Quasi-experiments in epidemiological research:

Causal effects of work-related risk factors and health indicators

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What is known based on the ”traditional” observational studies?

- Work-related stressors are shown to associate with cardiovascular disease, their risk factors, sickness absence as well as e.g. sleep problems
- Bi-directional associations of work-related stressors and health indicators, e.g. sleep and job strain
- Temporal order between work-stressors and health outcomes need further clarification

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Limitation in terms of causal inference in previous studies

- Very often association between prevalent work stressor and health outcome is examined
  - Healthy worker bias – people working in certain types of jobs are selected group of people and often also healthier than those who switch to other job
  - E.g. shift work, stressful job

- Conducting trial to examine causality between work stressors and health outcomes is difficult
  - Unethical to disturb people's sleep or incraese work stressors on purpose

Quasi experiments in epidemiological research: Pseudo trial / emulated target trial

- Ability to account timing of exposure and outcome
  - Miquel Hernan: ”Low hanging fruit for causal inference”
  - Hernan MA et al. 2008 Epidemiology / Hernan MA et al. 2016 Am J Epidemiol

- Compared to RCTs, randomization is not possible
  - Need to account the confounding factors (adjustments or matching)

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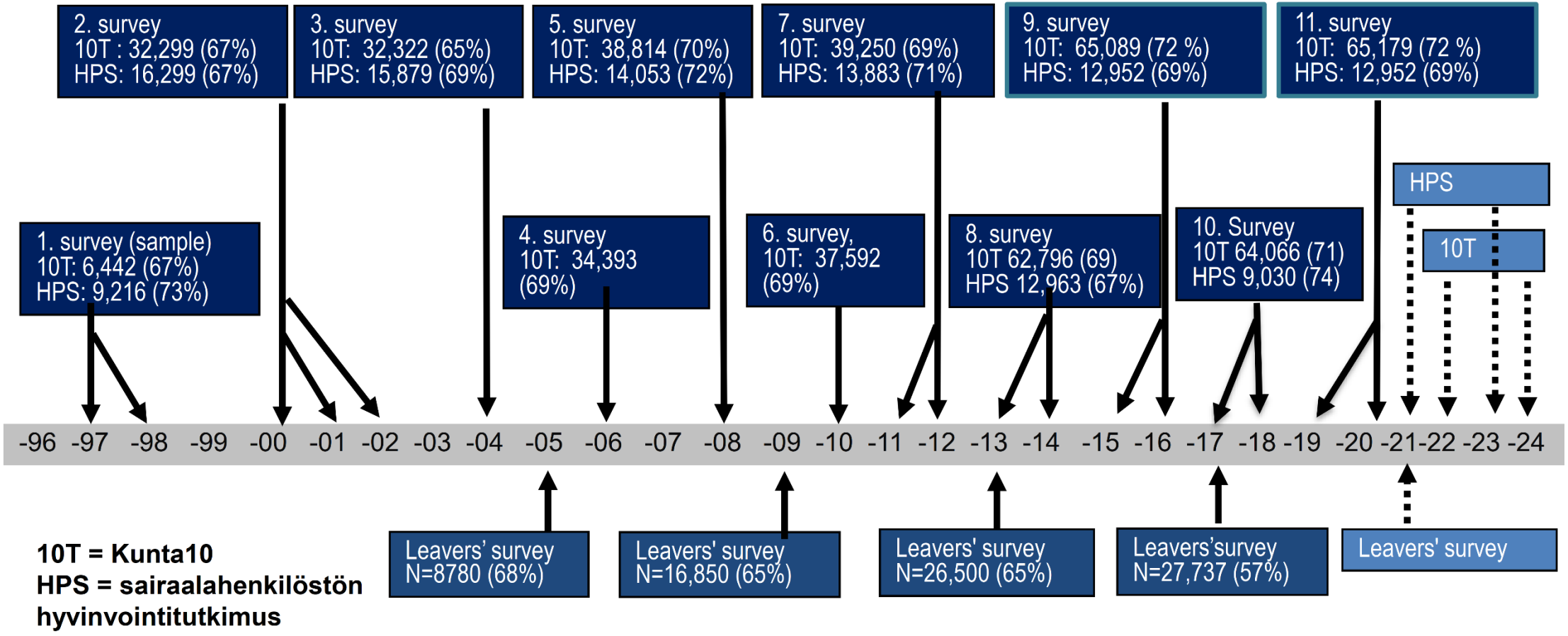
Kuntasektorin henkilöstön seurantatutkimus (Finnish Public Sector study)

