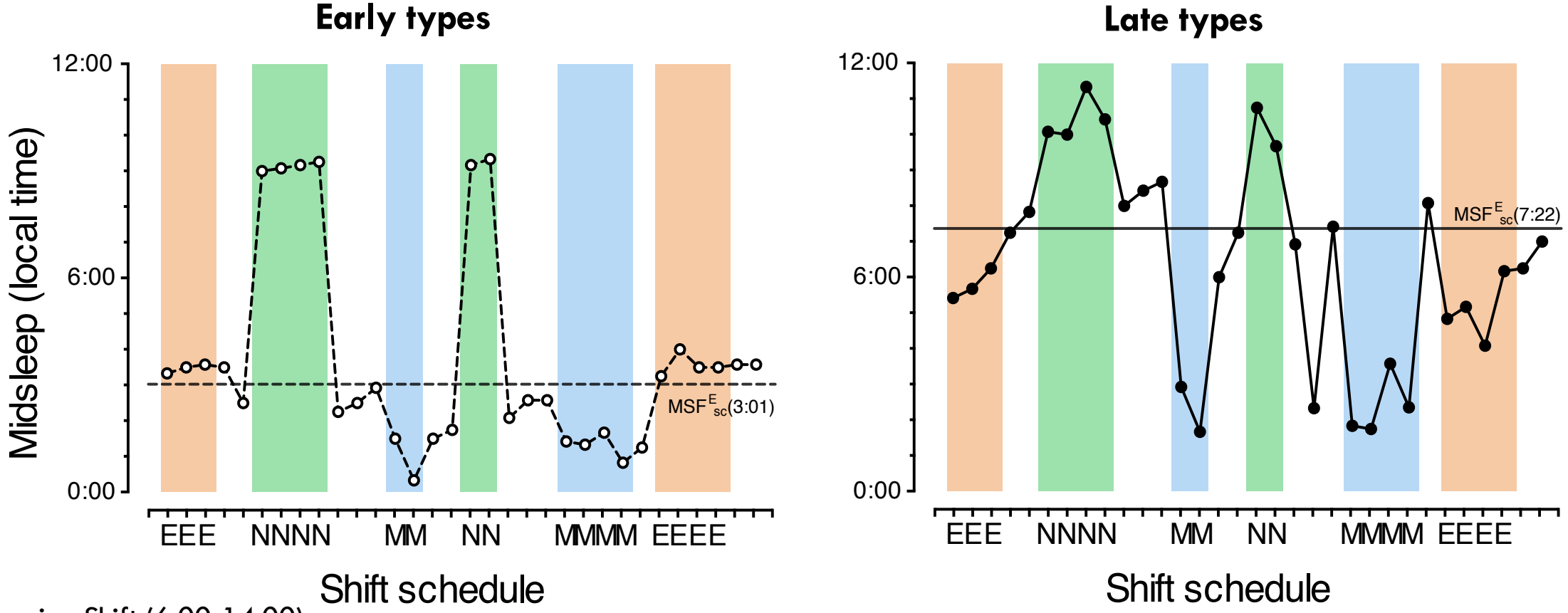
- **Prevention strategies**

Protective factors and counter-measures



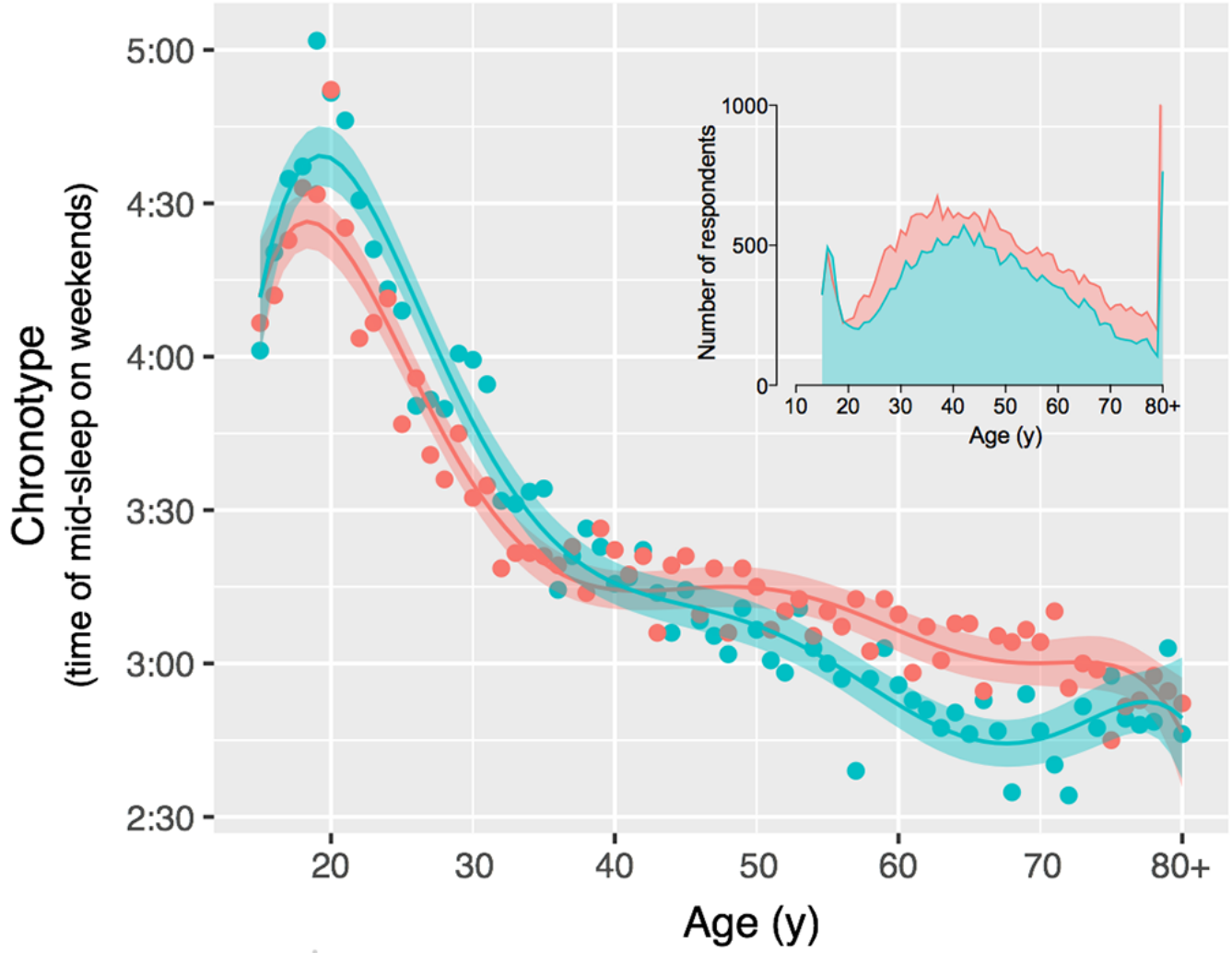
Kecklund & Axelsson, 2016, BMJ

How relevant are inter-individual differences in circadian phenotypes for resilience to shift work?

