Workshop ICOH-CVD conference Varese, 2017

Occupational physical activity and Cardiovascular disease: Research updates and international collaboration

Els Clays
Niklas Krause
Andreas Holtermann

8:15 **Welcome**
Els Clays, Ghent, Belgium
Andreas Holtermann, Copenhagen, Denmark
Niklas Krause, Los Angeles, CA, USA

8:20 **Introductions around the table: current research teams and questions** (Attendees)

8:40 **The emergence of an OPA health paradox**
Andreas Holtermann, Copenhagen, Denmark

9:00 **Risk modifiers & vulnerable worker populations: Interactions between**

a) OPA & CHD (10 min)
Niklas Krause, Los Angeles, CA, USA

b) OPA & psychosocial job factors (10 min)
Els Clays, Ghent, Belgium

c) OPA & Hypertension (10 min)
Karen Allesoe, Copenhagen, Denmark

9:30 **Emerging specific OPA risk factors:**

a) Sitting (10 min)
David Hallman, Gävle, Sweden

b) Standing (10 min)
Niklas Krause, Los Angeles, CA, USA

c) Lifting (10 min)
Mette Korshøj, Copenhagen, Denmark

d) Shift work (10 min)
Karin I. Proper, Bilthoven, The Netherlands

10:10 **Break**

10:30 **Aerobic exercise interventions**
Mette Korshøj, Copenhagen, Denmark

10:50 Pathophysiological model of OPA and CVD
Niklas Krause, Los Angeles, CA, USA

11:10 **OPA and autonomous nervous activation**
b) OPA vs LTPA and effects on heart rate variability
David Hallman, Gävle, Sweden

11:30 Research methods:

a) How to measure OPA using sensor technology in the field? (20 min)
Andreas Holtermann, Copenhagen, Denmark

b) How to operationalize OPA in analyses? Exploring thresholds and non-linear dose responses (20 min)
Jian Li, Düsseldorf, Germany

12:10 Lunch break

13:10 Future research questions, plans, collaborations:

a) Reviews and meta-analyses(13:10 – 13:40)
Pieter Coenen, Amsterdam, The Netherlands (15 min)
Jian Li, Düsseldorf, Germany (15 min)

b) New, ongoing or planned projects or data collections on OPA – CVD (13:40-14:50)
Els Clays, Ghent, Belgium (10 min)
Pieter Coenen, Amsterdam, The Netherlands (10 min)
Melker Johansson (MSJ), Copenhagen, Denmark (10 min)
Karin I. Proper, Bilthoven, The Netherlands (10 min)
Mette Korshøj / Andreas Holtermann, Copenhagen, Denmark (10 min)
Niklas Krause, Los Angeles, CA, USA (10 min)
Contribution from other attendees (10 min)

Break (14:50-15:10)

e) Suggestions and planning for future collaboration (15:10-15:30)

15:30 End

FORSKNINGSCENTER FOR ARBEJDSMILJØ

The emergence of an OPA health paradox on CVD

ICOH-CVD workshop
Varese 2017

Andreas Holtermann

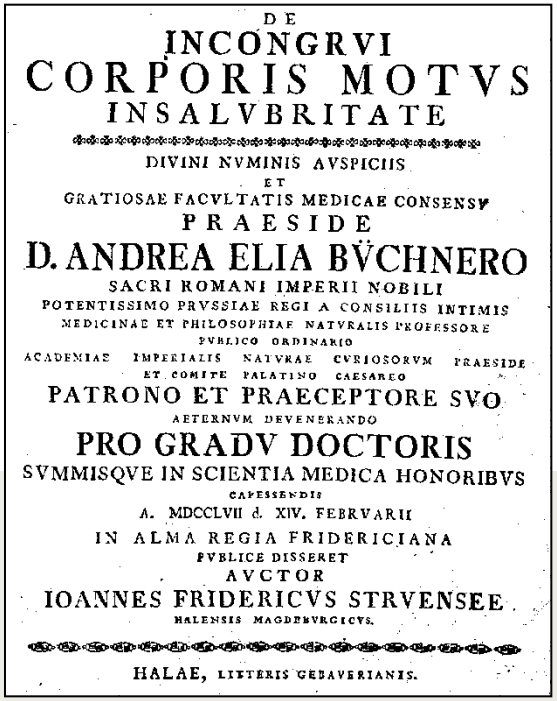
NATIONAL RESEARCH CENTRE
FOR THE WORKING ENVIRONMENT

Johann Friedrich Struensee 1738-1772

Doctoral thesis “On the detrimental health effects of physical work activity”