Työterveyslaitos

Employees of 10 towns and 21 hospitals
Survey cohort (N=92,727), Register cohort (N=151,618)



10T = Kunta10
HPS = sairaalahenkilöstön hyvinvointitutkimus

ORIGINAL ARTICLE SLEEP, Vol. 40, No. 1, 2017

Change in Job Strain as a Predictor of Change in Insomnia Symptoms: Analyzing Observational Data as a Non-randomized Pseudo-Trial

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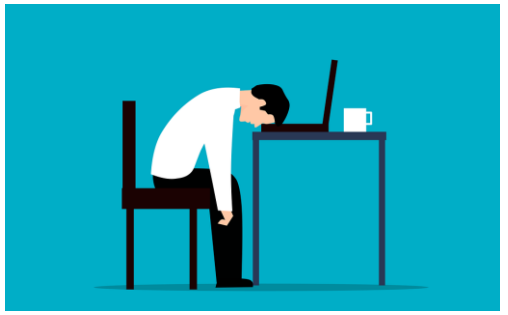
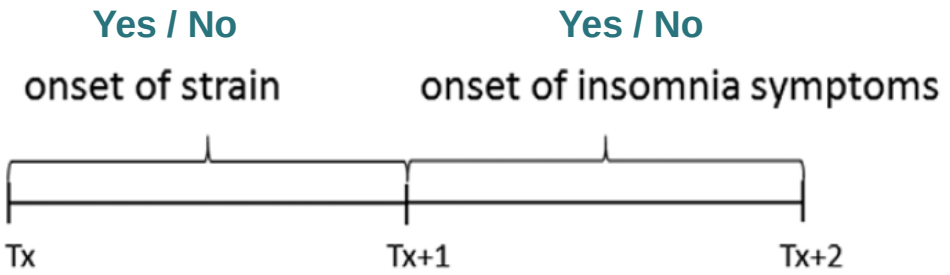
Study design and inclusion criteria



Onset analysis:
n participants=7354

Pseudo-trial 1
start year 2000
n observations=5594



Exposure:
Self-reported job strain (combination of high demands and low job control)

Outcome:
Sleep complaints more than once a week

- Participation in at least 3 successive waves
- No job strain baseline T_X and onset / no onset of job strain at time T_{X+1}.
- No insomnia symptoms at time-points T_X and T_{X+1}, but onset / no onset at T_{X+2}.

Halonen et al. 2017 Sleep

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Statistical modelling

- **General estimating equations**
  - Taking into account of within-person correlation in two nested pseudo trials
  - Results presented as ORs using those with “no onset job strain” and “no disappearance of job strain” as the reference groups

- **Model adjustment**
  - Potential baseline confounders: age, sex, marital status, education, physical inactivity, smoking, heavy alcohol consumption, BMI, and comorbidity

