

Scientific Symposium
The Health Effects of Shift Work

Toronto, April 12, 2010

Shift work and cardiovascular disease

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Aim

- To evaluate the epidemiologic evidence for a causal relation between shift work and ischemic heart disease

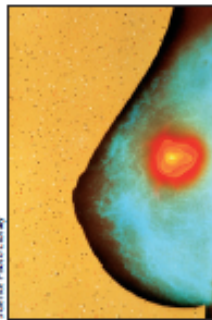
(Frost P, Kolstad HA, Bonde JP: Shift work and the risk of ischemic heart disease - a systematic review of the epidemiologic evidence..

Scand J Work Environ Health. 2009 May;35(3):163-79)

Background to the review

- Danish National Board of Industrial Injuries.
- Guidelines of the Scientific Committee of the Danish Society of Occupational and Environmental Health.

Breast cancer on the night shift



Denmark has just become the first country to regard breast cancer as an occupational disease. Danish women who have developed breast cancer but who have no known risk factors other than working a night shift at least once a week for the past 20 years have begun receiving compensation. So far, about 40 nurses and flight attendants have received payments.

In 2007, the International Agency for Research on Cancer (IARC) reclassified working at night from a possible to a probable (group 2A) human carcinogen. Working night shifts disrupts the circadian system, alters sleep patterns, induces chronic sleep deprivation, and suppresses the production of melatonin (an antioxidant and tumour suppressor). Breast cancer, however, is associated with raised concentrations of oestrogen, which is overproduced under artificial light and suppresses melatonin production.

The Danish decision comes as a surprise. The IARC monograph that details the link between shift work and cancer risk is yet to be published (only a statement has been released so far). The existing scientific evidence is

scarce: only a few observational studies have been done and yielded data that are inconsistent, incomplete, and probably inaccurate (due to recall bias, variations in the definition of shift work, and lack of adjustment for potentially important factors such as socioeconomic status and use of sleeping and stimulant drugs). Because of the lack of data coherency, the UK Health and Safety Executive, has commissioned an extensive study on the topic that is to be completed in 2011.

The ramifications of the Danish decision for occupational health are huge. Every fifth employee in Europe and North America works night shifts. The move could increase legal pressure on employers to reduce risks associated with shift work and might create sexual discrimination in some jobs. Most importantly, it establishes a desperate need for more rigorous scientific research into cancer that might be attributable to shift work. In the meantime, the emphasis should be on prevention of cancer by concentrating on established and controllable risk factors, such as maintaining a healthy weight, drinking moderately, and exercising regularly. ■ *The Lancet*

Ischemic heart disease

(European cardiovascular disease statistics 2008)

- 463 mio. inhabitants
- 741,000 deaths in EU, 15-16% of all deaths
- 250,000 before the age of 75, 10-15% of all deaths

Other risk factors to consider

- Age
- Gender
- Calendar time
- Smoking
- Blood pressure
- Social class
- Anthropometry
- Blood lipids
- Physical inactivity
- Psychosocial work loads?

Shift work and cardiovascular disease – pathways from circadian stress to morbidity