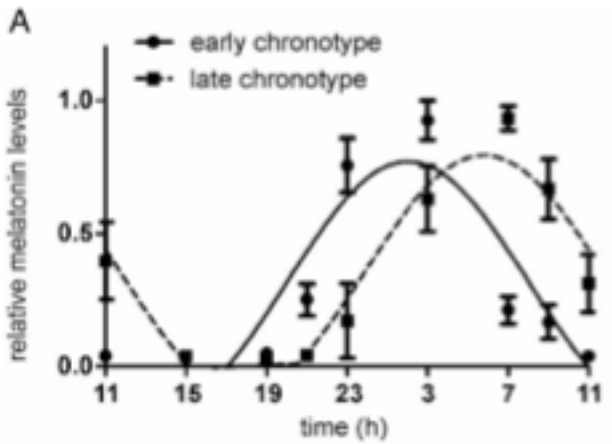


Fischer, Vetter & Roenneberg, 2016, Sci Rep

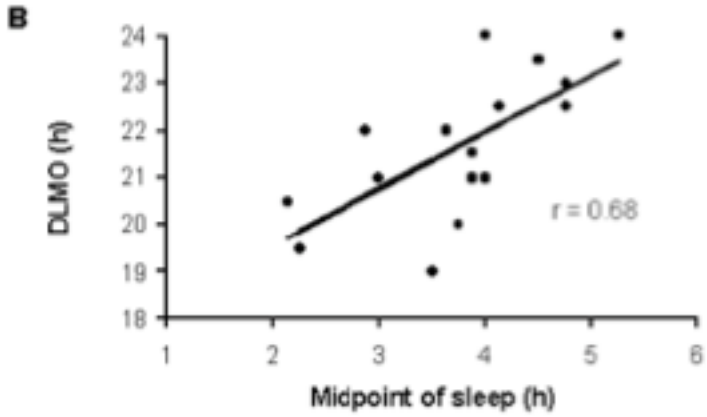
Distribution of Circadian Phenotypes



Fischer et al., 2017, PloS One



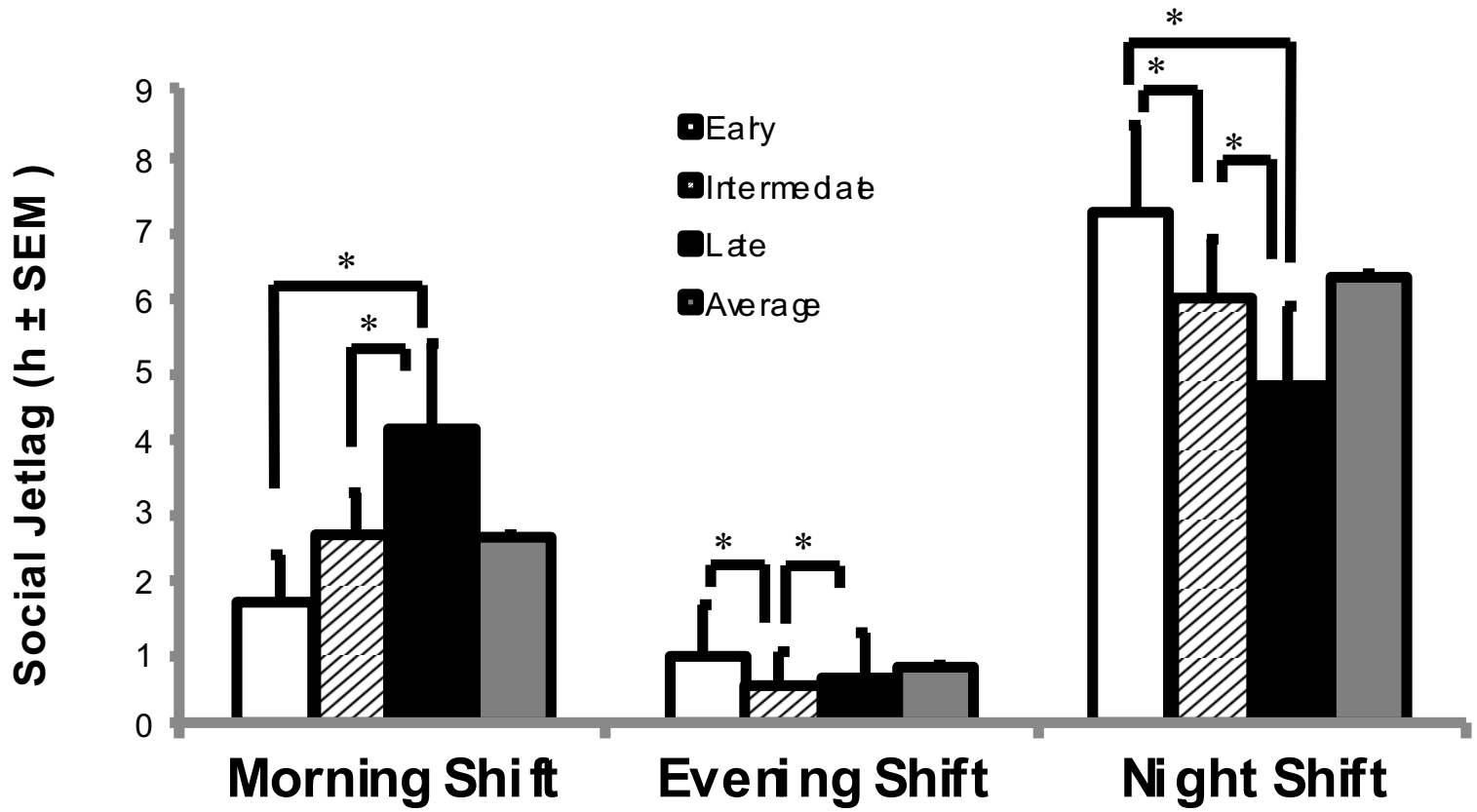