Halonen et al. 2017 Sleep

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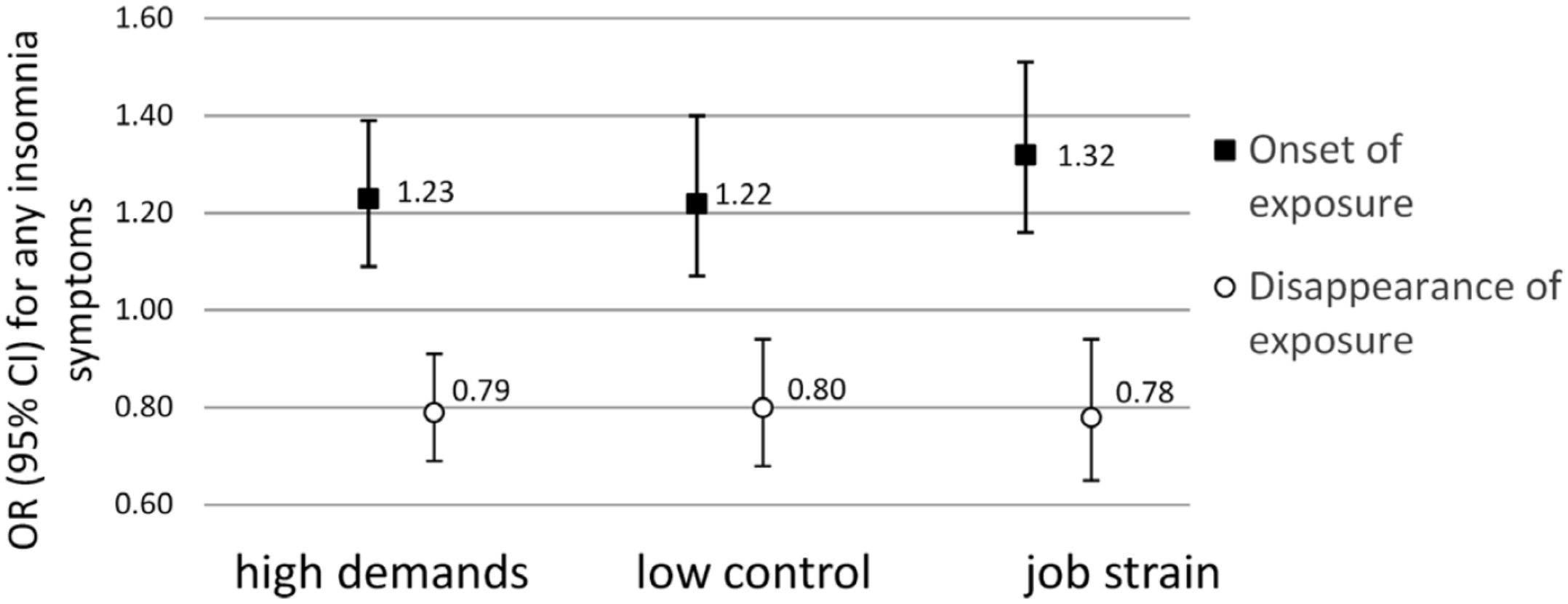
Onset / disappearance of job strain and odds ratios for onset of insomnia symptoms



Halonen et al. 2017 Sleep

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Main findings

- Exposure to job strain affects sleep quality.
- Workplace modifications aiming to reduce job strain might have the potential to reduce insomnia symptoms.
- Further intervention studies are needed to confirm the findings.

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Advance Access Publication Date: 11 May 2015
Original article

Non-communicable Disease Risk Factors

Onset of impaired sleep as a predictor of change in health-related behaviours; analysing observational data as a series of non-randomized pseudo-trials

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SLEEP 2016;39(9):1709–1718.

SLEEP AND CARDIOVASCULAR DISEASE

Onset of Impaired Sleep and Cardiovascular Disease Risk Factors: A Longitudinal Study

Alice Jessie Clark, PhD[1,2]; Paula Salo, PhD[3,4]; Theis Lange, PhD[5]; Poul Jennum, PhD[6,7]; Marianna Virtanen, PhD[3]; Jaana Pentti, BSc[3]; Mika Kivimäki, PhD[8,9]; Naja Hulvej Rod, DMSc[1,2,*]; Jussi Vahtera, PhD[3,10,*]

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Exposure: Onset of impaired sleep

- Short sleep duration: participants reported 6.5 hours of sleep
- Long sleep duration: participants reported 9 hours of sleep
- Disturbed sleep: participants reported sleep complaints more than once a week

Outcome 1: Changes in health-related behaviours

- Increase in high-risk alcohol use: >16 units/week for women and >24 for men
- Quitting smoking
- Becoming physically inactive: MET < 14 h/week
- Becoming overweight or obese: BMI ≥ 25 kg/m^2 / ≥ 30 kg/m^2