by Sampsa Puttonen, PhD,¹ Mikko Härmä, MD, PhD,¹ Christer Hublin, MD, PhD¹

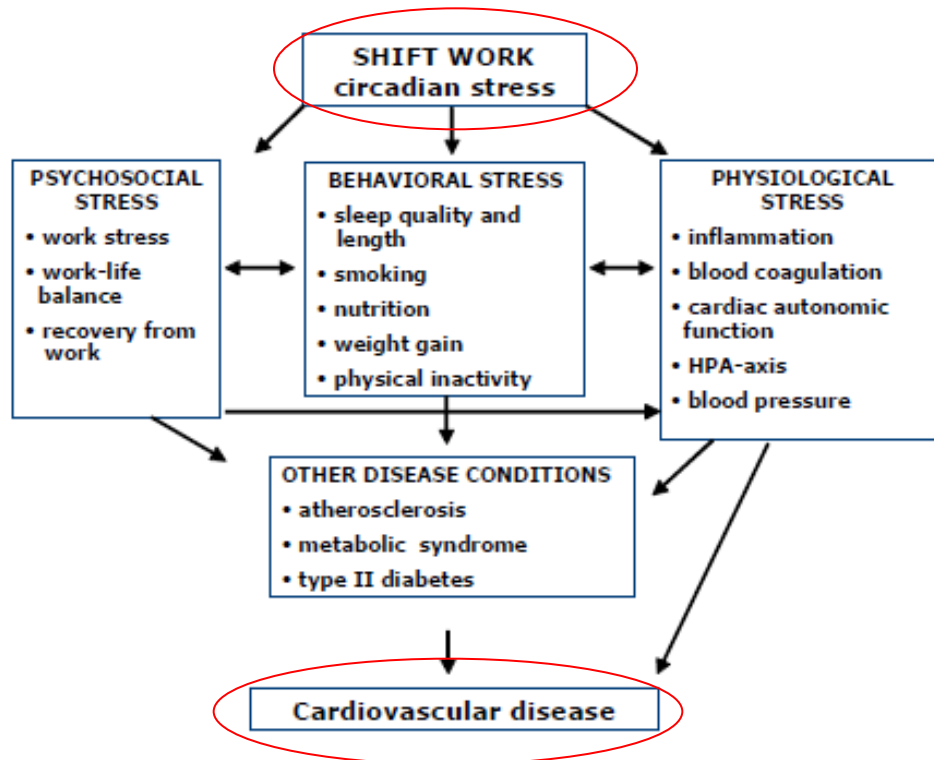


Figure 1. Model for pathways from shift work to cardiovascular disease.

Pathways

Puttonen et al. *Scand J W Environ Health* 2010;36:96-108

- Work-stress
- Work-life balance
- Recovery from work
- Sleep quality
- Smoking
- Weight gain
- Physical inactivity
- Inflammation
- Blood coagulation
- Cardiac autonomic function
- HPA-axis
- Blood pressure

Pathways

Puttonen et al. *Scand J W Environ Health* 2010;36:96-108

- There is sufficient evidence for possible disease pathways – although strong evidence on any specific plausible mechanism is so far missing.

Risk and pathways

Bøggild and Knutsson *Scand J W Environ Health* 1999;25:85-99

- Relative risk of 1.4
- Behavioural changes - especially smoking and diet.
- Change in circadian rhythms
- Disturbed sociotemporal patterns

Systematic review

- Inclusion criteria: epidemiology, shift work, ischemic heart disease, prospective design, N=14 original papers.
- Extraction: study design, sample size, follow up time, completeness of participation, exposure assessment, exposure level, case definition, sources of information, confounders considered, risk estimates, and exposure response analyses.
- Open review process with revisions according to external experts: Henrik Bøggild, Anders Ahlbom, and George Davey Smith.

