Sustainable return to work with (ischemic) cardiovascular diseases

Gilbert Wijntjens, MD PhD

Bedrijfsarts – klinisch arbeidsgeneeskundige

Polikliniek Mens en Arbeid, Department Public and Occupational health, Amsterdam UMC

NVKA CONGRES - VRIJDAG 1 NOVEMBER 2024

Disclosure belangen spreker

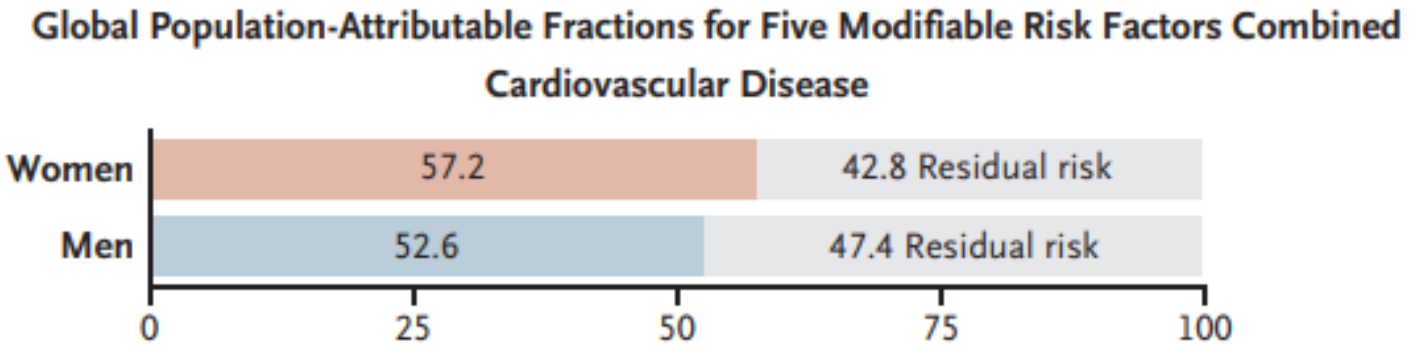
(potentiële) belangenverstrengeling	geen /zie hieronder
Voor bijeenkomst mogelijk relevante relaties met bedrijven	Polikliniek Mens en Arbeid, AUMC HumanCapitalCare B.V.
• Sponsoring en onderzoeksgelden • Adviseurschappen en honorarium incl. sprekersvergoedingen > € 300,00 • Aandeelhouder • Andere relatie, namelijk …..	

Introduction

- 57.2% and 52.6% of cases of incident cardiovascular disease among women and men, respectively, may be attributable to five modifiable risk factors.

- CVD burden continues to rise for almost all countries outside high-income countries, and alarmingly, the age-standardized rate of CVD has begun to rise in some locations where it was previously declining.
- 5-year event rate recurrent ischemic event is 33.5% after ACS

- 19 percent of IHD-mortality for men and 9 percent for women can be attributed to occupational CVD risk factors.



Magnussen N Engl J Med. 2023; Roth JACC 2020; ‘t Mannetje Scand J Work Environ Health 2005; Steen JAHA 2022

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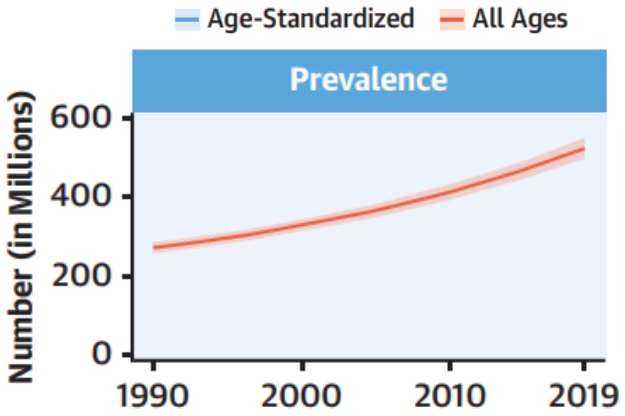

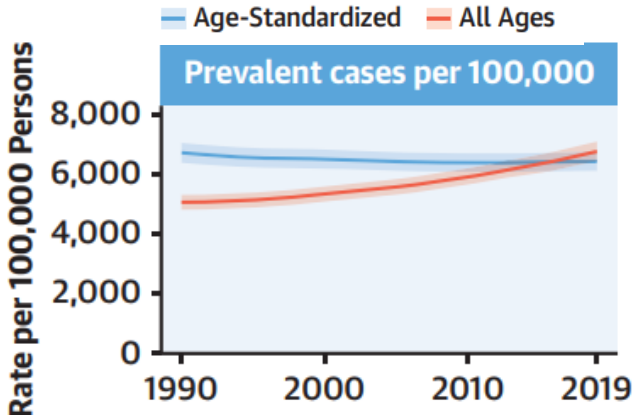

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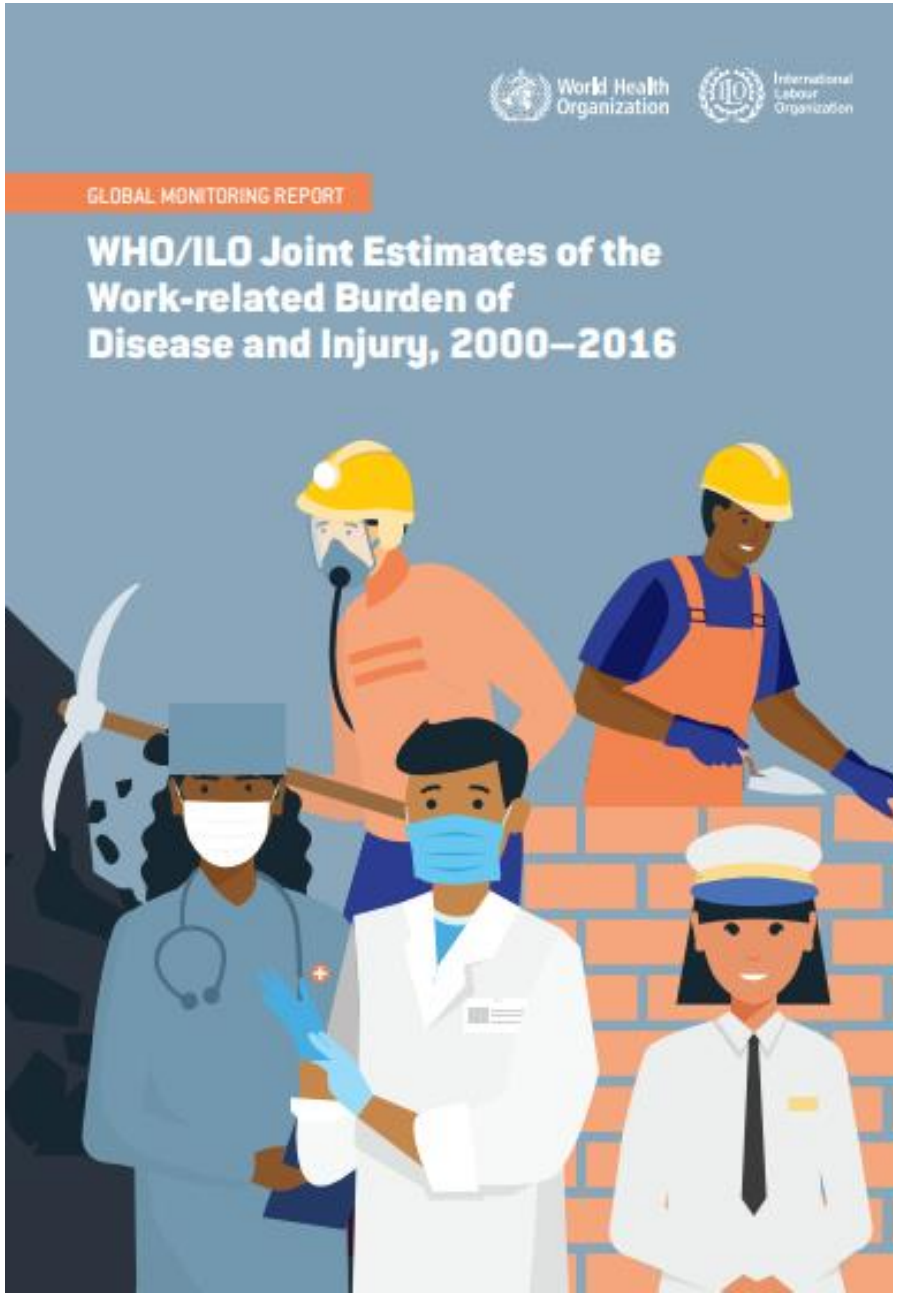
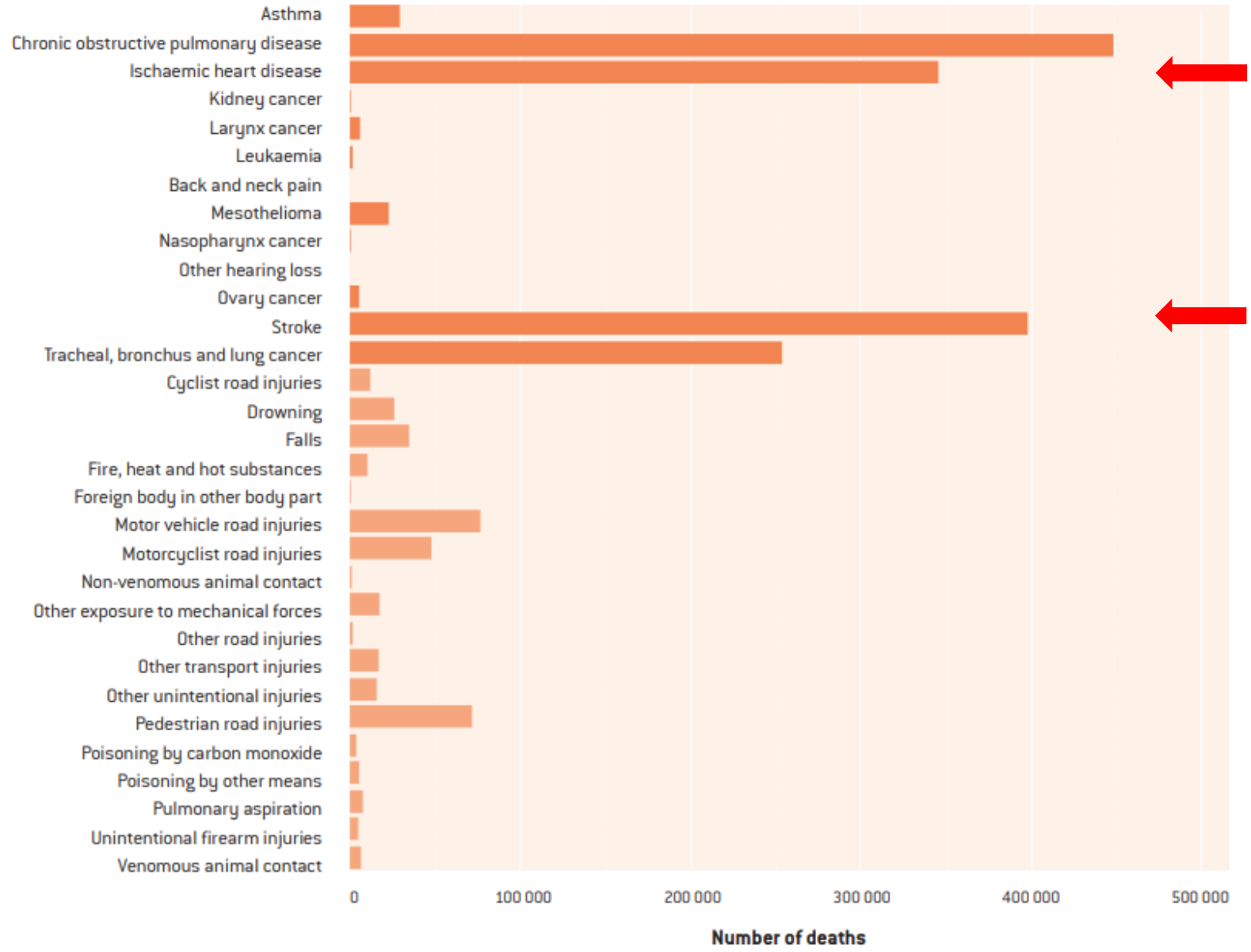