Two types of physical activity

- If the purpose of the activity is to promote health (physical activity at leisure)
- If the physical activity is for other purposes than promoting health (work)



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INCONGRVI
CORPORIS MOTVS
INSALVBRITATE

DIVINI NVMINIS AVSPICIIS
ET
GRATIOSAE FACVLTATIS MEDICAE CONSENSV
PRAESIDE
D. ANDREA ELIA BVCHNERO
SACRI ROMANI IMPERII NOBILI
POTENTISSIMO PRVSSIAE REGI A CONSILIIS INTIMIS
MEDICINAE ET PHILOSOPHIAE NATVRALIS PROFESSORE
PVBLICO ORDINARIO
ACADEMIAE IMPERIALIS NATVRAE CVRIOSORVM PRAESIDE
ET COMITE PALATINO CAESAREO
PATRONO ET PRAECEPTORE SVO
AETERNVM DEVENERANDO
PRO GRADV DOCTORIS
SVMMISQVE IN SCIENTIA MEDICA HONORIBVS
CAPESSENDIS
A. MDCCLVII d. XIV. FEBRVARII
IN ALMA REGIA FRIDERICIANA
PVBLICE DISSERET
AVCTOR
IOANNES FRIDERICVS STRVENSEE
HALENSIS MAGDEBVRGICVS.

HALAE, LITTERIS GEBAVERIANIS.

The investigation of differential effects of physical activity at work and leisure on CVD is not novel

Acta Med Scand 209: 277–283, 1981

Physical Activity at Work and at Leisure in Relation to Coronary Risk Factors and Social Class

A 4-Year Mortality Follow-up
The Oslo Study

I. Holme, A. Helgeland, I. Hjermann, P. Leren
and P. G. Lund-Larsen

From Life Insurance Companies' Institute for Medical Statistics and the Medical Out-Patient Clinic, Ullevaal Hospital, Oslo, Norway

It is paradoxical that increasing physical activity at work is associated with increasing mortality.

Acta Med Scand 209: 277–283, 1981

Physical Activity at Work and at Leisure in Relation to Coronary Risk Factors and Social Class

A 4-Year Mortality Follow-up
The Oslo Study

I. Holme, A. Helgeland, I. Hjermann, P. Leren
and P. G. Lund-Larsen

One of the reasons for the discrepancy with regard to the two dimensions of physical activity may be that the type of activity differs. Physical activity at leisure is supposed to confer rather good aerobic capacity to the heart, while in most cases the degree of physical activity at work does not. A high degree of physical activity at work has more to do with heavy lifts during rather short intervals with much sedentary activity in between, i.e. a more anaerobic type of activity.