Type of shift work exposure

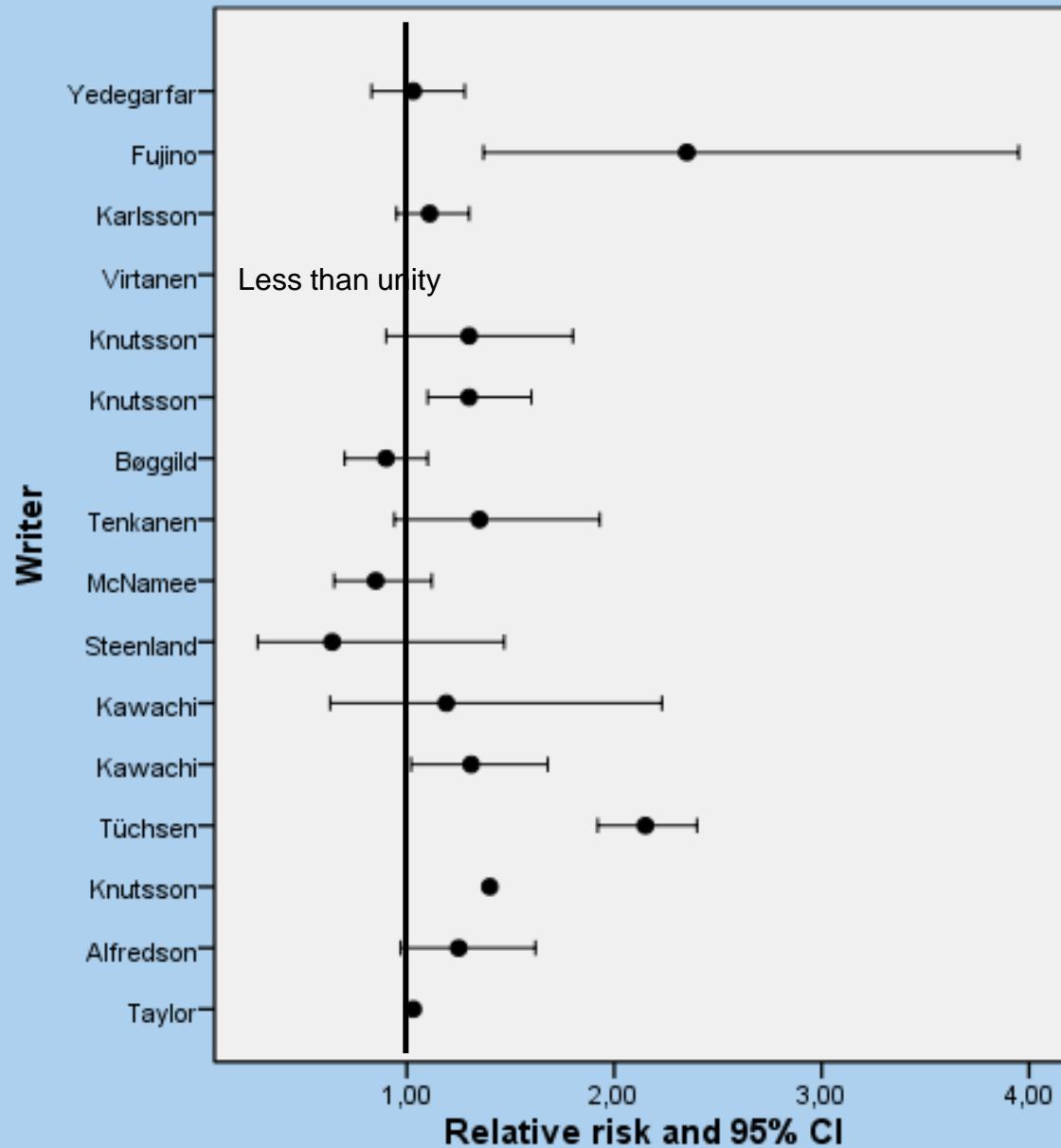
- Non day work vs. day work: nine studies
- Work at night vs. day work: four studies
- Work in the evening vs. day work: two studies.

