Occupational risk of myocardial infarction: a DOC*X case study – preliminary results on physically demanding work

THE DOC*X COORDINATING TEAM

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Objectives

- To examine the gender specific risk of myocardial infarction (MI) according to a range of occupational risk factors
  - Short-term (triggering) effects
  - Long-term (cumulative) effects

- Occupational exposures of interest:
  - Job demands, decision authority, job strain
  - Noise
  - Sedentary work
  - Ultrafine particulates
  - **Physically demanding work**

Several studies indicate increased risk of IHD related to physically demanding work

Do highly physically active workers die early? A syste
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Petersen *et al. BMC Public Health* 2012, **12**:1070
http://www.biomedcentral.com/1471-2458/12/1070

BMC
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Christina B Peter
and Andreas Hol

Original article

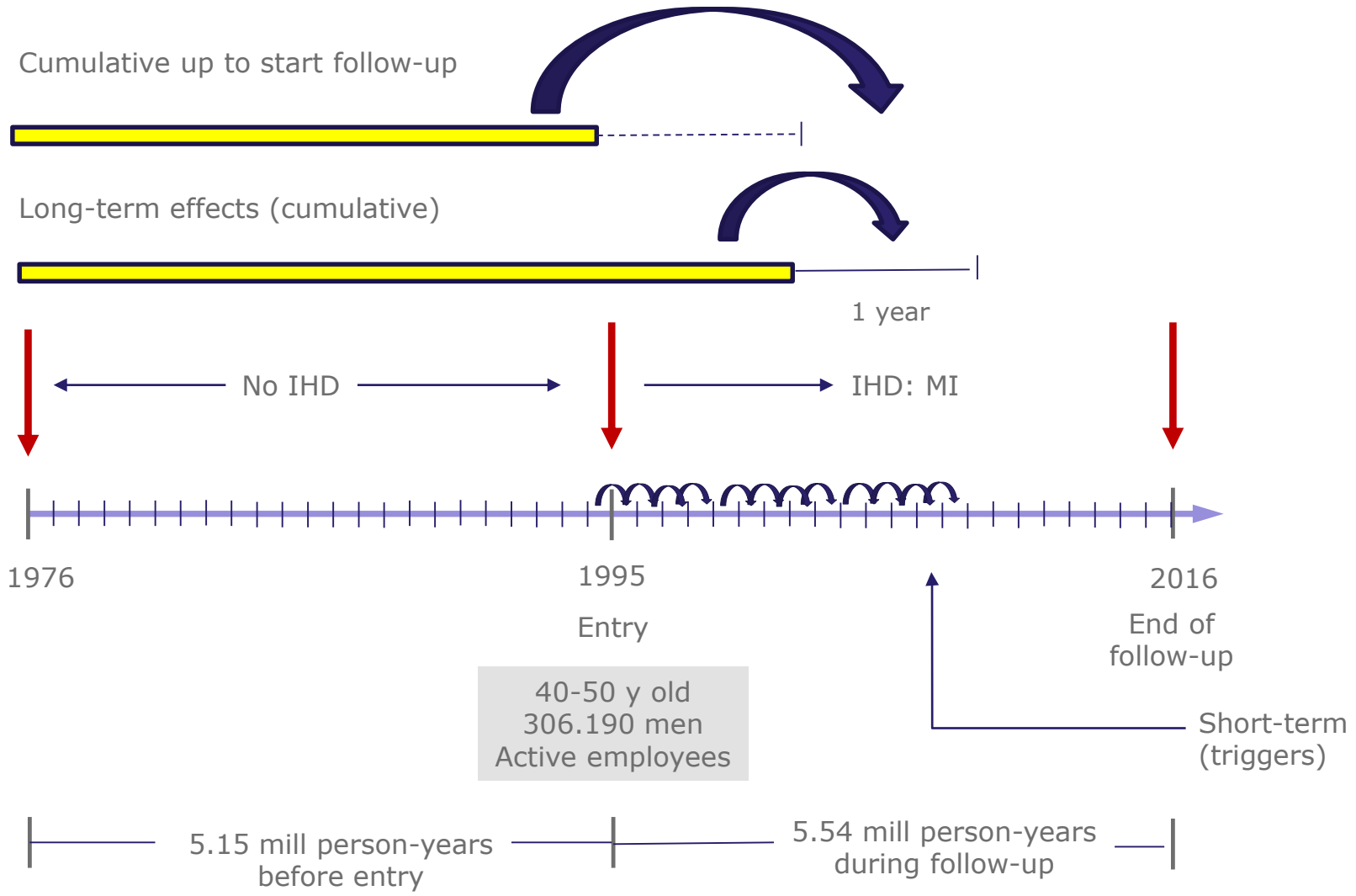
Scand J Work Environ Health 2016;42(5):423-434

doi:10.5271/sjweh.3580

Effects of leisure-time and occupational physical activities on 20-year incidence of acute myocardial infarction: mediation and interaction

by Wang A, Arah OA, Kauhanen J, Krause N

Population and design of analysis



Exposure assessment by JEM using DOC*X edited DISCO-88 job codes

Lower body JEM (Rubak TS et al. BMC Musculoskeletal disorders 2014):