Cardiovascular workload and CVD

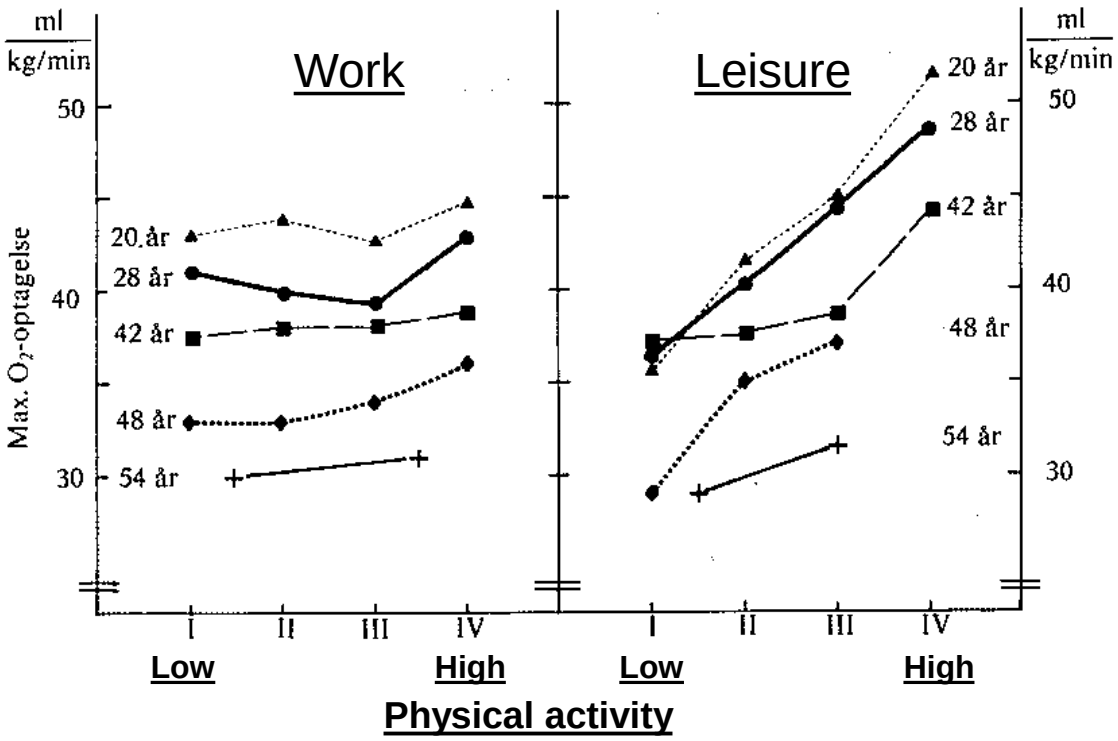
Scand J Work Environ Health 10 (1984) 403—408

Physical load on the cardiovascular system in different work tasks

by Juhani Ilmarinen, PhD[1]

Substantial Finnish research in the 1980-ies on how physical fitness determines the cardiovascular workload at any given task and importance for CVD, and the cardiovascular load in different occupational groups (much on forest workers) and on older workers

Does high physical work demands enhance physical fitness?

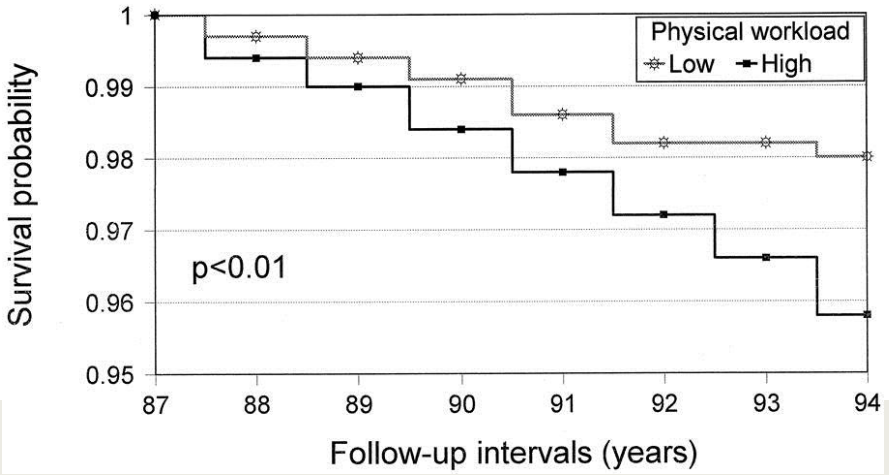


Modified from Bengt Saltin, 1986

Physical activity at work:
Risk for cardiovascular diseases and mortality

- Kristal-Boneh et al 2000
- Physical activity at work in 3844 Israeli male industrial workers
- 8 years follow-up on
  - All-cause mortality
  - Cardiovascular mortality

	All-Cause Mortality		CVD Mortality	
Physical Activity at Work	No. of Deaths	Age-Adjusted RR (95% CI)	No. of Deaths	Age-Adjusted RR (95% CI)
Low	30	1.0	14	1.0
High	99	1.88 (1.2–2.8)	41	1.68 (0.9–3.1)
P value	0.002		0.096	



Physical activity at work: Risk for atherosclerosis

Krause and colleagues 2007

- A sample of 612 representative Finnish male workers
- Interview about physical activity at typical workday
- 11-year follow up on progression of atherosclerosis (Carotid intima-media thickness)
- Positive association between energy consumption at work and progression of atherosclerosis

Original article

Scand J Work Environ Health 2007;33(6):405–424

Occupational physical activity, energy expenditure and 11-year progression of carotid atherosclerosis

by Niklas Krause, MD,[1] Richard J Brand, PhD,[2] George A Kaplan, PhD,[3] Jussi Kauhanen, MD,[4] Smriti Malla, MSc,[1] Tomi-Pekka Tuomainen, MD,[4] Jukka T Salonen, MD[4,5]

Krause N, Brand RJ, Kaplan GA, Kauhanen J, Malla S, Tuomainen T-P, Salonen JT. Occupational physical activity, energy expenditure and 11-year progression of carotid atherosclerosis. *Scand J Work Environment & Health.* 2007;33(6):405–424.