Novakova et al., 2013, Chrono Int



Burgess et al., 2003, Behav Sleep Med

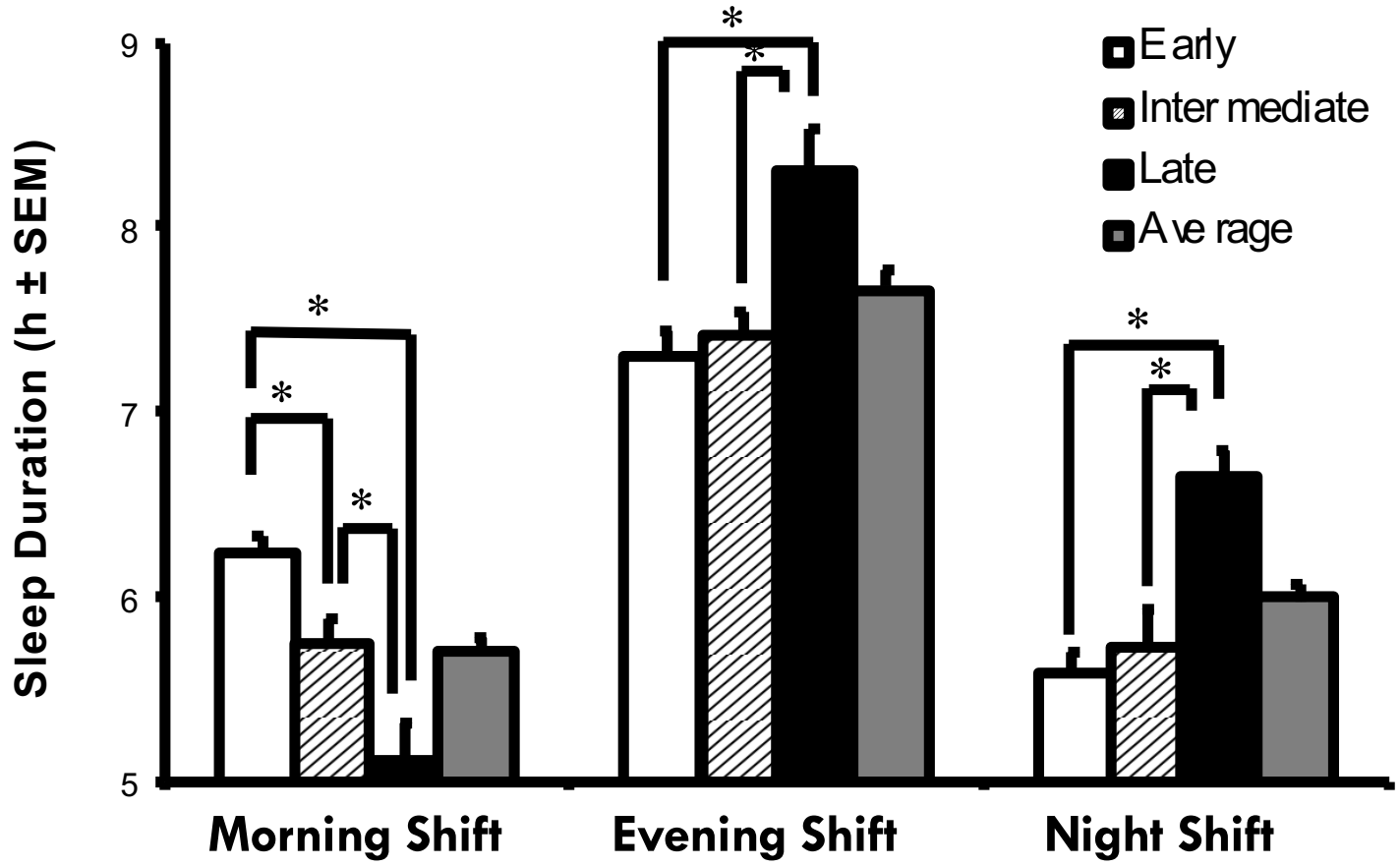
Social jetlag – a proxy for circadian strain – is modulated by circadian phenotypes of shift workers