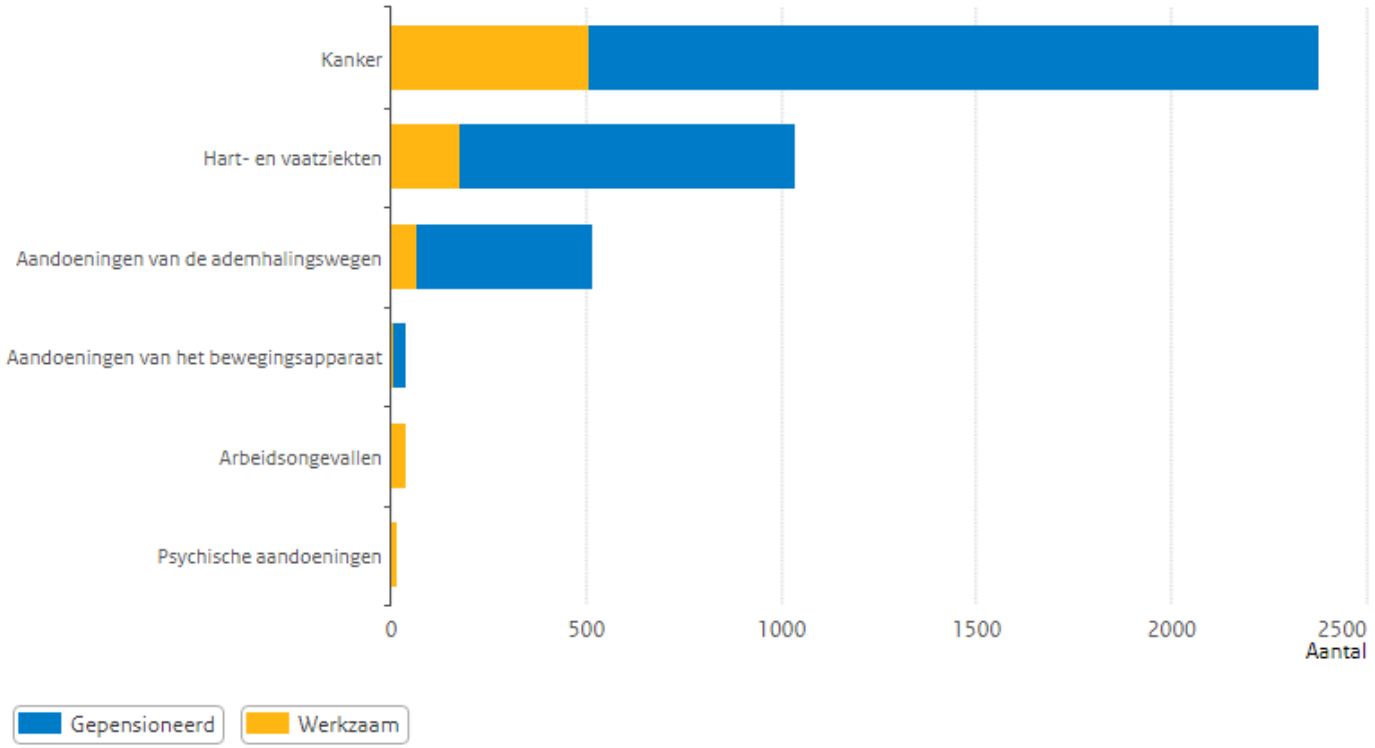
Health outcomes



Beroepsziekten | Sterfte

Wijzigingsdatum 26-04-2024

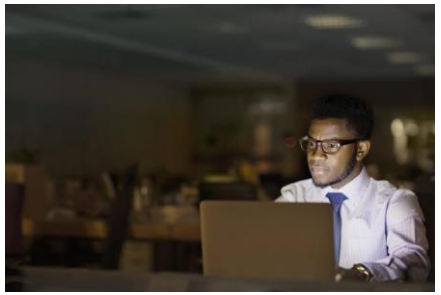
Sterfte beroepsbevolking naar hoofdgroepen 2022



https://www.vzinfo.nl/beroepsziekten/sterfte

Occupational CVD risk factors

- Psychosocial stress: financial stress; job insecurity; mobbing; injustice
- Shift work / irregular working hours
- Long working hours (≥55 hours per week)
- Occupational physical activity
- Sedentary work without compensation
- Chemical hazards
- Occupational noise
- Vibrations
- Ionizing radiation
- Heat/cold



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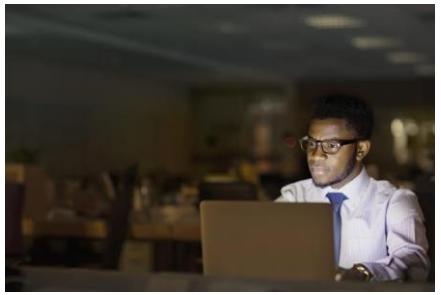
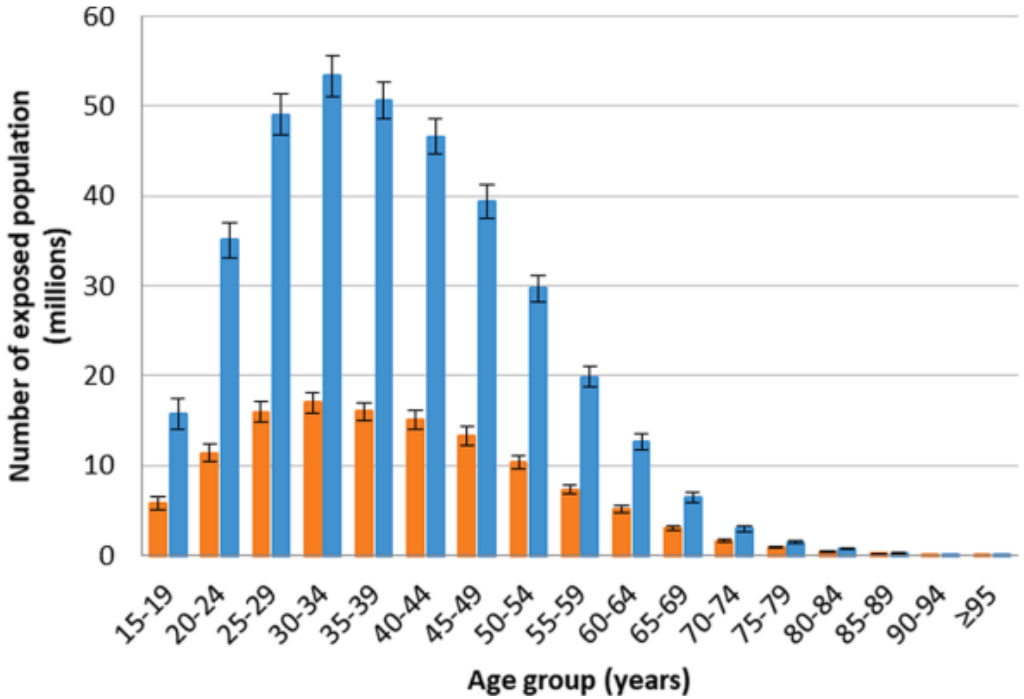
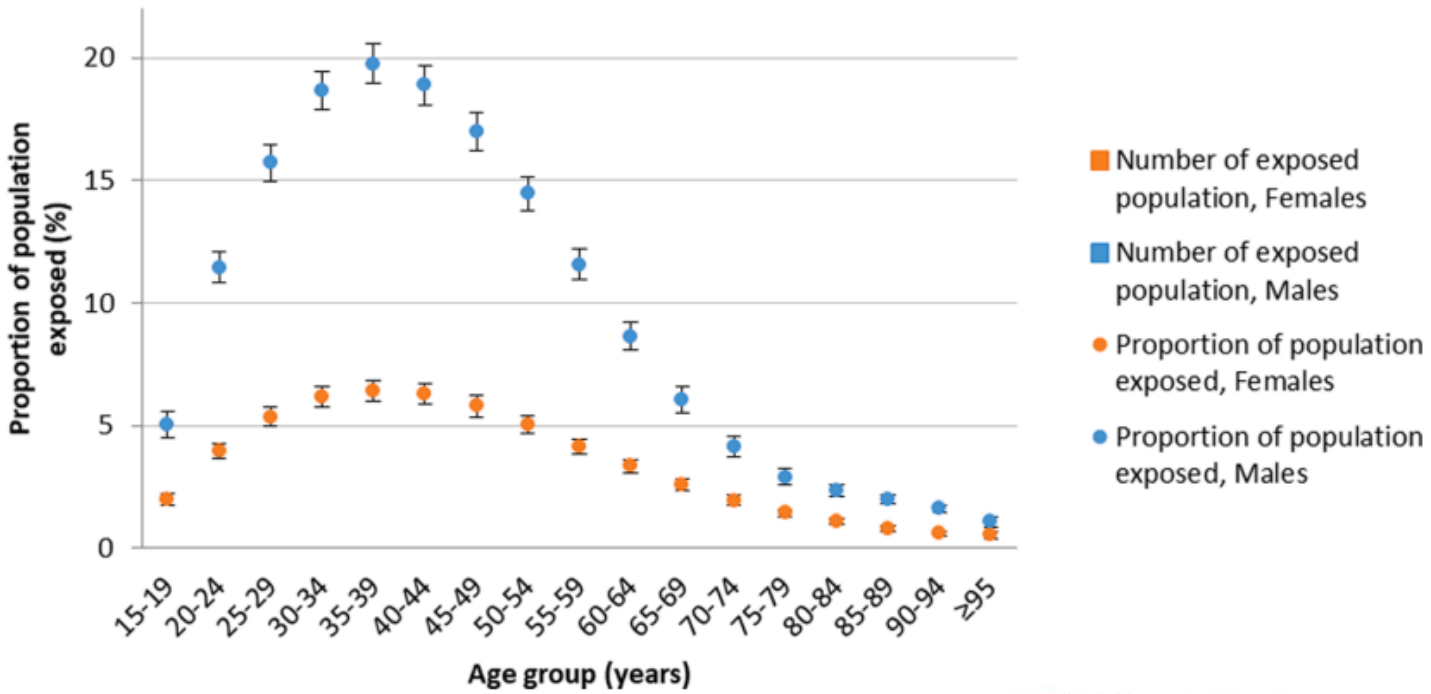