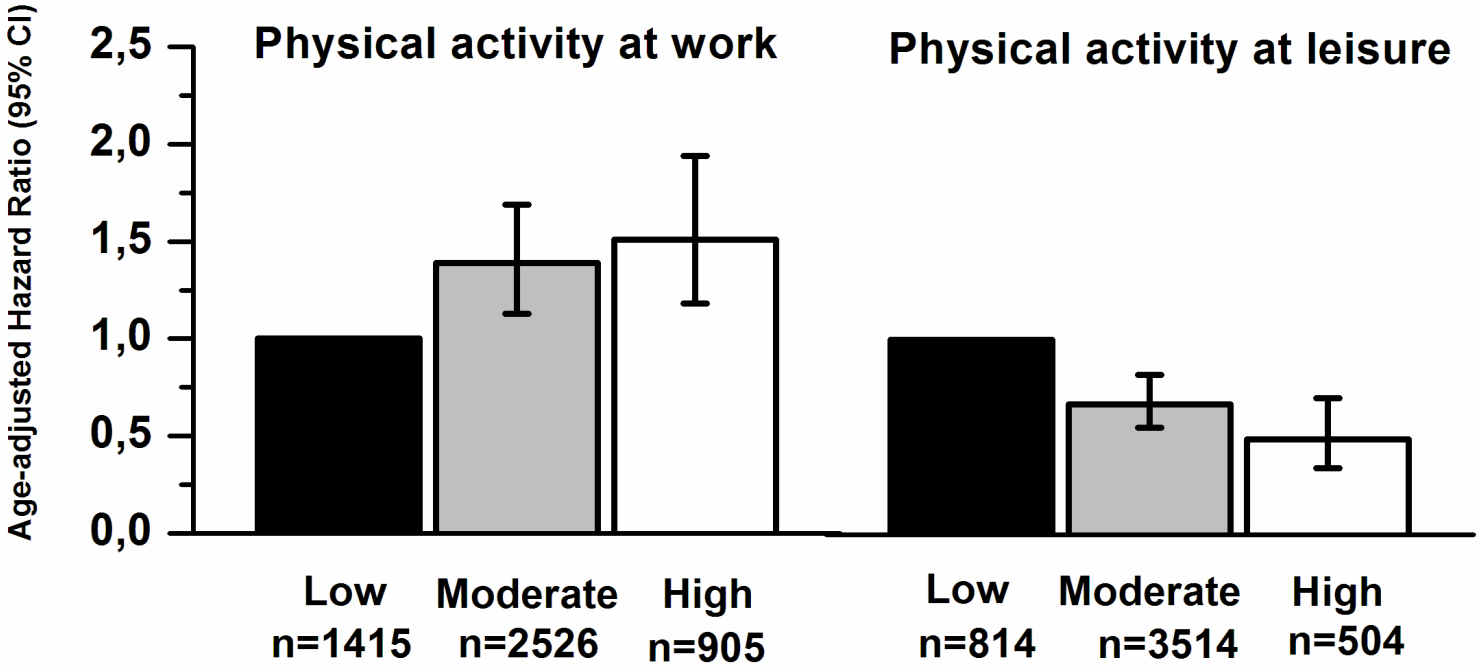
Objectives This study prospectively assessed the effects of occupational physical activity on atherosclerosis progression.

Methods This population-based prospective study of ultrasonographically assessed carotid intima media thickness (IMT) used repeated measures of occupational physical activity during baseline, 4-year, and 11-year examinations of 612 Finnish men 42–60 years of age at baseline. The association between five measures of energy expenditure and the 11-year change in maximum IMT was evaluated in regression models adjusting for 21 potential confounders, including biological factors, leisure-time physical activity, smoking, socioeconomic status, psychosocial job factors, and baseline health status.