- **Average of 5 blinded expert evaluations** of 372 DISCO job codes
  - Total load of lifted burdens kg/day (264 codes>0 kg, range 0-3.500kg)
  - Frequency of lifting >20 kg/day (262 codes >0, range 0-42 times)

Ergonomic demands JEM (Madsen I et al. Occup Environ Med 2018):

- **Age and sex specific average of 8 item scores 0-6 obtained by BLUP modelling in a random population sample (AH 2014) addressing:**
  - Sitting posture
  - Standing and walking
  - Back twisted or bent
  - Arms lifted above the shoulders
  - Repetitive arm movements
  - Squatting kneeling
  - Pushing or pulling
  - Carrying burdens

Range of composit-score 8-48

Outcome ascertainment

- **Incident cases of myocardial infarction** (ICD-10 DI21) during follow-up retrieved from the National Patient registry (1977) and the Danish registry of Mortality

- 20.069 cases during follow-up 1995-2016

Adjustment by potential confounders

- **Registry data:**
  - Gender (by stratification)
  - Age
  - Social position (restriction employees and DISCO-88 main group (1-2 / 3 / 4-5 /6-7 / 8-9)

- **Lifestyle JEM (age, sex and calendar period specific)**
  - Body mass index
  - Tobacco smoking
  - Leisure time physical activity

  Bondo Petersen S et al. OEM 2018

Results: Prediction of IHD by lifestyle JEMs

Smoking Years likelyhood > Q3	**N IHD**	**Years**	**IRR_{age}**	**IRR_{all}**	**95% CI**
<1	2.844	1.257.788	1.00	1.00	-
1-6	2.348	975.111	1.10	1.07	1.01-1.13
7-12	4.200	1.610.750	1.22	1.10	1.05-1.16
13+	7.559	2.268.149	1.45	1.21	1.15-1.27

Grouping by 25, 50 and 90 percentiles

Adjustment by BMI, LFA and education

Results: Prediction of IHD by lifestyle JEMs

LTFA Years > Q3	N IHD	Years	IRR_{age}	IRR_{all}	95% CI
<1	3.217	993.140	1.00	1.00	-
1 -2	2.526	844.616	0.96	0.96	0.92-1.02
3-12	8.090	3.158.176	0.90	0.90	0.87-0.94
13+	3.118	1.115.866	0.83	0.87	0.83-0.92

LTFA: Leisure time physical activity

Grouping by 25, 50 and 90 percentile

Time-varying cumulative approach

Prediction of IHD by heavy lifting JEM

Time varying exposure previous year

Total kgs/day	N IHD	Years	IRR_{age}	IRR_{all}	95% CI
0 kg	7.265	2.659.567	1.00		
1 – 200 kg	1.096	391.444	1.08		
201- 1800 kg	6.863	2.499.571	1.10		
1801+ kg	1.615	523.300	1.26		

Grouping by 25, 50 and 90 percentile

Prediction of IHD by heavy lifting JEM

Time-varying exposure previous year

Total kgs/day	IHD	Years	IRR_{age}	IRR_{all}	95% CI
0 kg	7.2	2.659.567	1.00	1.00	-
1 – 200 kg	1.096	444	1.08	1.02	0.95-1.09
201- 1800 kg	6.863	2.4	1.10	0.87	0.82-0.91
1801+ kg	1.615	523.30	1.26	0.89	0.83-0.95

No short-term effect of heavy lifting

Grouping by 25, 50 and 90 perce

Prediction of IHD by heavy lifting JEM:

Cumulative exposure 1976 up to previous year

Helthy worker selection??