Long working hours: ≥55 hours per week





194 landen

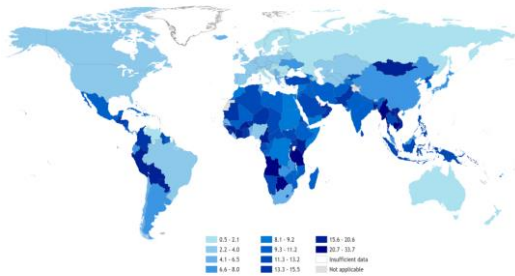
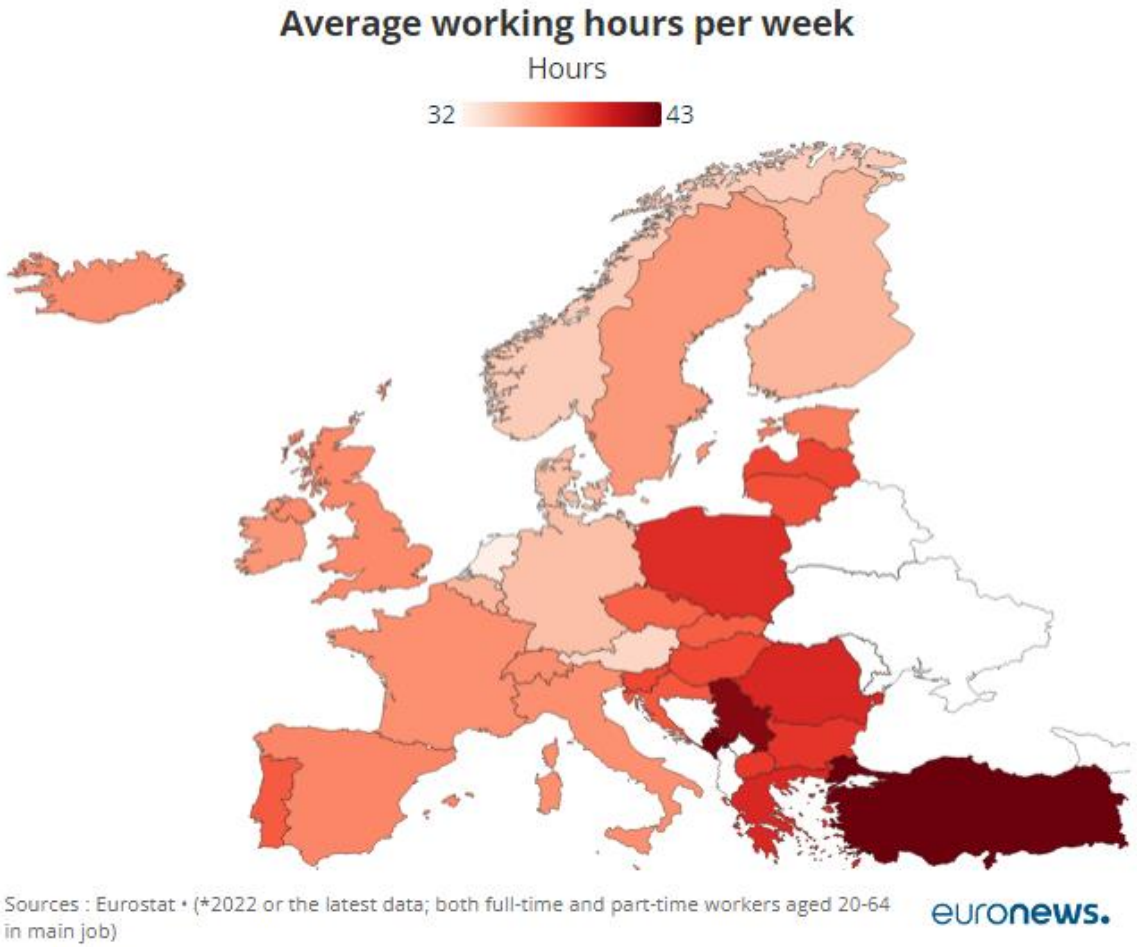
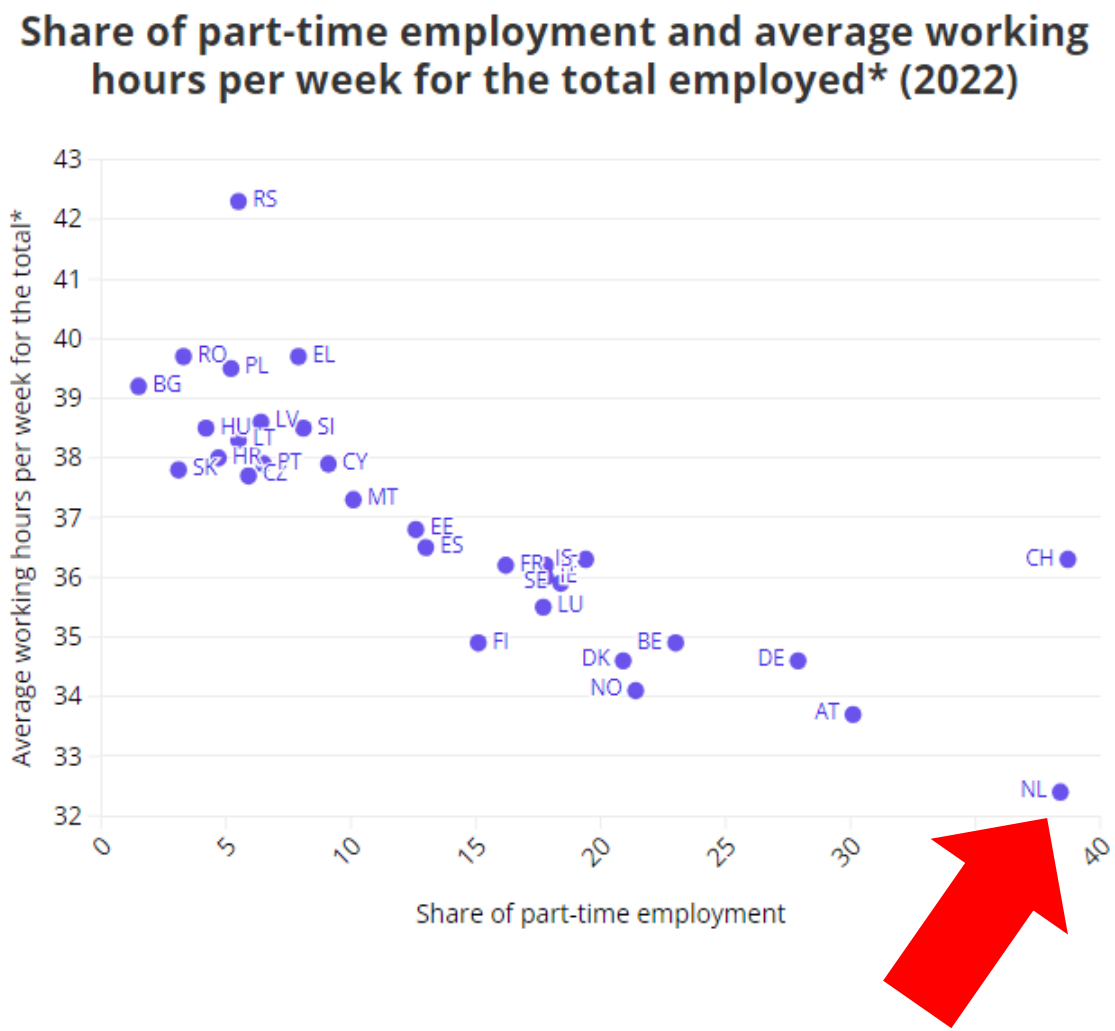


Fig. 3. Proportion (%) of population exposed to long working hours (≥55 hours/week), 2016, 194 countries.


Average working hours per week
Hours
32
43
Sources : Eurostat • (*2022 or the latest data; both full-time and part-time workers aged 20-64 in main job)
euronews.