Shift systems

- Rotating: seven studies
- Fixed: two studies
- Unclear: five studies

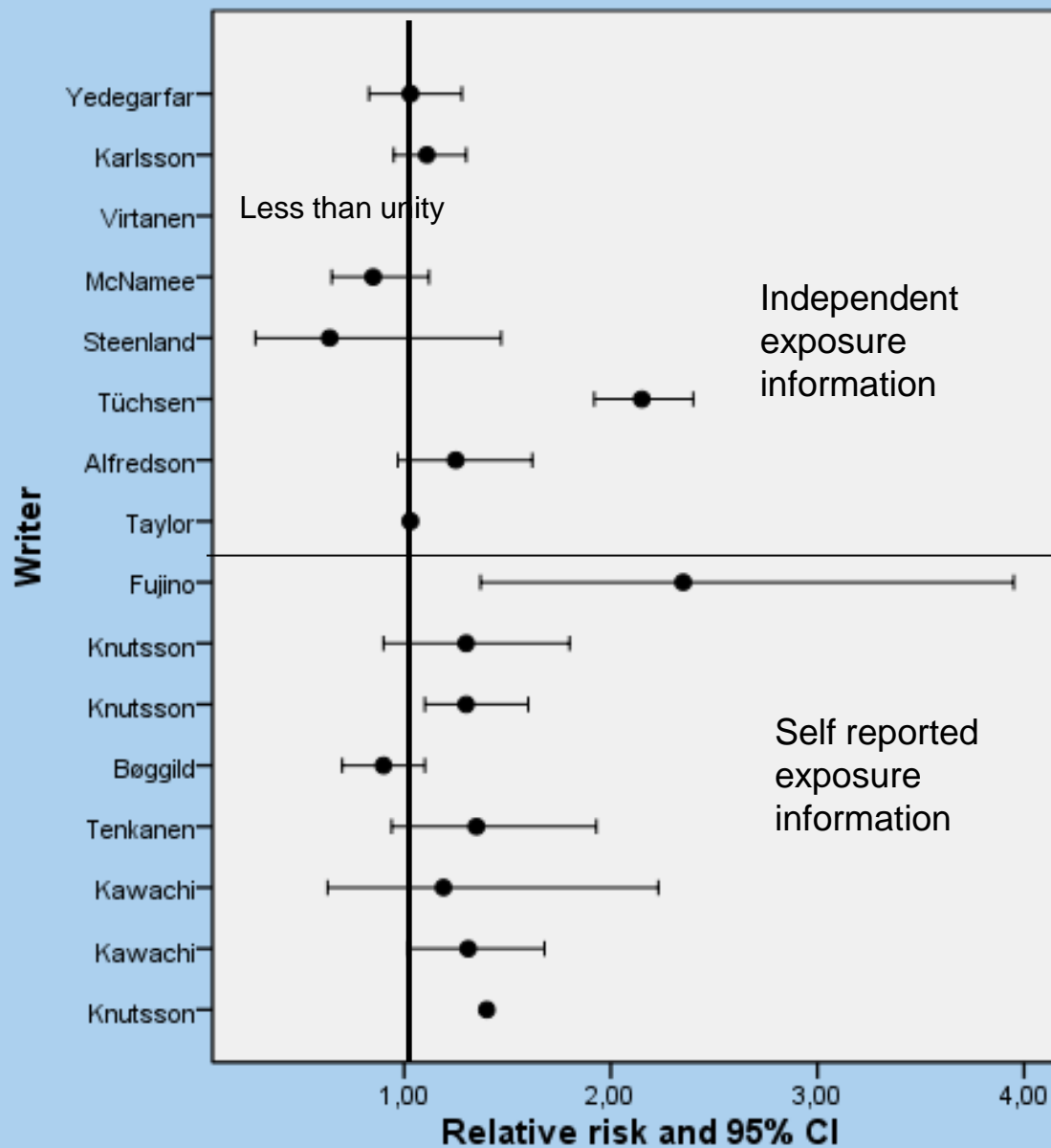
Sources of information on outcome

- Generally based on independent sources like death and patient registers or medical records



Sources of information on shift work

- Individual by self report: six studies
- Individual by company information: four studies
- JEM: four studies