Δ Mid-sleep work and free days



N= 225, redrawn from Juda, Vetter & Roenneberg, 2013, JBR

Sleep duration in shift workers is modulated by circadian phenotype



N= 225, redrawn from Juda, Vetter & Roenneberg, 2013b, JBR

Changing work hours to improve sleep and reduce circadian misalignment

Early Type

Morning Shift

Evening Shift

~~Night Shift~~

Intermediate Type

Morning Shift

Evening Shift

Night Shift

Late Type

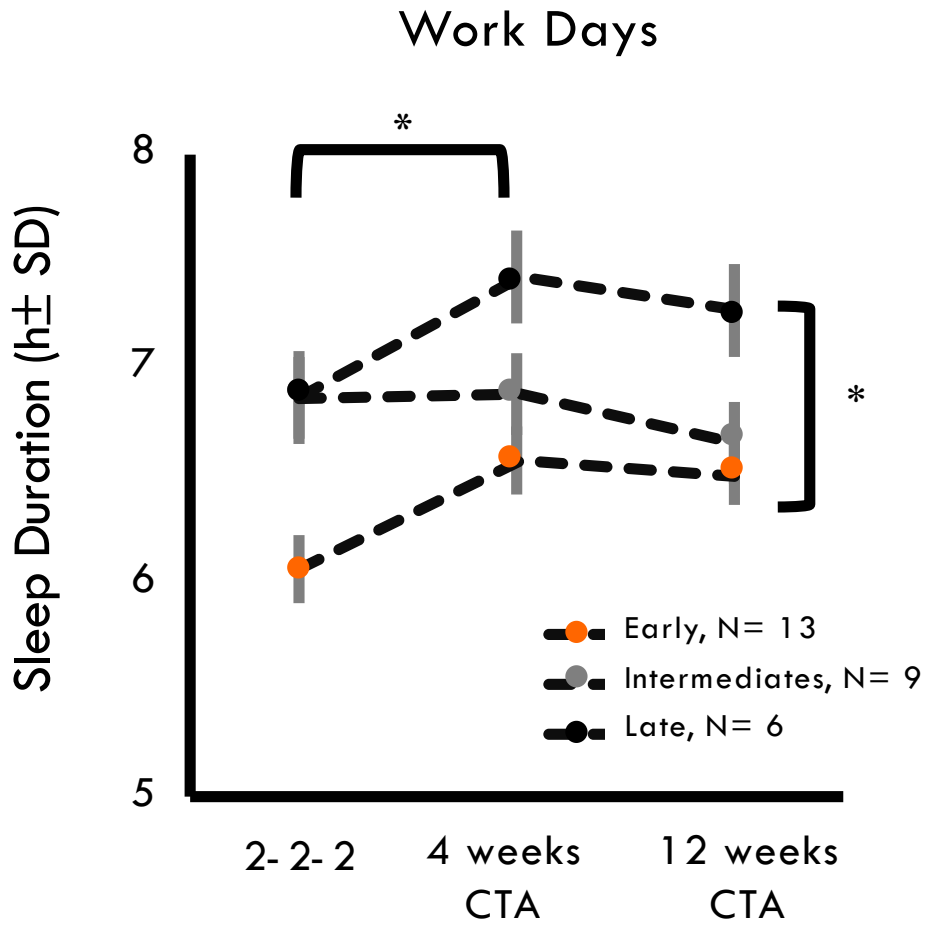
~~Morning Shift~~

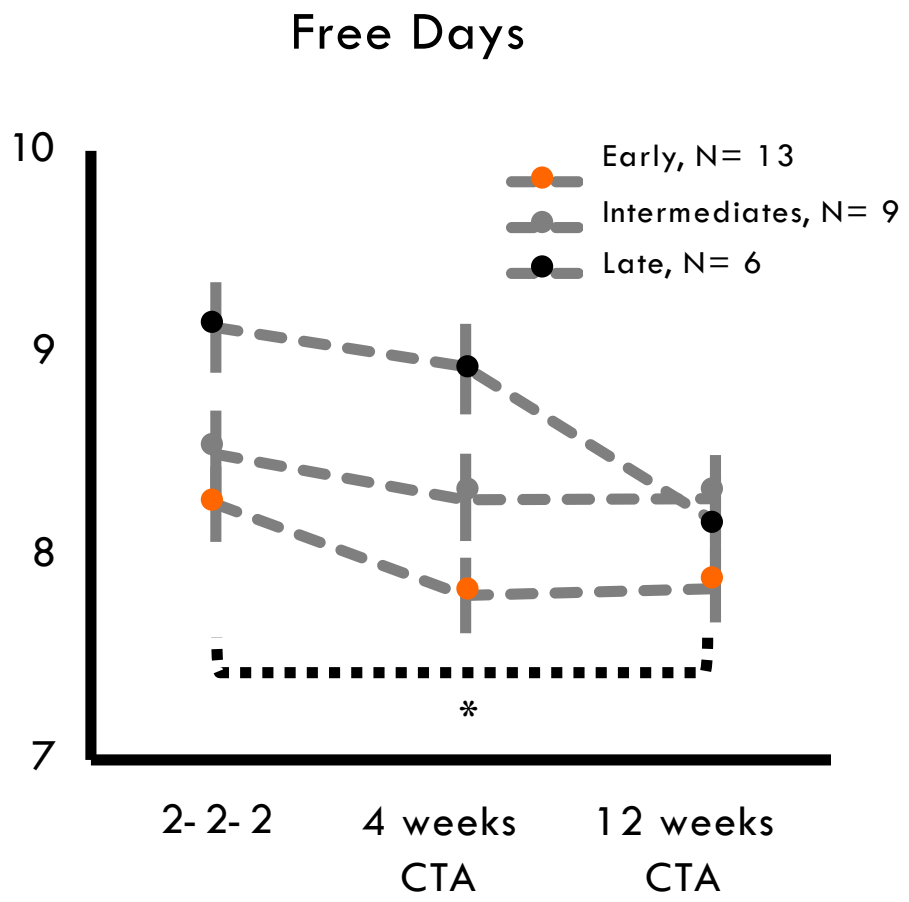
Evening Shift

Night Shift

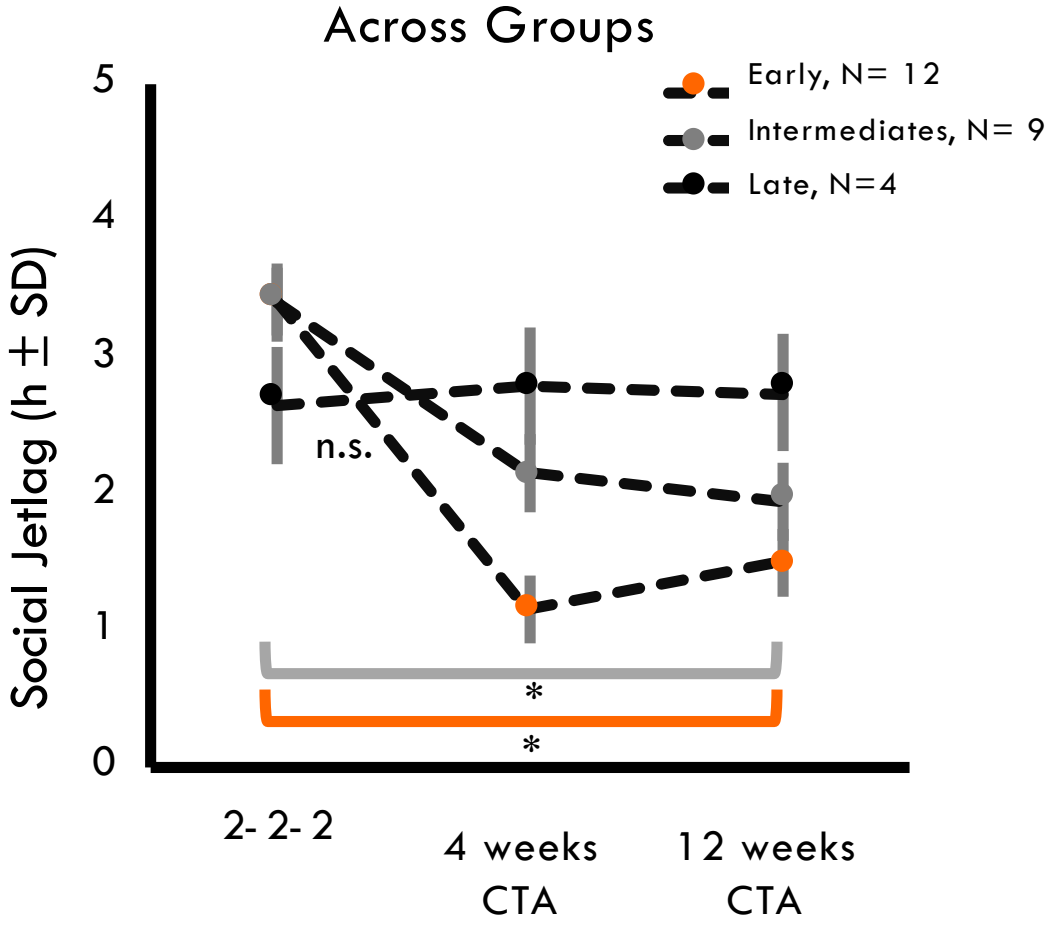
Vetter et al., Curr Biol, 2015

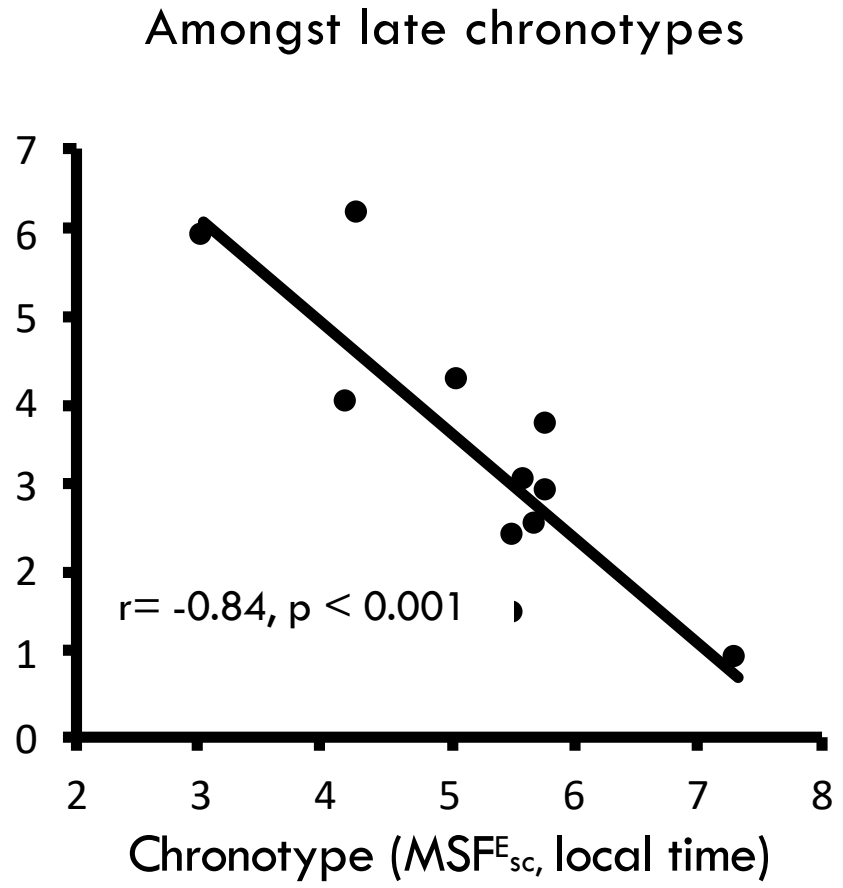
We could increase sleep duration on work days by 0.5h in early and late chronotypes