Share of part-time employment and average working hours per week for the total employed* (2022)
Average working hours per week for the total*
Share of part-time employment
43
42
41
40
39
38
37
36
35
34
33
32
0
5
10
15
20
25
30
40
RS
RO
PL
EL
BG
HU
LV
SI
LT
HR
PT
CY
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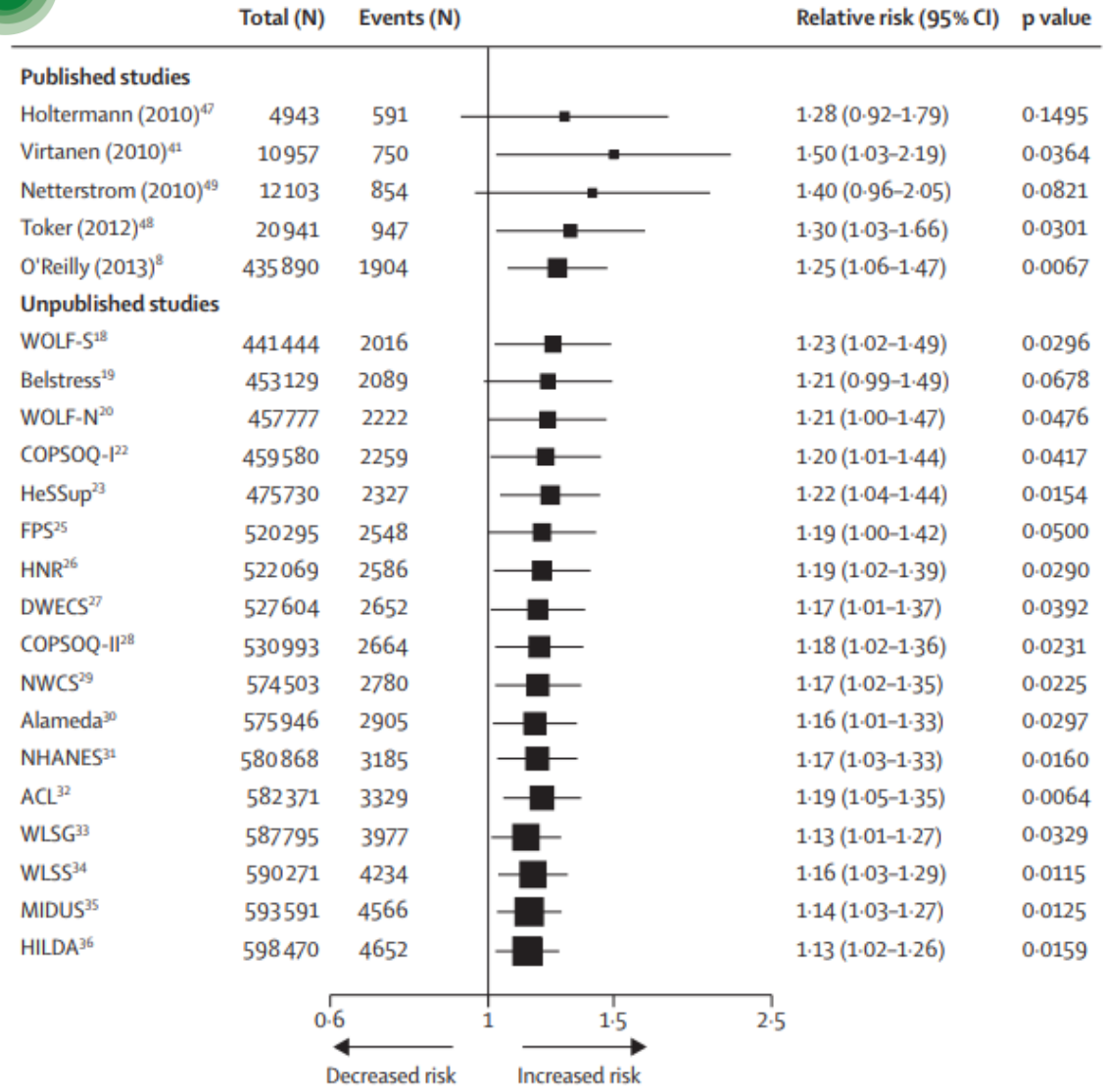
Long working hours:

Coronary heart disease

Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603 838 individuals

Mika Kivimäki, Markus Jokela, Solja T Nyberg, Archana Singh-Manoux, Eleonor I Fransson, Lars Alfredsson, Jakob B Bjorner, Marianne Borritz, Hermann Burr, Annalisa Casini, Els Clays, Dirk De Bacquer, Nico Dragano, Raimund Erbel, Goedele A Geuskens, Mark Hamer, Wendela E Hooftman, Irene L Houtman, Karl-Heinz Jöckel, France Kittel, Anders Knutsson, Markku Koskenvuo, Thorsten Lunau, Ida E H Madsen, Martin L Nielsen, Maria Nordin, Tuula Oksanen, Jan H Pejtersen, Jaana Pentti, Reiner Rugulies, Paula Salo, Martin J Shipley, Johannes Siegrist, Andrew Steptoe, Sakari B Suominen, Töres Theorell, Jussi Vahtera, Peter J M Westerholm, Hugo Westerlund, Dermot O'Reilly, Meena Kumari, G David Batty, Jane E Ferrie, Marianna Virtanen, for the IPD-Work Consortium

- 24 studies, 23 cohorts in Europe, USA and Australia
- N=603 838
- Mean follow-up 8.5 years
- Adjustment: Age, sex, SES
- RR Long working hours (≥55h vs. Standard hours (35-40h)



RR incident CHD: 1.13, 95%-CI 1.02-1.26

Kivimäki Lancet 2015

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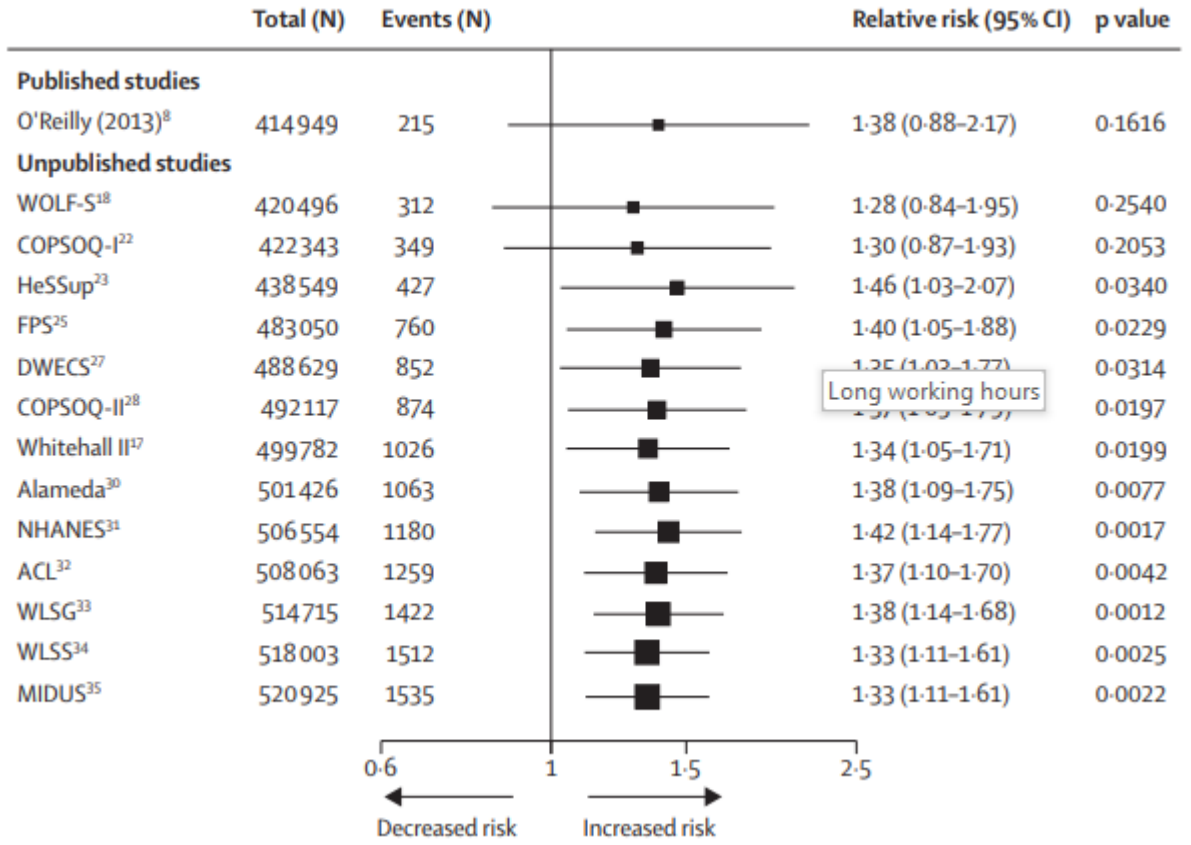

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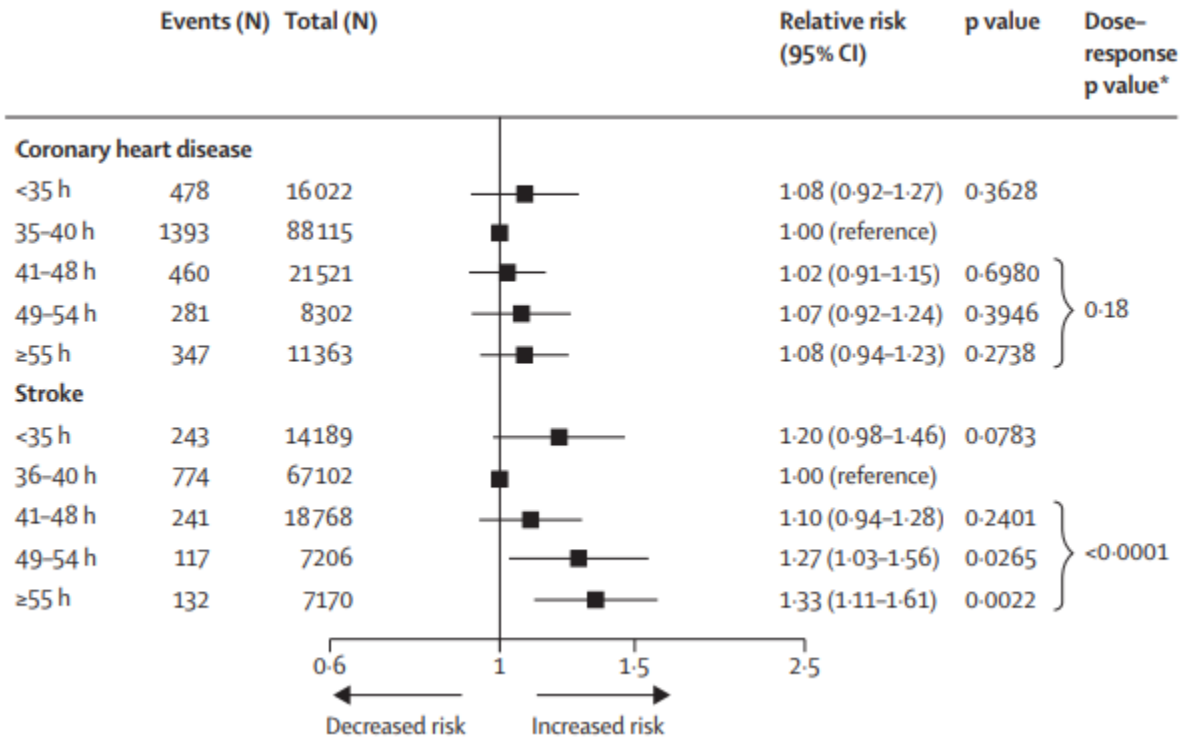