Outcome 2: Onset of CVD risk factors

- Initiation of medication for CVD risk factors was derived from electronic medical records

Clark et al. 2015 Int J Epidemiology & Clark et al. 2016 Sleep

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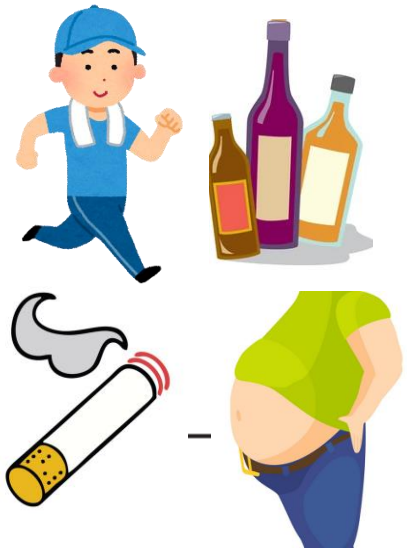
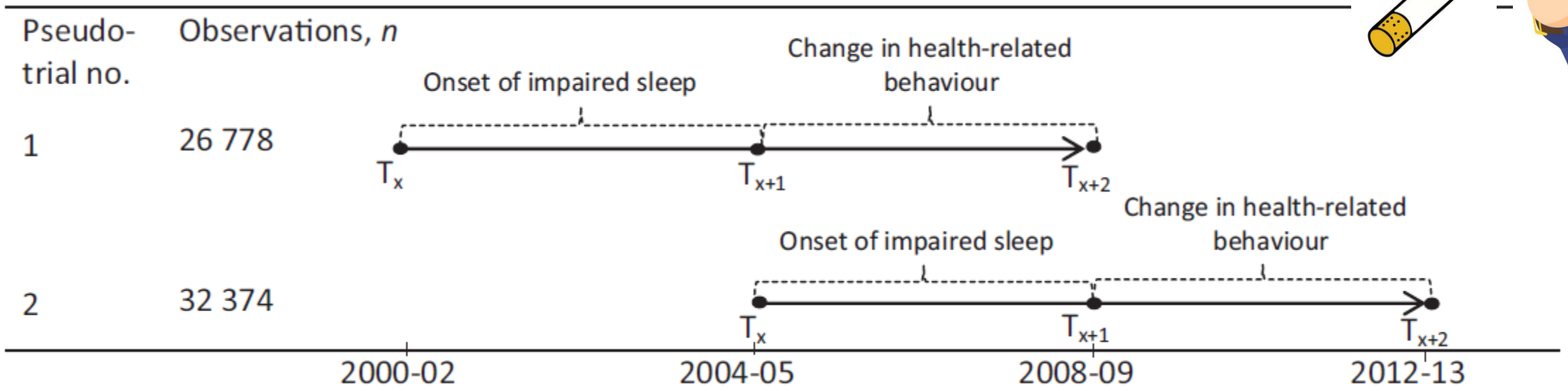
Study design and inclusion criteria





- Participation in at least 3 successive waves
- Normal sleep at baseline T_X and onset / no onset of impaired sleep at time T_{X+1}.
- No health behavioral risk factor at time-points T_X and T_{X+1}, but onset of risk factor at T_{X+2}.