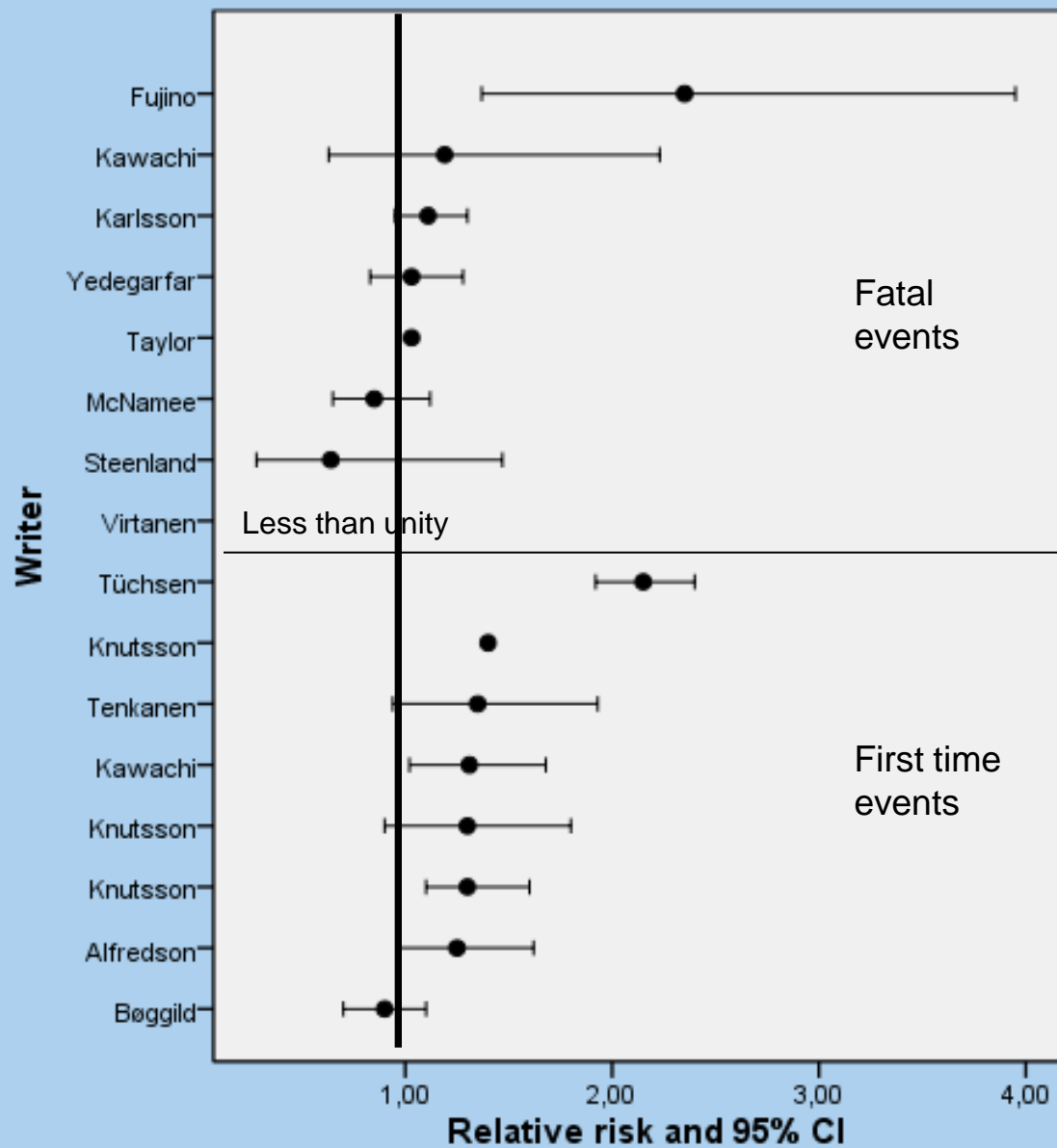


Case definitions

- Fatal cases only: eight studies. (Misses nonfatal events).
- First time events: angina, myocardial infarction, other acute ischemic heart disease, chronic ischemic heart disease, or sudden deaths due to ischemic heart disease: seven studies.