Total … year	N IHD	Years	IRR_{age}	IRR_{all}	95% CI
0.0 - 0.4 t	…05	3.156.615	1.00	1.00	-
0.4 – 5.9 t	2…	2.816.660	1.25	1.16	1.06-1.26
6.0 - 38.3 t	8.209	…7.741	1.57	1.14	1.04-1.24
38.4+ t	3.719	1.1…0	1.59	1.05	0.87-1.27

Grouping by 25, 50 and 90 p…ntiles

Prediction of IHD by heavy lifting JEM:

Cumulative exposure from 1976 up to baseline

Total ton-year to 1995	N IHD	Years	IRR_{age}	IRR_{all}	95% CI
0.0 - 0.4 t	3.026	2.659.567	1.00	1.00	-
0.4 – 5.9 t	3.234	391.444	1.26	1.13	1.07-1.19
6.0 - 38.3 t	9.000	2.499.571	1.47	1.16	1.10-1.22
38.4+ t	1.691	523.300	1.66	1.16	1.07-1.26

Grouping by 25, 50 and 90 percentile

Prediction of IHD by ergonomic demands JEM:

Time varying exposure previous year from start year of follow up 1995

Ergo demand score 8-48	N IHD	Years	IRR_{age}	IRR_{all}	95% CI
0.0 - 12.9	4.548	2.333.123	1.00	1.00	-
13.0 – 18.3	3.408	2.755.973	0.79	0.90	0.85-0.94
18.4 – 26.5	7.754	5.285.229	0.97	0.84	0.80-0.88
26.6+	1.241	1.208.790	0.92	0.78	0.72-0.83

Grouping by 25, 50 and 90 percentile

Conclusion: preliminary findings!

- Long-term heavy lifting may increase the risk of IHD independent of lifestyle and education – but no short-term effect
- Women similar findings
- Komposit proxy for occupational activity not related to IHD
- Residual confounding still an issue