Clark et al. 2015 Int J Epidemiology

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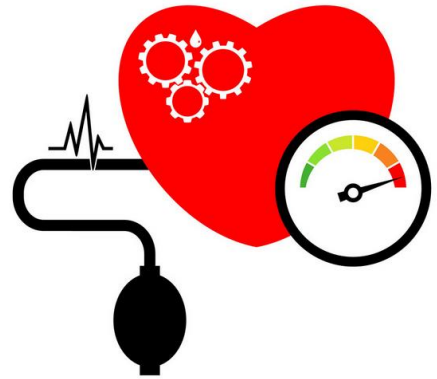
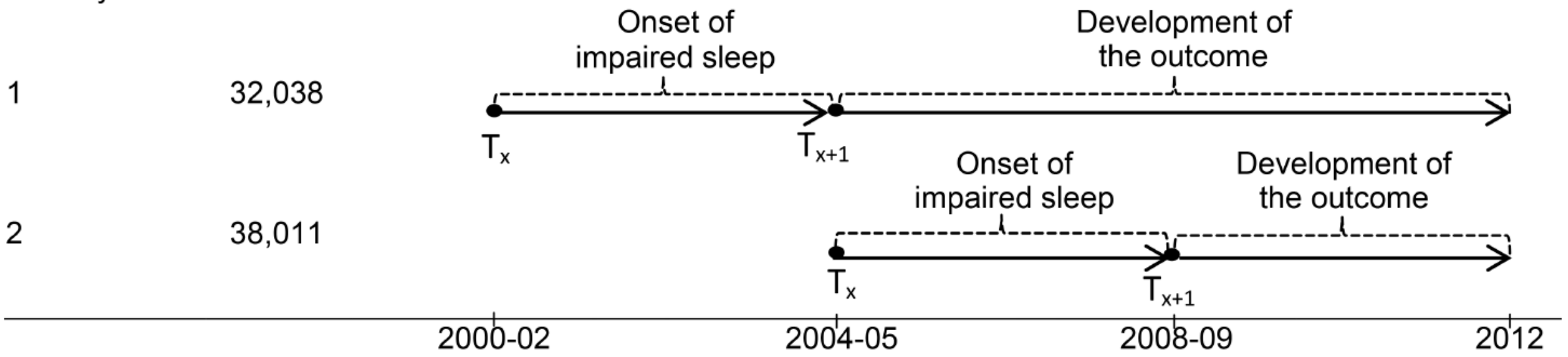
Study design and inclusion criteria



Data-cycle	Observations
1	32,038
2	38,011



- Participation in at least 2 successive waves and register follow-up
- Normal sleep at baseline T_X and onset / no onset of impaired sleep at time T_{X+1}.
- No pre-existing health outcome at time-points T_X and T_{X+1}, but onset at T_{X+2}.

Clark et al. 2016 Sleep

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Onset of impaired sleep and ORs for adverse changes in health-related behaviours

	Initiate high-risk alcohol consumption	Quit smoking	Become physically inactive	Become overweight / obese
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Onset of short sleep	1.17 (1.00–1.37)	0.78 (0.64–0.97)	1.00 (0.90–1.11)	1.09 (0.99–1.21)
Onset of long sleep	0.73 (0.50–1.07)	1.10 (0.70–1.72)	1.18 (0.97–1.43)	0.96 (0.79–1.16)
Onset of disturbed sleep	1.23 (1.05–1.45)	0.80 (0.63–1.00)	1.17 (1.06–1.30)	1.12 (1.01–1.23)

Ref (OR=1) is normal sleep duration or no disturbed sleep
Adjusted for potential confounders (age, sex, cohabitation, occupational status, retirement, cardio-metabolic disorders, respiratory disease, cancer, psychological, distress, depression, and anxiety) and mutually for other health behaviors

Clark et al. 2015 Int J Epidemiology

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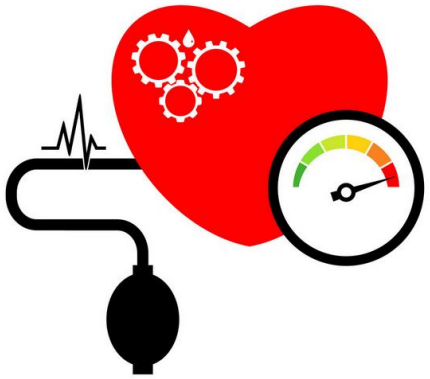
Onset of impaired sleep and HRs for hypertension, diabetes, and dyslipidemia



	Hypertension	Diabetes	Dyslipidaemia
	HR (95% CI)	HR (95% CI)	HR (95% CI)
Onset of short sleep	1.13 (0.96–1.33)	1.15 (0.97–1.37)	1.08 (0.98–1.19)
Onset of long sleep	0.87 (0.60–1.27)	1.34 (0.97–1.85)	1.10 (0.91–1.32)
Onset of disturbed sleep	1.35 (1.16–1.59)	1.29 (1.09–1.53)	1.27 (1.16–1.39)