Results At baseline, 31% of all the men and 51% of those with ischemic heart disease (IHD) exceeded the recommended maximum levels of relative aerobic strain. All five measures of energy expenditure were significantly associated with adjusted 11-year IMT change. Significant interactions were found between IHD and several measures of energy expenditure. Maximum relative aerobic strain resulted in a 90% increase in IMT among the men with IHD compared with a 46% increase among those without IHD. The men with preexisting carotid stenosis also had higher rates of IMT progression than the men without this condition.

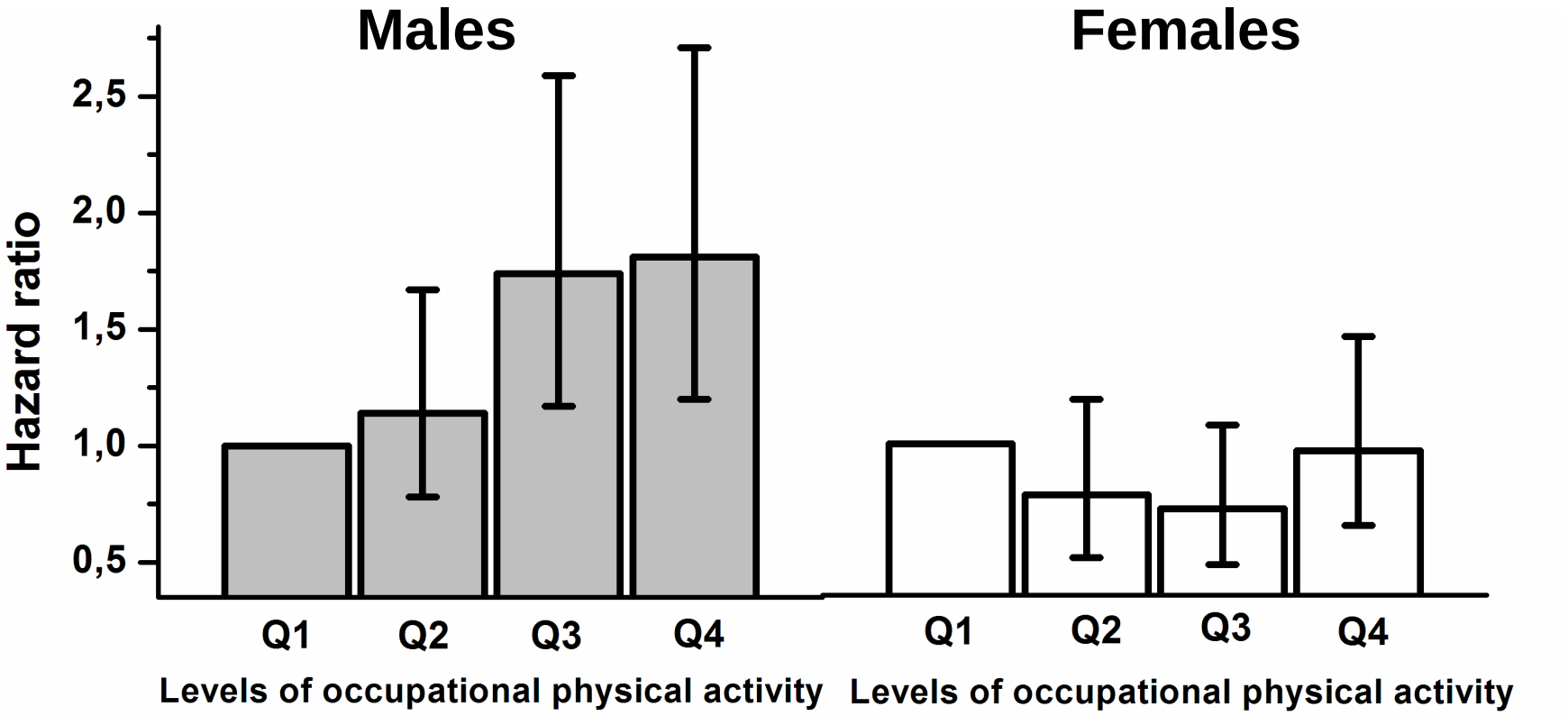
Conclusions This study shows that high energy expenditures at work are associated with an accelerated progression of atherosclerosis even after control for virtually all known cardiovascular risk factors, especially among older workers and workers with preexisting IHD or carotid artery stenosis. The findings support the hemodynamic theory of atherosclerosis and have important implications for workplace surveillance and disease prevention.