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karōshi

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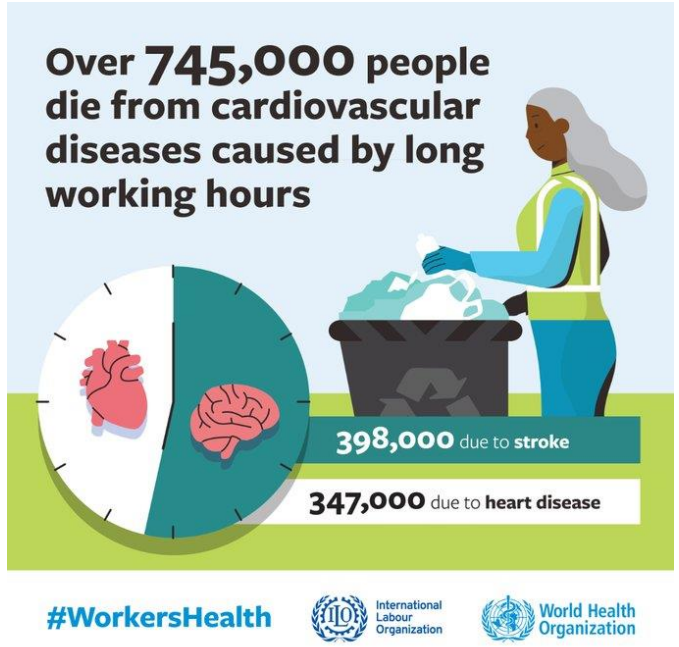
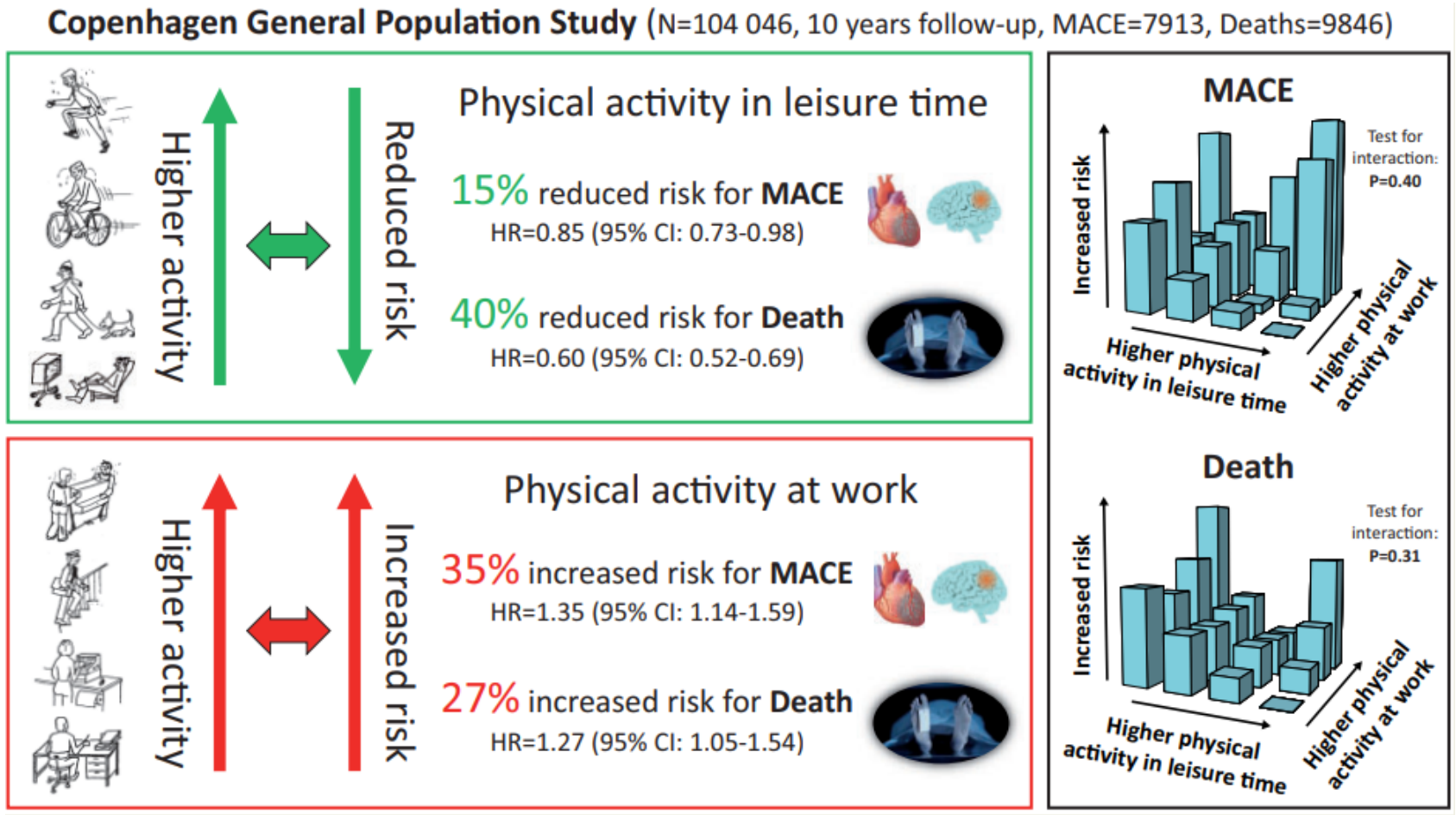


Kivimäki Lancet 2015

Occupational physical activity

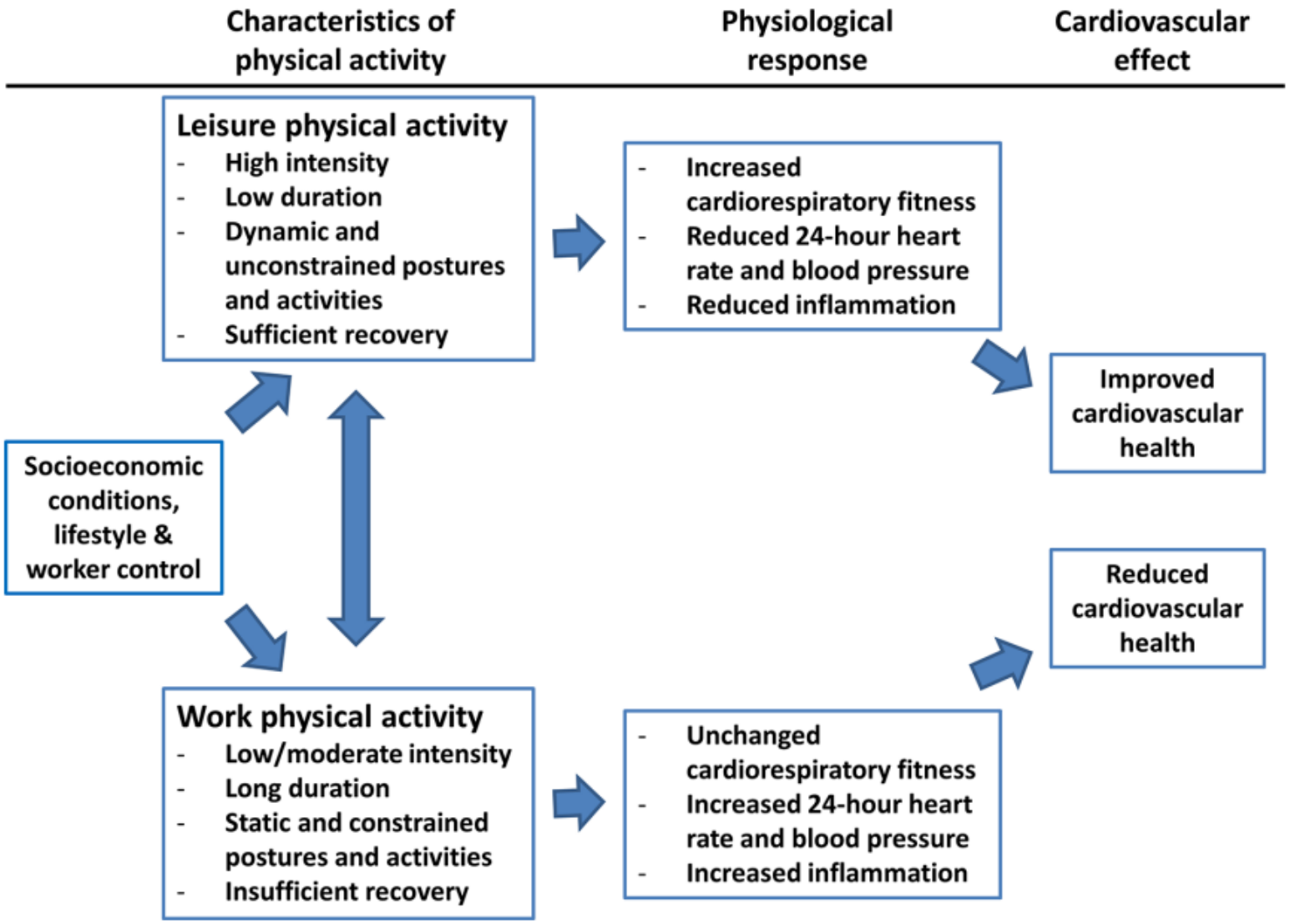
The physical activity paradox in cardiovascular disease and all-cause mortality: the contemporary Copenhagen General Population Study with 104 046 adults

Andreas Holtermann [1]*, Peter Schnohr[2], Børge Grønne Nordestgaard [2,3,4,5], and Jacob Louis Marott [2,3]*