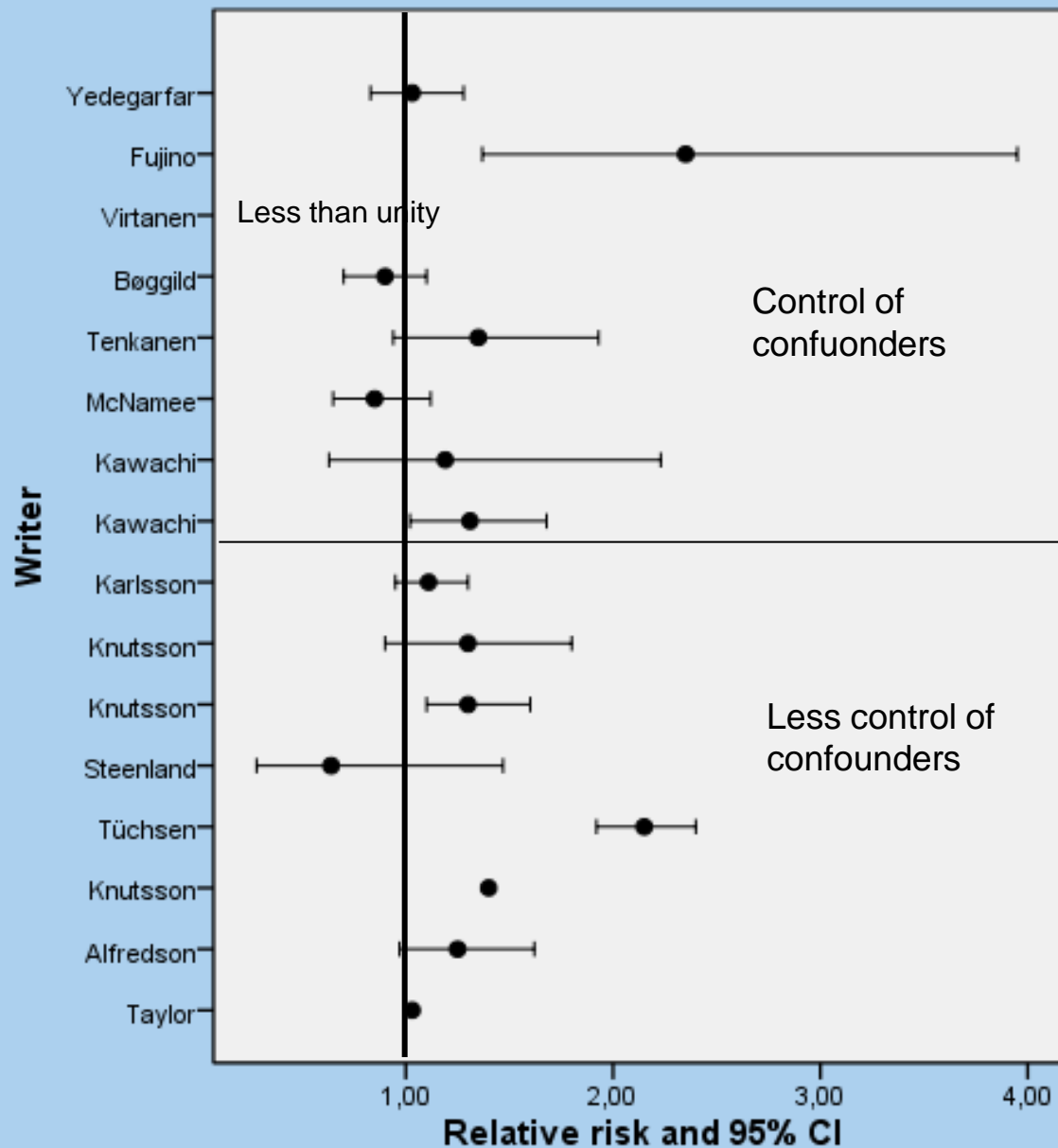
First time events of ischemic heart diseases in Denmark, 2002. (Heart statistics, 2004)

- Total: 24,464
- Angina: 9736
- Myocardial infarction: 8919
- Other ischemic heart disease: 5809
- Fatal cases: ?



Other risk factors considered

- Age: ok
- Gender: ok
- Calendar time: ok
- Smoking: seven studies
- Blood pressure: six studies
- Social class: four studies
- Anthropometry: five studies
- Blood lipids: two studies



Reporting of age and fully adjusted risk estimates

Writer	Cases	Exposed cases	Age adjusted	Fully adjusted
Kawachi	292	93	1.4	1.3
McNamee	467	305	0.8	0.9
Tenkanen	n.r.	n.r	1.4	1.3
Knutsson	1417	252	1.5	1.3
Bøggild	1006	208	1.0	0.9
Fujino	86	18	2.3	2.3
Yedegarfar	635	354	1.1	1.0

Conclusion

shift work and ischemic heart disease

- The available evidence concerning the influence of shift work as such, and of type and duration of shift work, on the risk of ischemic heart disease is too limited to permit any firm conclusion.

Research options – exposure assessment

- Methods for exposure assessment have been inadequate for evaluation of risk in relation to type of shift systems and cumulative exposure.
- Independent information on working hours at the individual level should form the basis for exposure assessment.
- Exposure measures should be driven by hypotheses

Confounding or effect mediation.

- Age, gender and social class should always be controlled
- Other risk factors could be mediator of the effect
- Requirements for repeated measurements

Study design – prospective follow up

Study population
Female and males when entering the labor market and providing information on working hours, social class, age, gender. Dynamic sampling to take advantage of historical information

T-0

Exposed – time varying

Not exposed

Disease

No disease

Disease

No disease

Sub samples for evaluation of mechanisms with follow up on smoking, blood pressure, blood lipids, weight gain, etc.

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Registers unequivocal id