Ischemic Heart Disesase mortality Copenhagen Male Study



Holtermann et al. SJWEH, 2009

All-cause mortality
Danish Work Environment Cohort Study

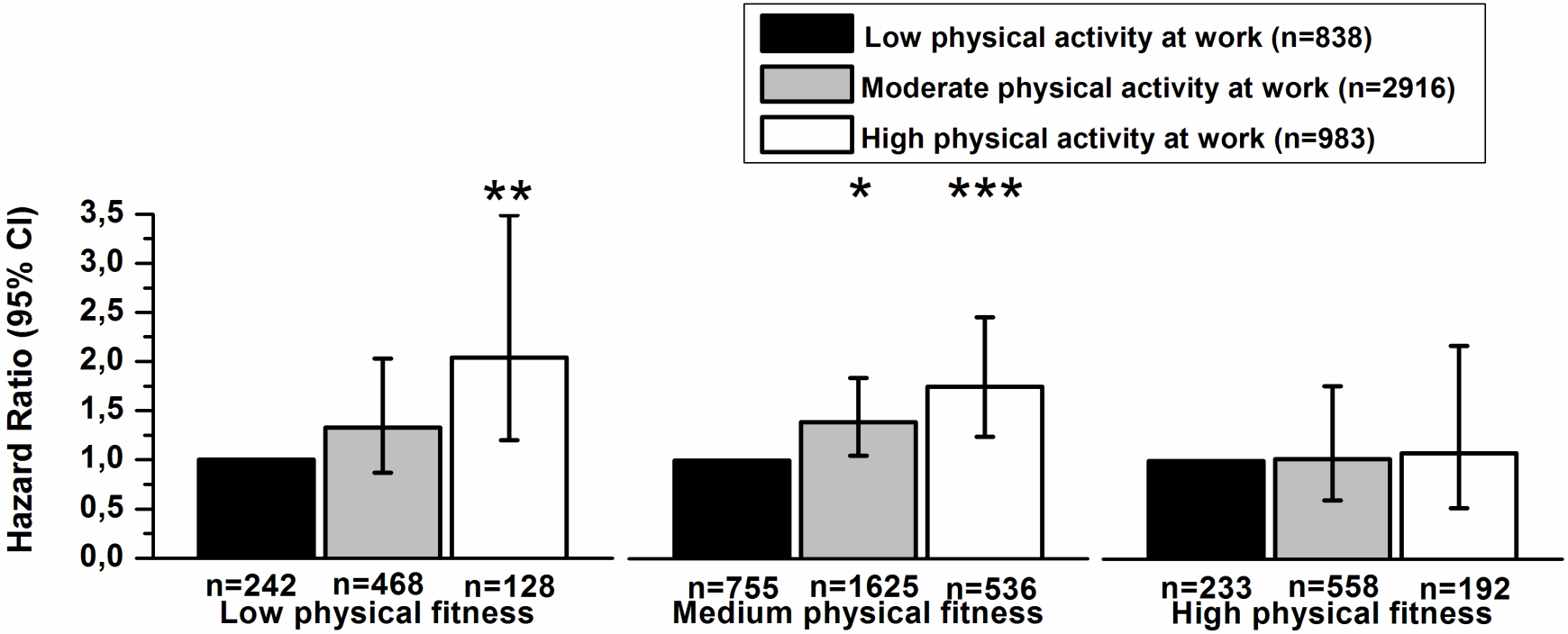


Adjusted for Age, Smoking, Alcohol, BMI, Self-reported diagnosed diseases, Influence at work and Social class

Holtermann et al. IAOEH, 2010

Risk for IHD mortality

Copenhagen Male Study



Cox's proportional hazards regression model controlled for Age, BMI, systolic BP, diastolic BP, diabetes (treatment for), hypertension (treatment of), alcohol use, and smoking (current, never, previous).
*: p < 0.05; **: p< 0.01; ***:p<0.001

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Interaction physical work activity * physical fitness * IHD mortality p=0.002