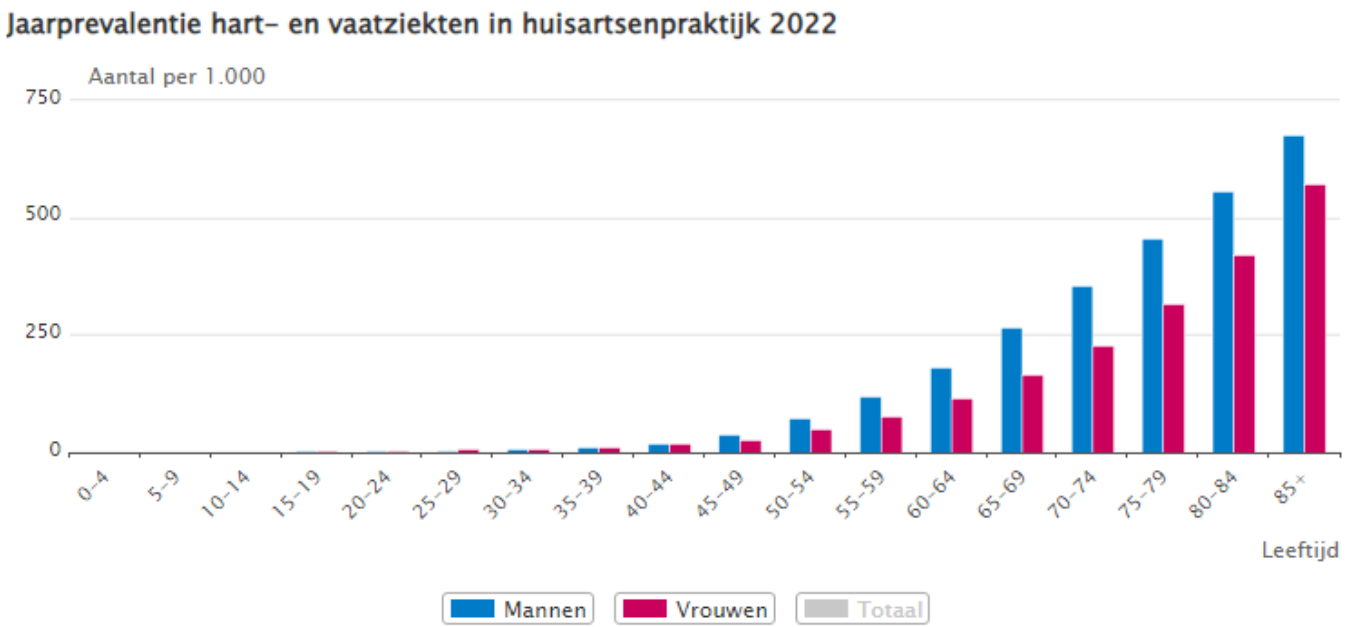
Holterman EHJ 2018

Occupational physical activity



Holterman Br J Sports Med 2018

First myocardial infarction



Ziekenhuisopnamen

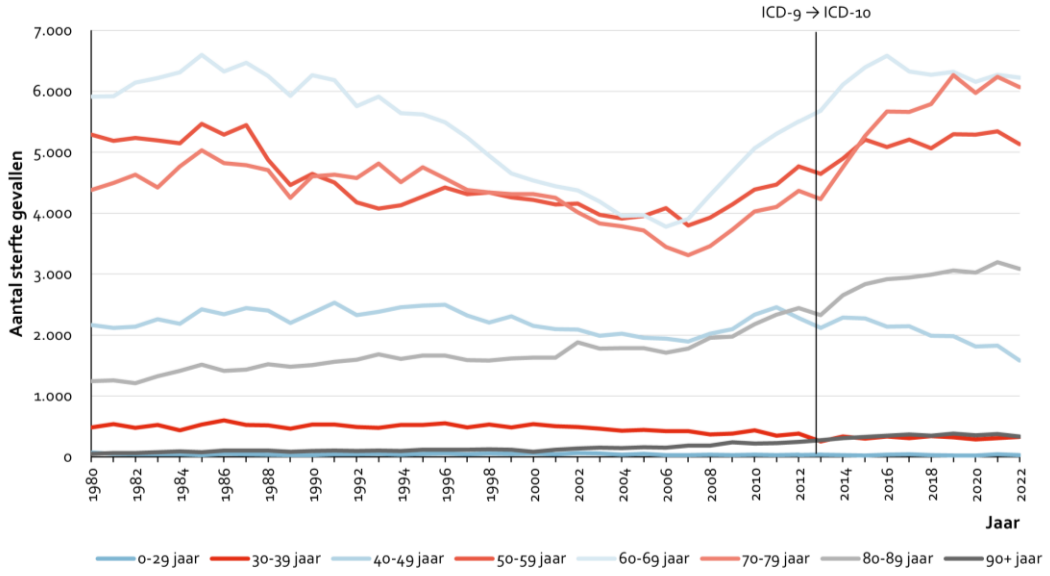
In 2022 vonden er 33.769 ziekenhuisopnamen wegens een hartinfarct plaats, waarvan 22.789 opnamen van mannen en 10.980 van vrouwen. Dit zijn 62 opnamen per dag voor mannen en 30 opnamen per dag voor vrouwen. De gemiddelde leeftijd bij een ziekenhuisopname vanwege een hartinfarct was 67 jaar bij mannen en 71 jaar bij vrouwen.

https://www.vzinfo.nl/hart-en-vaatziekten/leeftijd-en-geslacht/totaal

First myocardial infarction

Figuur 9. Absoluut aantal ziekenhuisopnamen vanwege hartinfarct naar leeftijd in mannen

Bron DHD



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https://www.hartenvaatcijfers.nl/jaarcijfers/basiscijfers-hartinfarct-b35d3

First myocardial infarction

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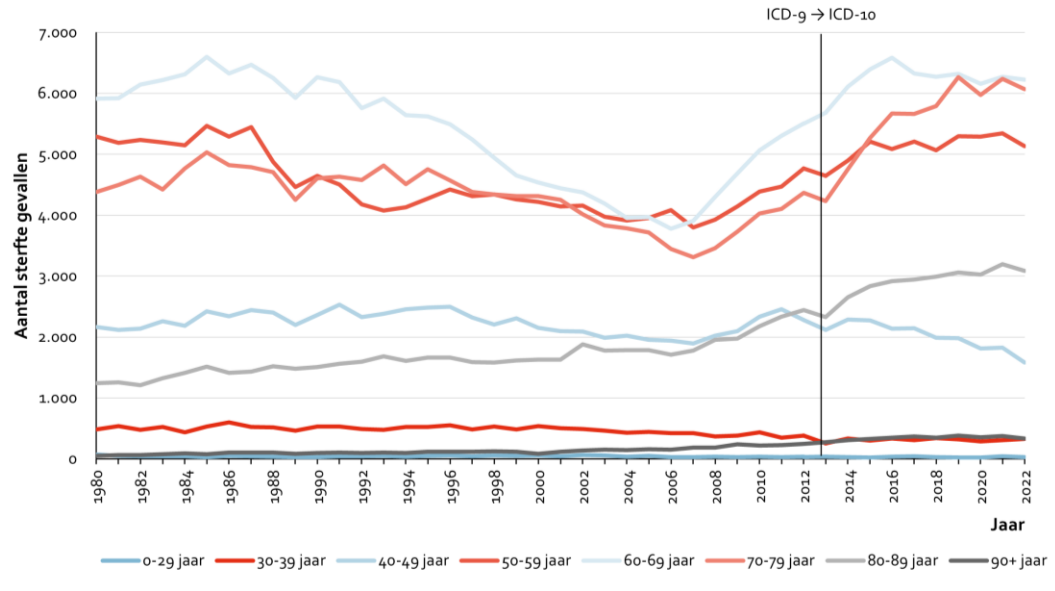

Approximately half of individuals with first MI are of working age!

Return to work: costs

- **Number of patients with IHD in the workforce is increasing**
  - Increasing number of patients with IHD
  - Increasing retirement age
  - Improved treatment strategies
  - Societal demand

- **Economic burden of cardiovascular diseases**
  - Mortality
  - Premature retirement
  - Absenteeism
  - Loss of productivity/presenteeism

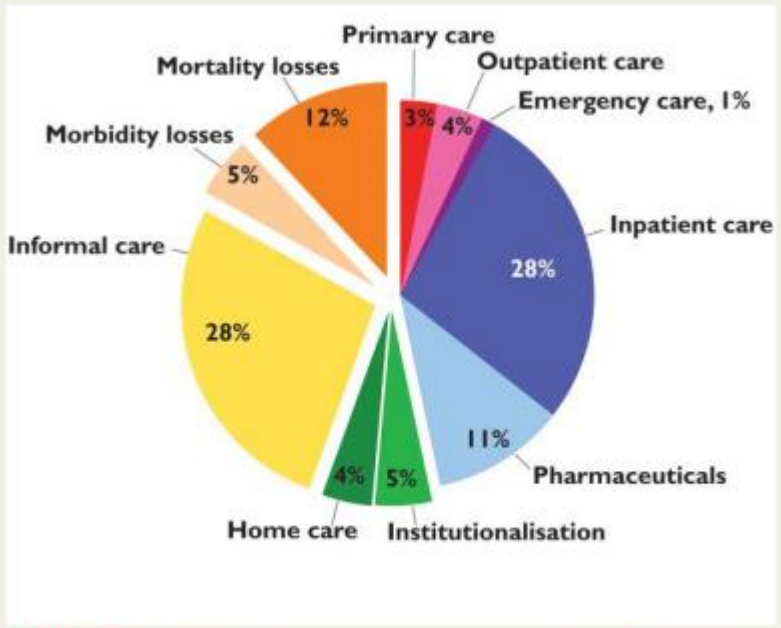

Figure 2 Distribution of cardiovascular disease-related total costs across cost categories

Total costs: 282 mld

Productivity costs: 48 mld (17%)

Informal care costs: 79 mld (28%)

Luengo-Fernandez EHJ 2023

Return to work: costs

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  - Disability
  - Premature retirement
  - Absenteeism
  - Loss of productivity