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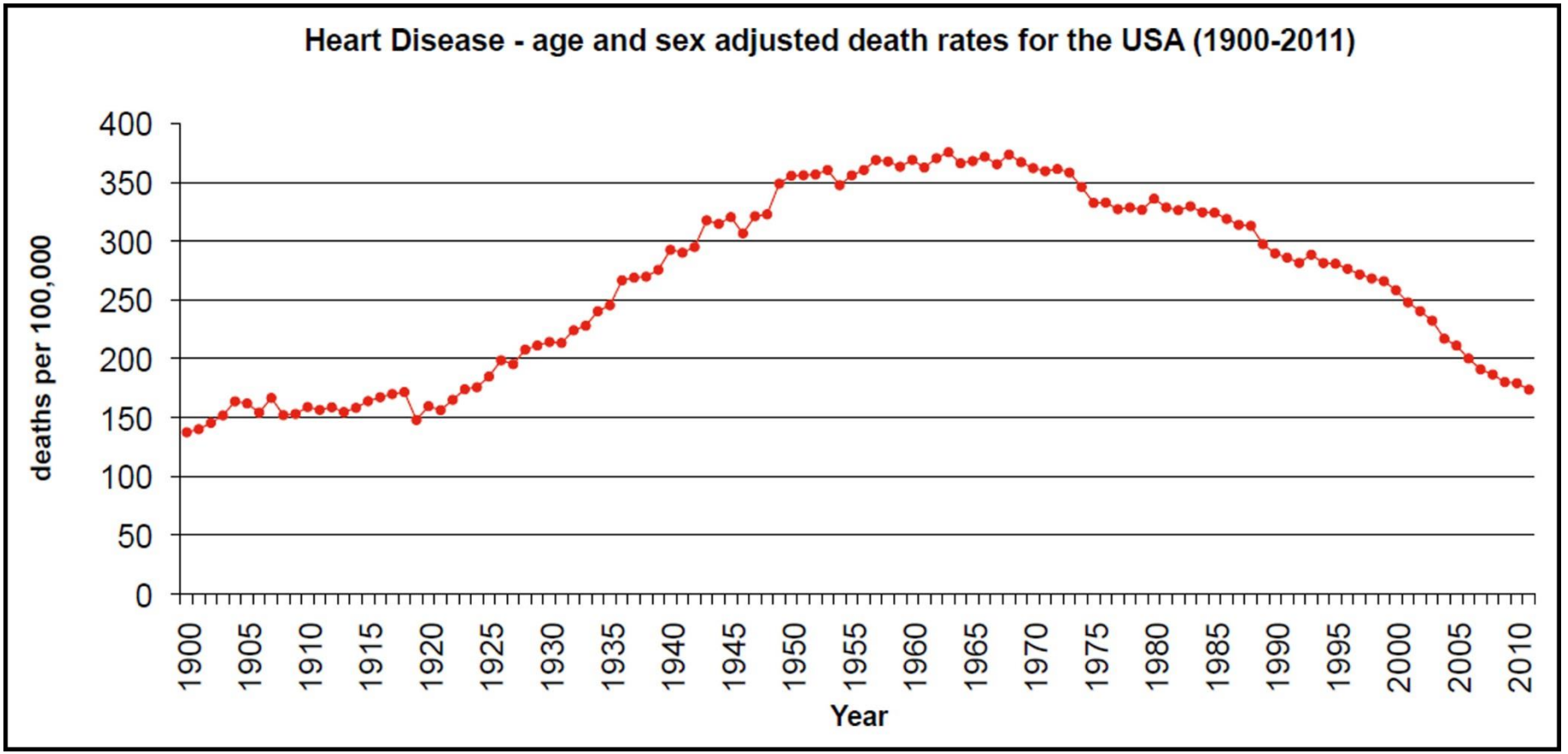
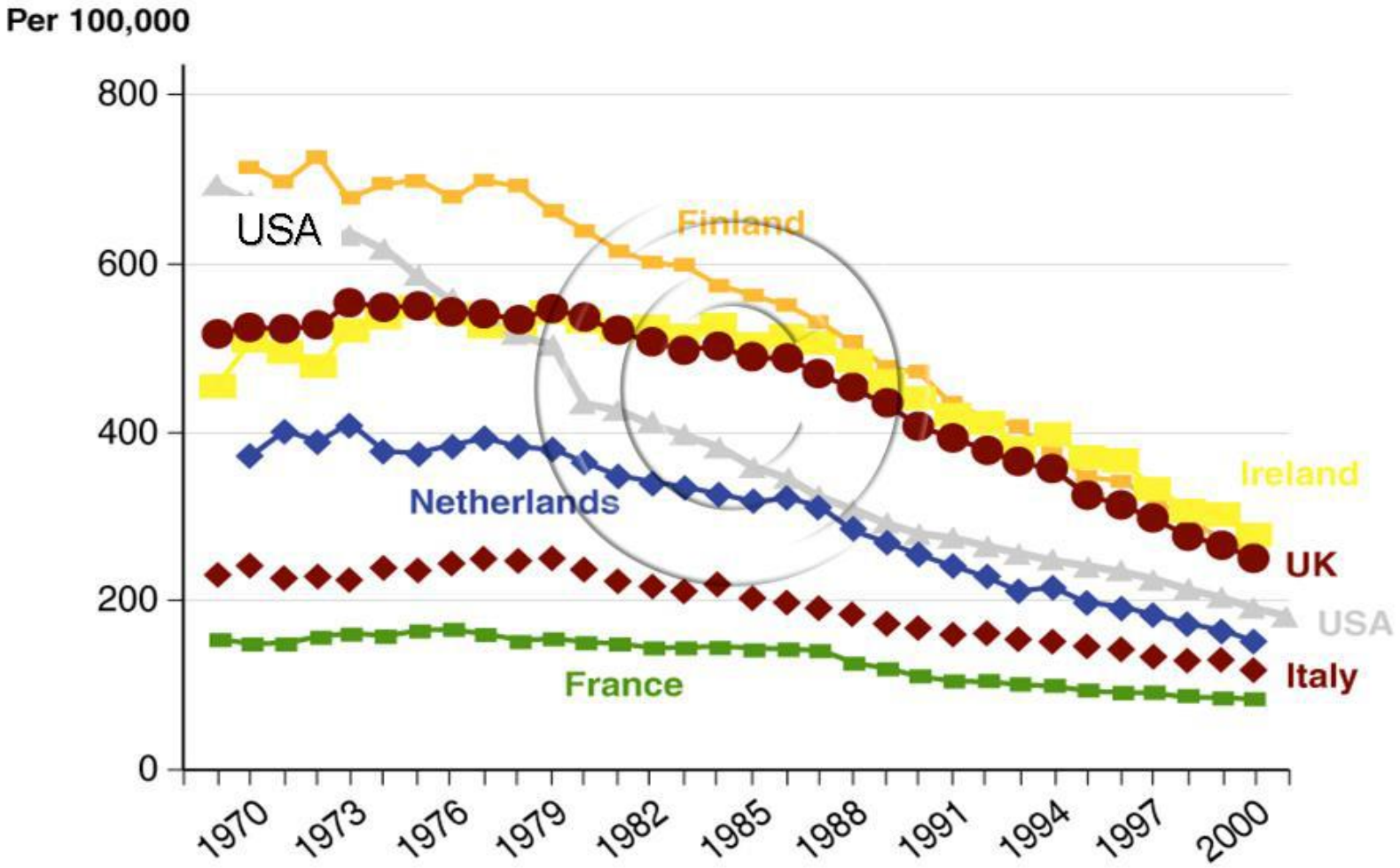


The American Journal of Medicine
Volume 129, Issue 3, Pages 307-314 (March 2016)

International CHD Mortality Trends in Men: 1968-2003



Source: WHO statistics, 2004; men aged 35-74, standardized.