Ref (HR=1) is normal sleep duration or no disturbed sleep

Adjusted for potential confounders

Clark et al. 2016 Sleep

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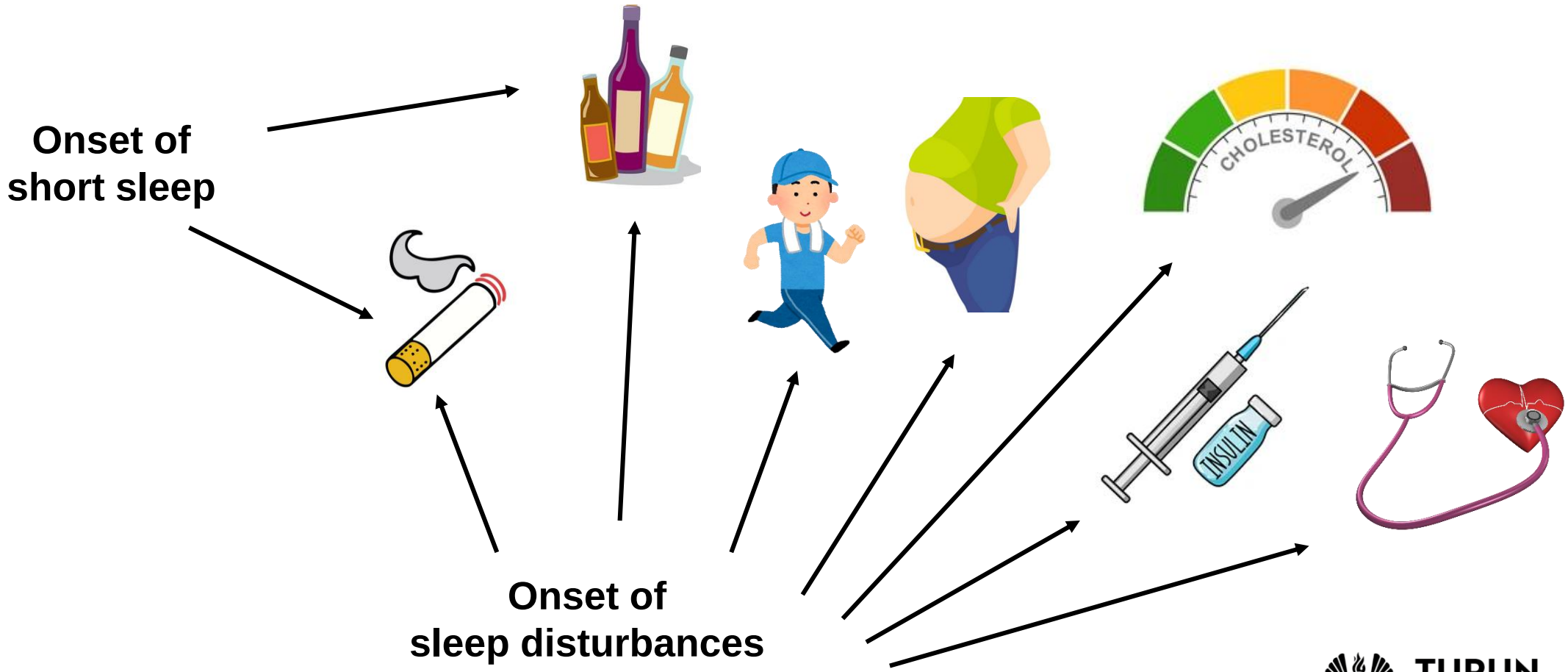
Onset of impaired sleep has an adverse effect of lifestyle changes and CVD risk factors



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Stengths and barriers of pseudo trials

Strengths

- Mimics interventions
- Clear temporal ordering of causes and effect
- Enables studying exposures, which are difficult to modify in RCTs

Barriers

- Requires high resolution longitudinal data, with short measurement intervals
- Inclusion and exclusion criteria require large datasets
- Explaining the design may be challenging

Questions?
Comments?

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