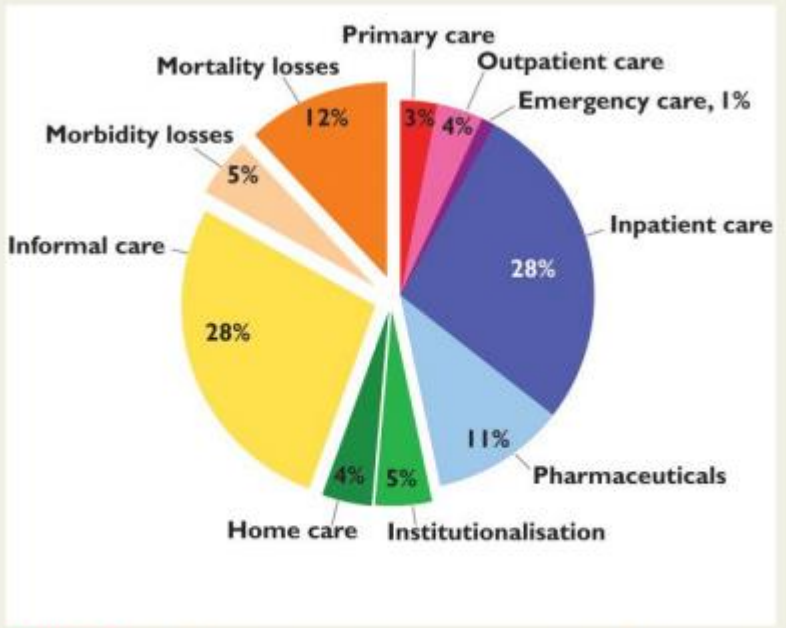


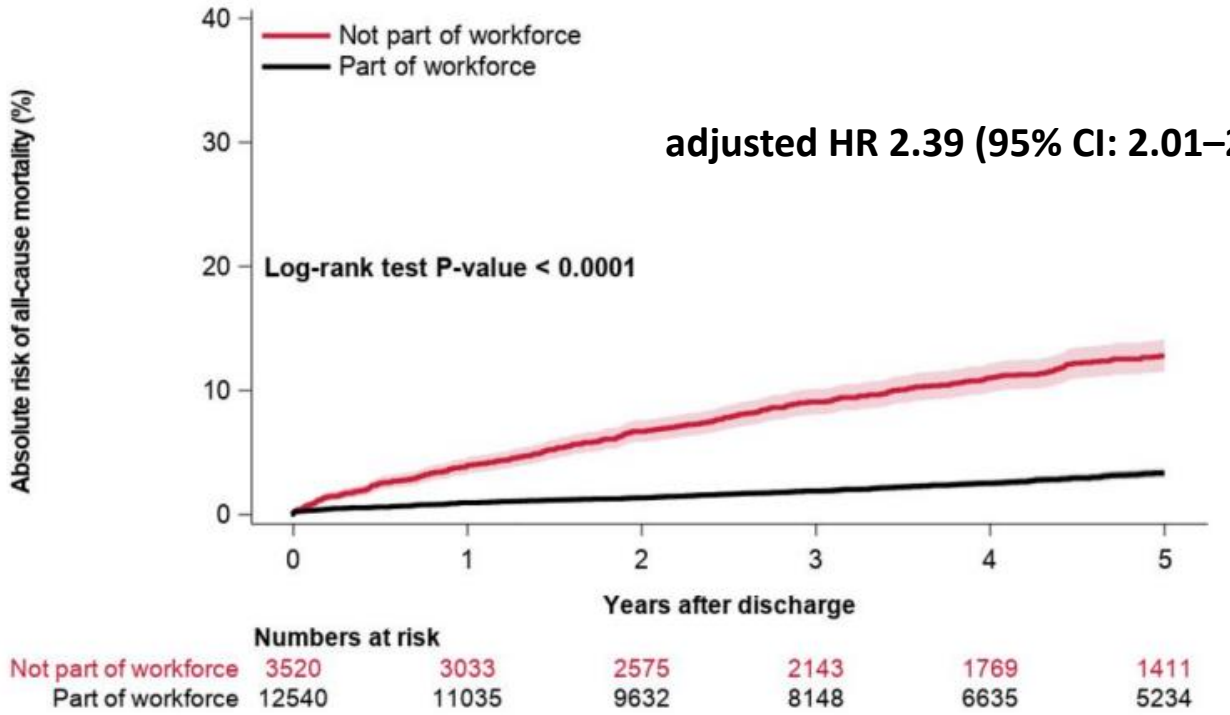
Figure 2 Distribution of cardiovascular disease-related total costs across cost categories

Overall, CHD was estimated to have cost the EU €77 billion in 2021: over one-quarter of the overall cost of CVD. This represented a cost of €173 per EU citizen, which after adjusting for price differentials ranged from €100 in Luxembourg to €325 in Lithuania (*Table 4*). Of the total cost of CHD, 37% of costs were due to healthcare, 2% to social care, 24% to productivity losses, and 37% to informal care.

Luengo-Fernandez EHJ 2023

Return to work: QoL

- **Inability to resume employment after acute MI has important implications for patients.**
  - ***Worse survival***
  - Lower quality of life and lower self-rated health status
  - Increased depression or anxiety
  - Financial stress / job insecurity
  - More difficulties affording medicine (USA)



adjusted HR 2.39 (95% CI: 2.01–2.83)

Petersen Eur J Prev Cardiol 2023; Warraich Circ Cardiovasc Qual Outcomes 2018; Van de Cauter Eur J of Prev Cardiol 2019

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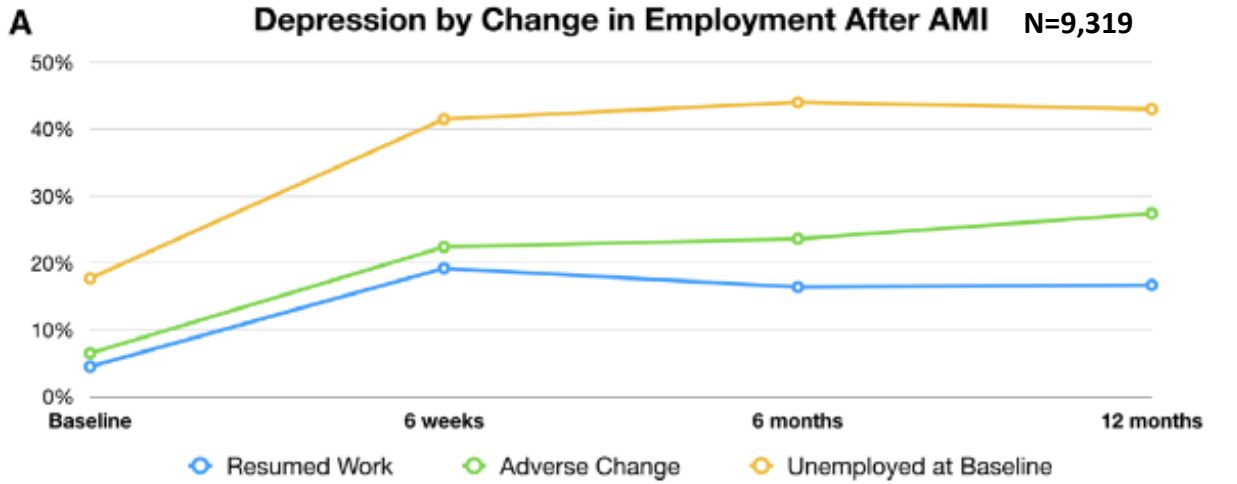

	Baseline	6 weeks	6 months	12 months
Resumed work vs Adverse Change	0.04	0.10	<0.01	<0.01
Resumed work vs Unemployed	<0.01	<0.01	<0.01	<0.01
Advserse Change vs Unemployed	<0.01	<0.01	<0.01	<0.01

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Table 2. Characteristics at the time of the interview in function of employment status.

	Employed pre-event ($n=2661$) % (n)	RTW ($n=2014$) % (n)	Non-RTW ($n=637$) % (n)
HADS-D			
Normal	81.1 (2050/2527)	83.7 (1594/1905)	73.5 (450/612)
Mild	12.9 (362/2527)	11.5 (220/1905)	17.0 (104/612)
Moderate to severe	6.0 (151/2527)	4.8 (91/1905)	9.5 (58/612)
HADS-A			
Normal	74.0 (1870/2527)	77.2 (1470/1905)	64.5 (395/612)
Mild	14.9 (376/2527)	13.2 (252/1905)	19.8 (121/612)
Moderate to severe	11.1 (281/2527)	9.6 (183/1905)	15.7 (96/612)
HeartQoL$_{global}$ (SD)	2.30 (0.61)	2.37 (0.56)	2.09 (0.68)
HeartQoL$_{physical}$ (SD)	2.29 (0.65)	2.37 (0.61)	2.06 (0.72)
HeartQoL$_{emo}$ (SD)	2.33 (0.69)	2.39 (0.65)	2.14 (0.79)

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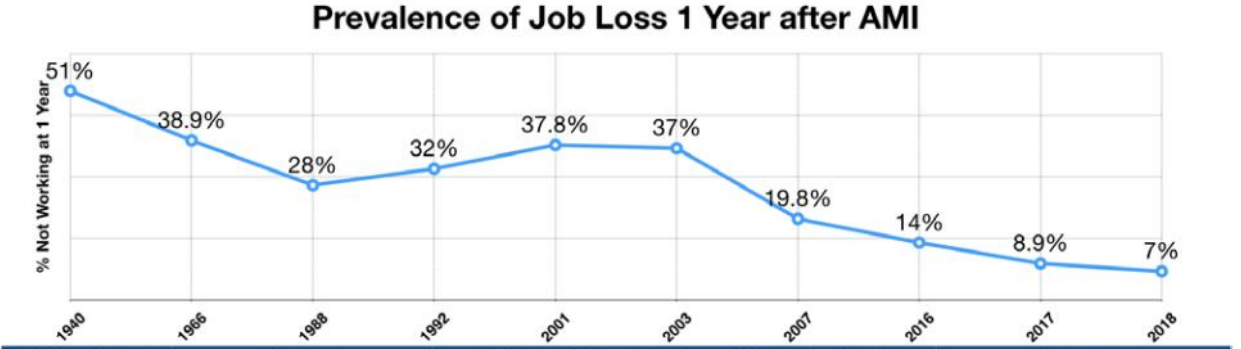
  - ***More difficulties affording medicine (USA)***

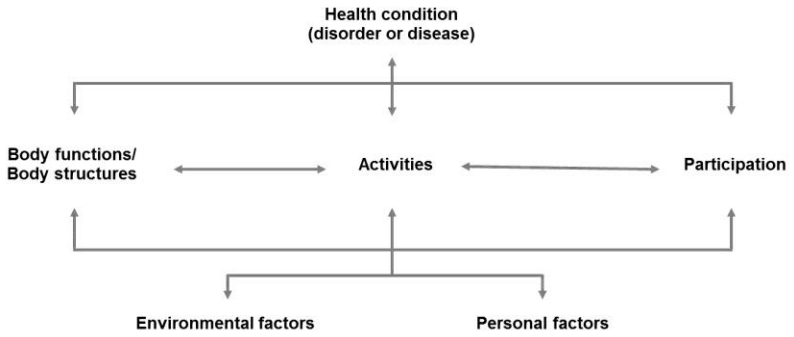


Publication Year	Authors	Analysis Period	Employed (N)	% Male	Location
1940	Master & Dack	1930-1939	415	82	New York City, NY
1966	Weinblatt et al	1961-1963	275	100	New York City, NY
1988	Smith & O'Rourke	1984-1985	151	90	Little Rock, AK
1992	Rost & Smith	-	149	93	Little Rock, AK
2001	Mittag et al	-	154	100	Germany
2003	Soderman et al	1992-1994	85	79	Sweden
2007	Bhattacharyya et al	2001-2004	101	88	London, UK
2016	Dreyer et al	2008-2012	1,680	43	US/Spain/Australia
2017	Smedegaard et al	1997-2012	22,394	81	Denmark
2018	Warraich et al	2010-2012	4,730	80	US Multicenter