Holtermann et al. SJWEH, 2010

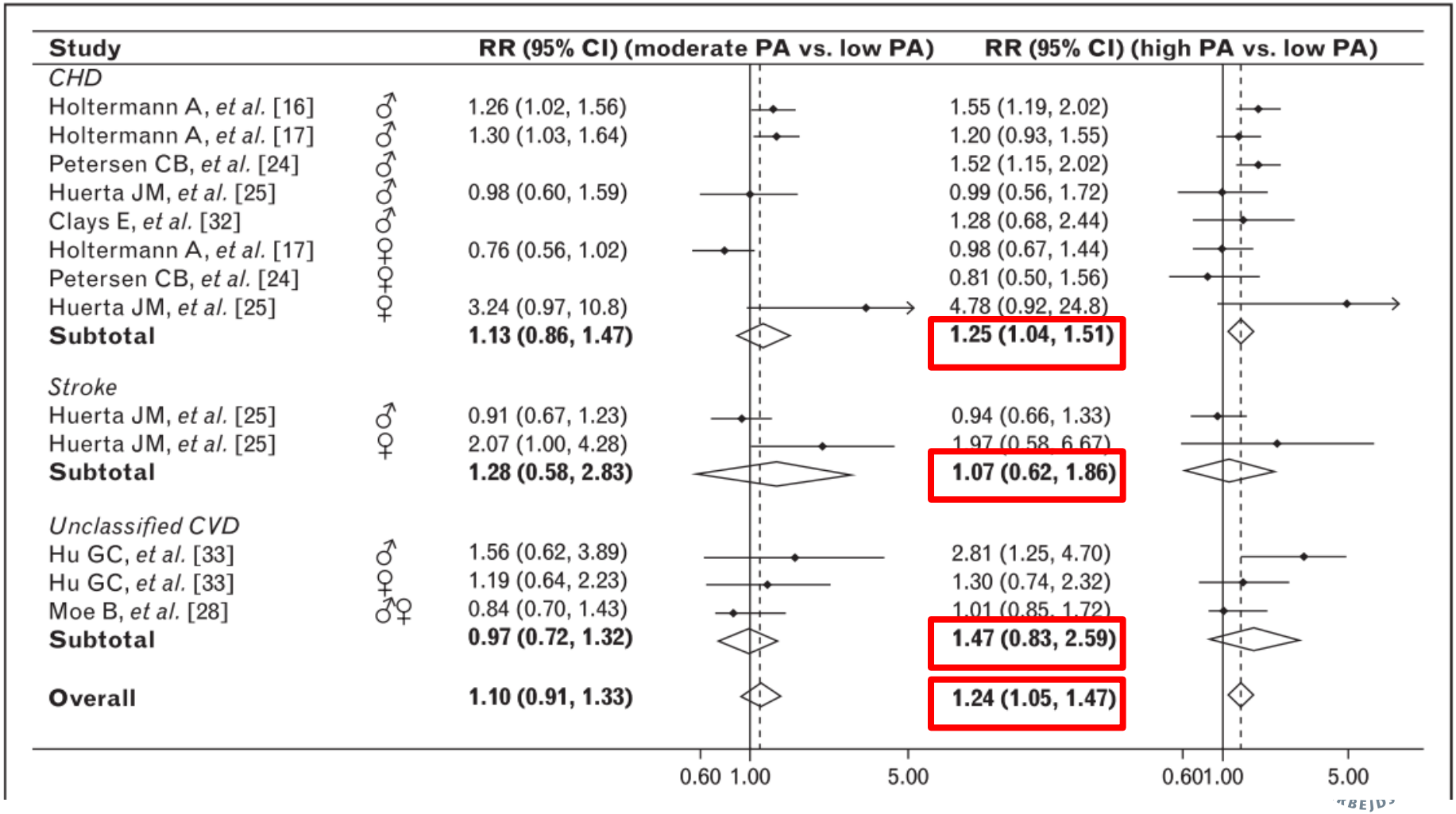
The health paradox of occupational and leisure-time physical activity

Holtermann et al, BJSM 2012

If physical activity is such a valuable health insurance,

how can the most physically active persons in our society have such poor life expectancy?

Meta-analysis of recent studies on occupational physical activity and CVD



Li et al, Current opinion Cardiology, 2013