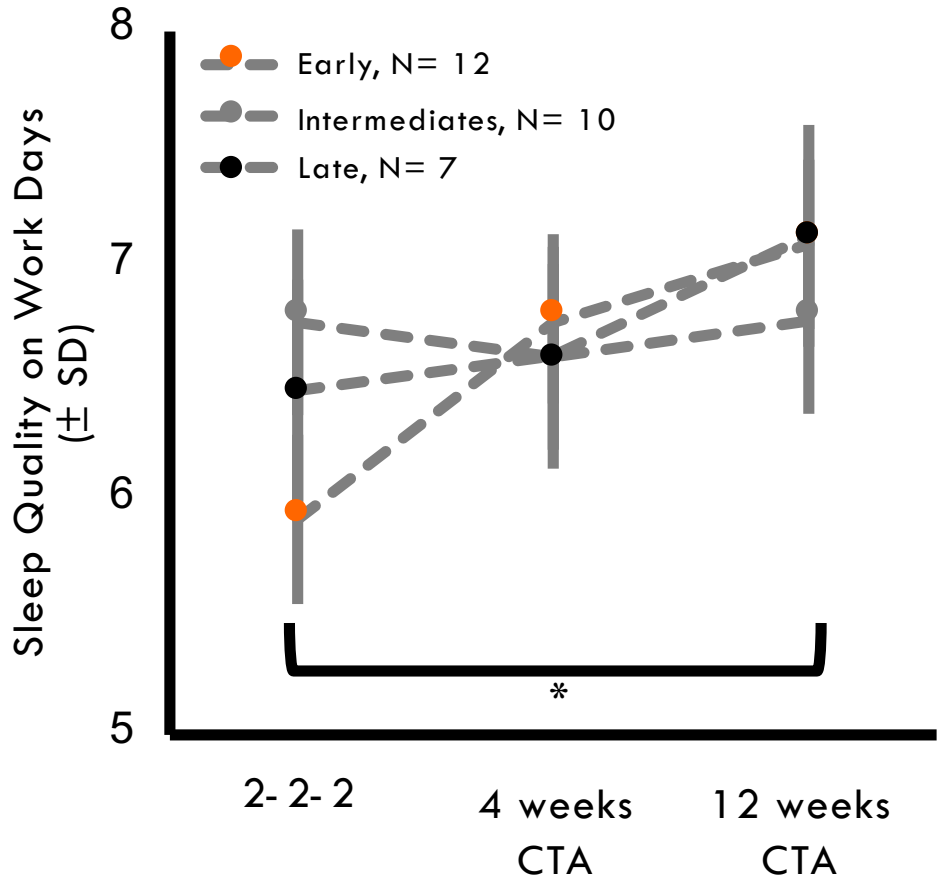


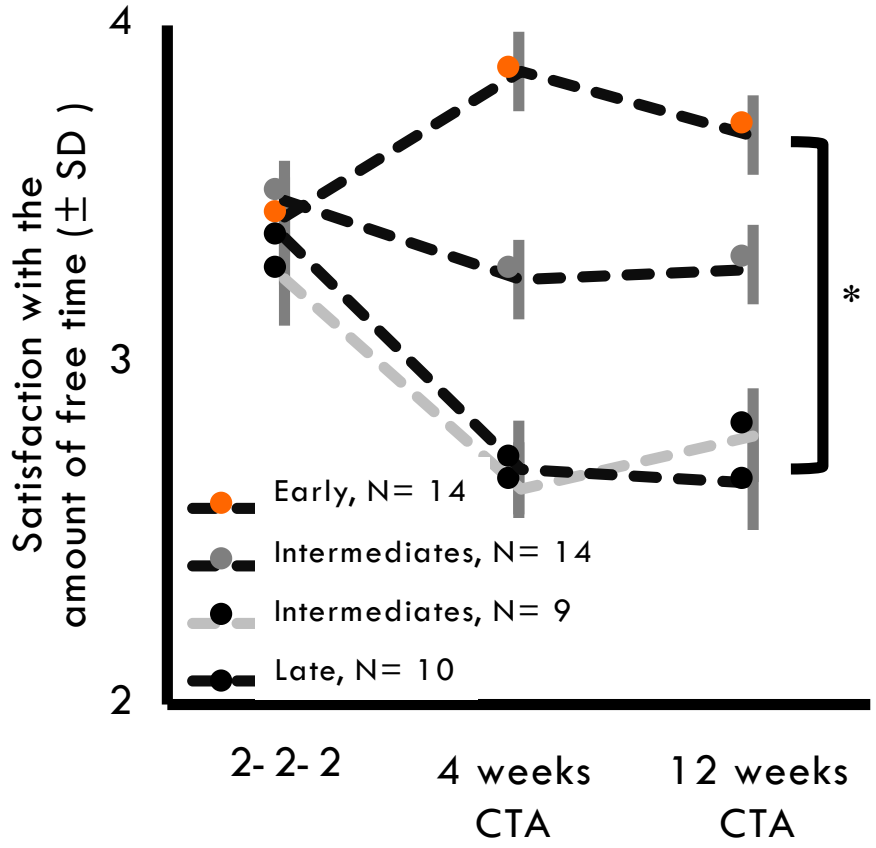
An intention-to-treat analysis showed that we reduced the overall level of social jetlag by 1h





We also improved work-day sleep quality, but late chronotypes were less satisfied with their social life