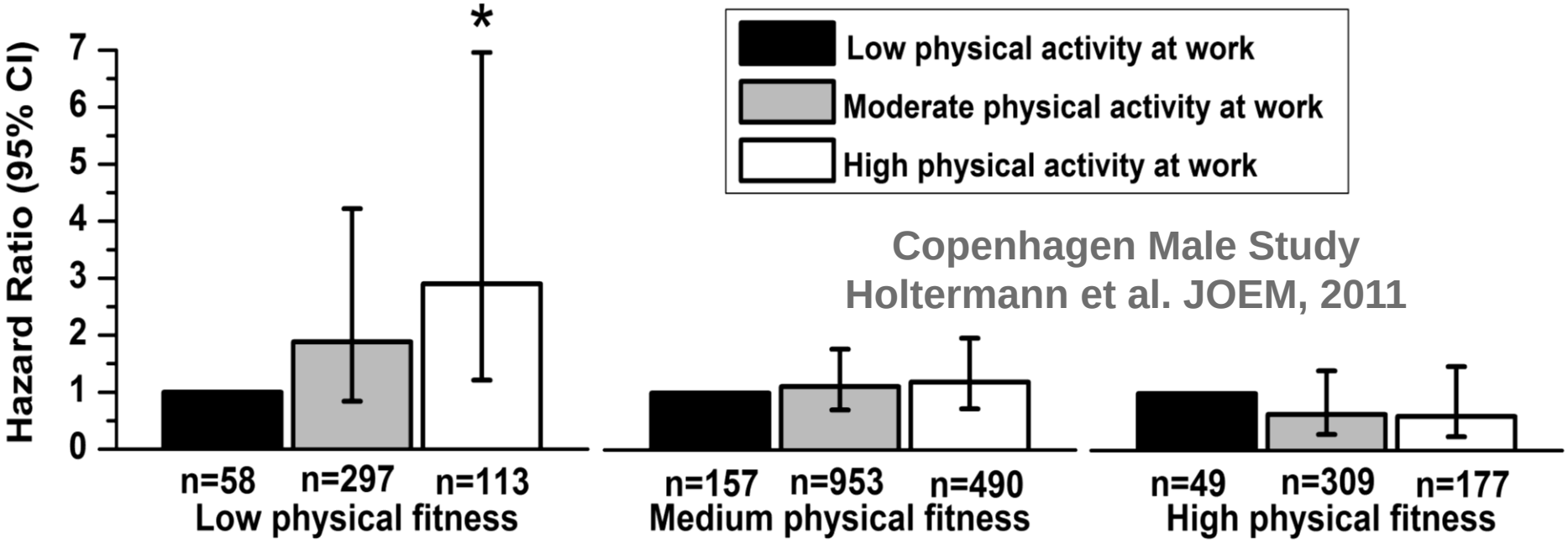
Background

- IHD mortality declining past 50 years, but morbidity less so and IHD is still a leading cause of death

- A range of occupational risk factors have been reproted but lack of scientiifc consensus on causality remains an issue

- Methodological limitations:
    - Crude exposure assessment by individual recall
    - Selective reporting
    - Publication bias
    - Confounding
    - Inconsistent findings across studies

Risk of cardiovascular disease according to high physical work load



Cox's model adjusted for age, BMI, smoking, systolic blood pressure, diastolic blood pressure, diabetes (treatment), hypertension (treatment), alcohol consumption and leisure time physical activity

Only including lower social class men

Study population: subset of DOC*X cohort

Danish male citizens who in 1995 were 40-50 years old, gainfully employed and without cardiovascular hospitalisation up to 1995 with follow-up from 1995 through 2016 until 65 years of age, IHD, death or emigration

MEN 40-50 years in 1995	N Persons	N Person-years	
		Before entry 1976-1994	At risk 1995-2016
All employees	314.751	5.622.813	6.267.908
With valid Disco88 codes	312.553 (99.3%)	5.268.017 (93%)	5.680.119 (91%)
Without CVD before entry	306.190 (97.3%)	5.154.144 (91.7%)	5.538.608 (88.4%)

Design of analysis

Risk of hospitalisation/death by myocardial infarction during follow-up from 1995 through 2016 according to (Poission reg):

Trigger effect: level of exposure the preceding year (one year lag)

Cumulative effect: n years from 1976-previous year with exposure above 75%

Cumulative effect: n years 1976-1994 with exposure above 75% (possible healthy worker effect)

Occupational and non occupational JEMs treated similarly