Changing work hours to improve sleep and reduce circadian misalignment

Early Type

Morning Shift

Evening Shift

~~Night Shift~~

Intermediate Type

Morning Shift

Evening Shift

Night Shift

Late Type

~~Morning Shift~~

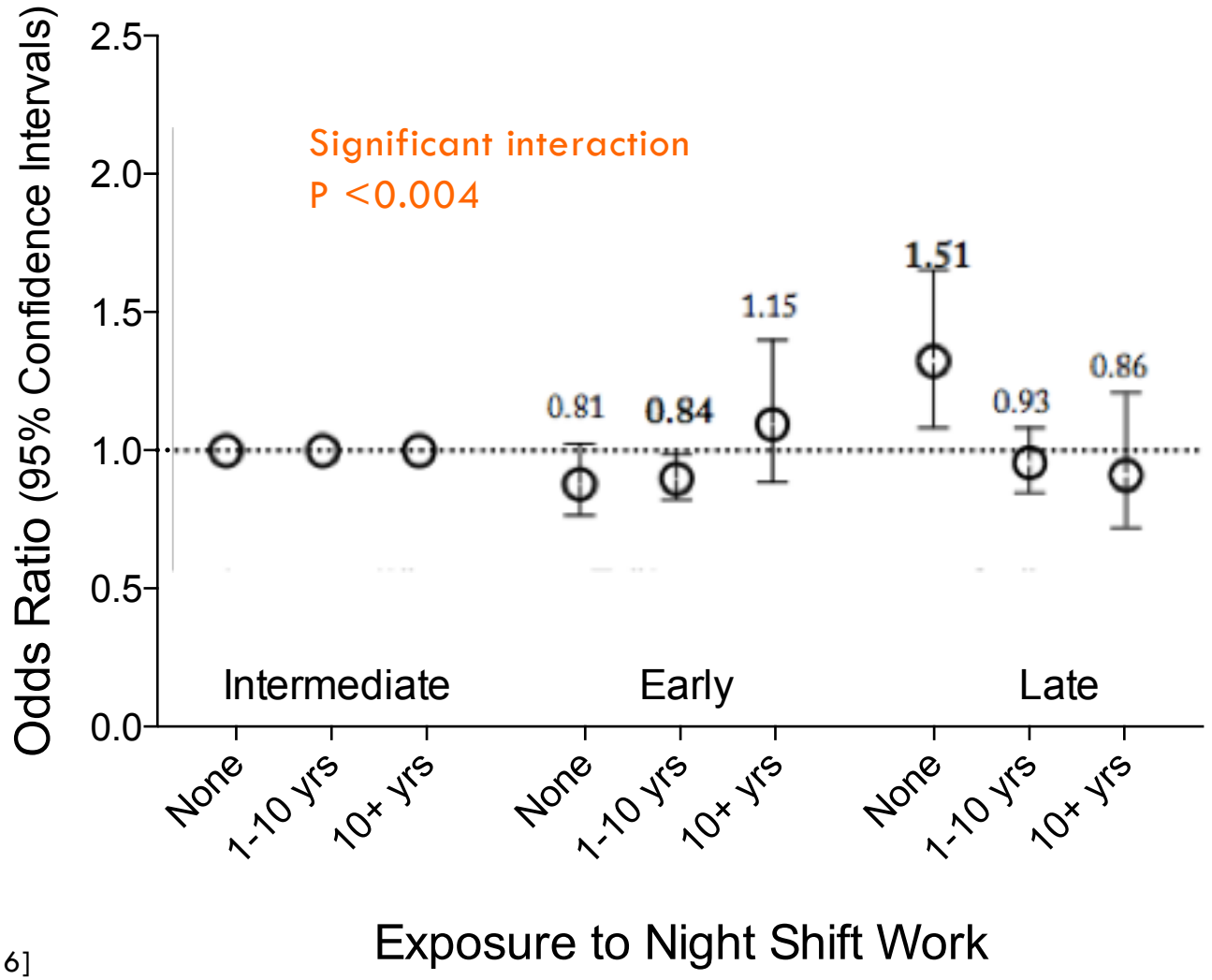
Evening Shift

Night Shift

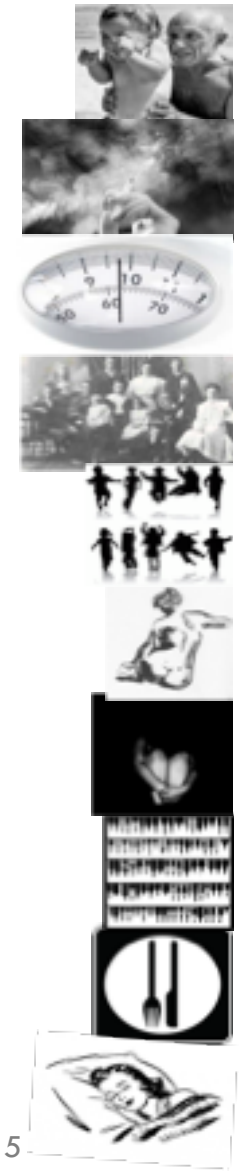
- Early and late types showed significantly longer work day sleep duration
- Overall social jetlag was reduced by 1h
- Workday sleep quality also improved
- Problematic cumulation of weekend night shifts amongst younger employees

Vetter et al., Curr Biol, 2015

Association between T2D risk and chronotype depends on shift work history



Adjusted for



Samples size [cases]
Intermediate: none 10,131[198],
1-10 yrs 21,829|528], 10+ yrs 2,726[96]
Early: none 6,774 [99], 1-10 yrs 14,232 |255], 10+ yrs 1,696 [59]
Late: none 1,857[68], 1-10 yrs 4,571|138], 10+ yrs 799 [31]

Vetter et al., Diabetes Care, 2015

More work is needed

"Except for hypnotics, several types of interventions reviewed had positive overall effects on chronic disease outcomes. There was substantial heterogeneity among studies with respect to study sample, interventions, and outcomes. **There is a need for further high-quality, workplace-based prevention research conducted among shift workers**."

Neil-Sztremko et al., , 2014, SJWEH

Take Home

- Inter-individual differences in circadian phenotype impact sleep duration and the level of circadian misalignment, but long-term effects are currently unclear
- Need for evaluation of feasibility and efficacy of personalized prevention strategies in collaboration with industry
- Need for adaptation is dependent on the type of schedule
- Sleep and circadian rhythms affect lifestyle risk factors of chronic disease