Petersen Eur J Prev Cardiol 2023; Warraich Circ Cardiovasc Qual Outcomes 2018; Van de Cauter Eur J of Prev Cardiol 2019

Return-to-work

- **Return-to-work-time depends on:**
  - **Occupation**
  - **Diagnosis**
  - **Treatment**
  - **Co-morbidities**
  - **Coping**



Aanbevelingen

- De projectgroep beveelt aan dat de begeleiding uit de volgende 6 stappen bestaat: globale screening, uitgebreidere screening, multidisciplinair overleg waarin interventies worden geselecteerd, overleg met de bedrijfsarts c.q. verzekeringsarts van het UWV, uitvoeren van de interventies en monitoring van werkhervatting.
- Het is sterk aan te bevelen dat er, met schriftelijke toestemming van de patiënt, altijd gecommuniceerd wordt met de bedrijfsarts over 1) de belastbaarheid (gegevens van de ergometrie en cardiaal-medische factoren zoals ischemie) en 2) het interventieplan vanuit de hartrevalidatie.
- Deze communicatie moet volgens de richtlijnen van de KNMG verlopen en is bij voorkeur vastgelegd in een lokaal protocol om juridische fouten te voorkomen.
- Het is sterk aan te bevelen zo vroeg mogelijk in de hartrevalidatie werkhervatting ter sprake te brengen, een interventieplan op te stellen en de begeleiding van werkhervatting te starten.
- De projectgroep is van mening dat interventie(s) gericht op het wegnemen van eventuele belemmerende factoren voor de werkhervatting op maat moeten zijn, dat wil zeggen aansluiten op de knelpunten geconstateerd in de screening (bijlage 8).

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  - **Co-morbidities**
  - **Coping**

- **(At least) during cardiac rehabilitation**

ADVIEZEN MET HET OOG OP OPTIMALE WERKHERVATTING

- Werkhervatting vindt idealiter tijdens de hartrevalidatie plaats en dient onder begeleiding opgebouwd te worden.
- Bied als bedrijfsarts actief individuele begeleiding aan, aan werkenden die niet deelnemen aan hartrevalidatie.[18]
- Verwijs, in overleg met de werkende, alle werkenden na een ischemische hartziekte voor psychologische ondersteuning en/of ontspanningstherapie, tenzij dit al is gebeurd bij de hartrevalidatie.[18]

Aanbevelingen

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Multidisciplinaire richtlijn hartrevalidatie; NVAB richtlijn ischemische hartziek

Return-to-work

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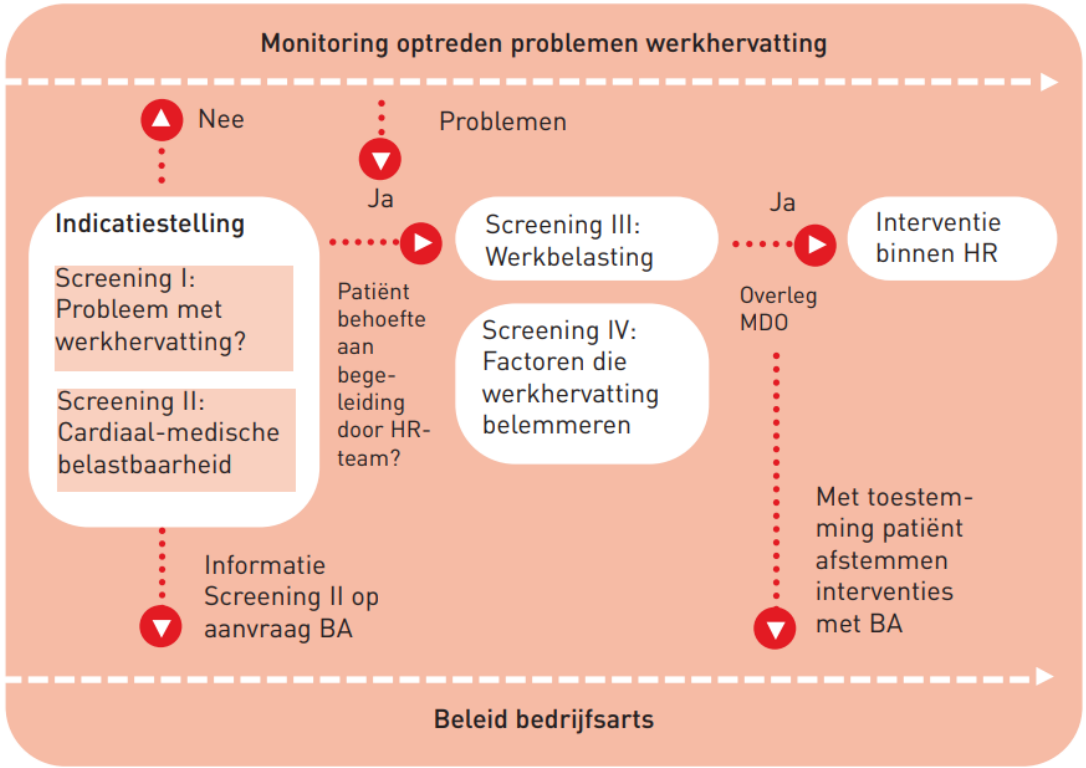
Cardiac rehabilitation

Hartrevalidatie is gericht op verbetering van de functionele capaciteit, fysiek herstel, en het verbeteren van het psychisch welzijn en sociaal functioneren, hetgeen leidt tot verlaging van cardiovasculaire incidenten en verhoging van de kwaliteit van leven van de patiënt. [Piepoli 2010]



CR assessment of:

- Personel barriers that impede return-to-work
- Cardiac risk factors that might infere with RTW / work capacity
- Occupational CVD risk factors for recurrent events

Multidisciplinaire richtlijn hartrevalidatie

Cardiac rehabilitation

I. INTAKE (Vragen die altijd gesteld moeten worden)

1. Heeft u betaald werk[1] verricht voorafgaande aan het hartprobleem?
   [ ] Ja, ga verder met vraag 2
   [ ] Nee, stop met vragenlijst
2. Is het de bedoeling dat u weer gaat werken?
   [ ] Ja, ga verder met vraag 3
   [ ] Nee, stop met vragenlijst
3. Welk werk verricht u? .....
4. Heeft u zich op het werk gestrest gevoeld in het afgelopen jaar?
   [ ] Ja
   [ ] Nee
5. Heeft u mogelijk te maken met lichamelijk zware of gevaarlijke werkomstandigheden?
   [ ] Ja
   [ ] Nee
6. Denkt u dat u op korte termijn zonder problemen kunt opstarten2?
   [ ] Ja, toelichting: .....
   [ ] Waarschijnlijk wel
   [ ] Ik heb twijfels
   [ ] Nee

Voorlopige conclusie m.b.t. werkhervatting:
[ ] Er zijn geen problemen te verwachten (geen risicoberoep volgens zorgverlener en 'nee'op vraag 4, 5 of 6). Er volgt een inventarisatie van cardiaal-medische belastbaarheid en check op de behoefte aan begeleiding.
[ ] Er zijn wel problemen te verwachten. Er volgt een inventarisatei van cardiaal-medische belastbaarheid, check op de behoefte aan begeleiding en uitgebreidere screening.

Checklist cardiaal-medische belastbaarheid (ALTIJD invullen)[3]:

[ ] Restischemie
[ ] Verminderde hartfunctie (LVEF < 40%)
[ ] Medicatie (m.n. β-blokkers)
[ ] Ritmestoornissen (atriaal of ventriculair)
[ ] Ventriculaire tachycardieën (bij inspanning en stress)
[ ] Onbehandelde/therapieresistente hypertensie (≥160/100 mmHg)
[ ] Lage inspanningstolerantie (geobjectiveerd door een inspanningstest)[4]
[ ] ICD/PM-implantatie

Return to work:

Barriers for return to work

Socio-economische factoren

Hoge GRADE	Het vrouwelijk geslacht, oudere leeftijd, laag inkomen en lage opleiding zijn onafhankelijke risicofactoren voor vertraagde werkhervatting. *Bronnen [Smedegaard 2017, Osler 2014, Butt 2018, Dreyer 2016, Catala tella 2017, Worcester 2014, Bergvik 2012]*

Psychische factoren

Hoge GRADE	Depressie is een onafhankelijke risicofactor voor vertraagde werkhervatting. *Bronnen [O'Neil 2010, Smedegaard 2017, Dreyer 2016, Catala Tella 2017, Worcester 2014]*

Fysieke (of klinische) factoren

Hoge GRADE	Harfalen, chronische nierziekte, beroerte en leverziekte zijn onafhankelijke risicofactoren voor vertraagde werkhervatting. *Bronnen [Smedegaard 2017, Butt 2018]*

Cardiac risk factors

That interfere with RTW / work capacity

- Residual ischemia
- Reduced heart function (LVEF <40%)
- Low physical endurance tolerance
- Medication
- (Ventricular) Arrhytmias
- Resistent hypertension
- ICD/Pacemaker

(zie ook paragraaf 5.4). Brügemann en Hellemans Brügemann 2007 concluderen dat bij patiënten die voldoen aan de volgende criteria, er geen cardiaal-medische belemmeringen zijn om het werk te hervatten: (a) zonder klachten, (b) met een bij ergometrie goede inspanningstolerantie (> 7 MET) en afwezigheid van aanwijzingen voor ischemie en (c) met een normale pompfunctie.

Multidisciplinaire richtlijn hartrevalidatie; de Rijk 2020 Handbook of Disability, work and Health; NVAB ischemische hartziekten

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Compendium of Physical Activities

Quantifying Physical Activity Energy Expenditure

Specific Activity Code	MET Value	Activity Description
11000	2.0	Active workstation, Pedal desk, balance chair/ball, General, light effort
11001	3.5	Active workstation, Pedal desk (40 watts)
11002	5.3	Active workstation, Pedal desk (80 watts)
11003	2.0	Active workstation, treadmill desk, walking slowly 1.0 mph or less
11004	2.8	Active workstation, treadmill desk, walking 1.0 – 2.0 mph
11006	3.0	Airline flight attendant
11008	4.8	Apple Harvesting
11010	4.0	Bakery, general, moderate effort
11015	2.0	Bakery, light effort
11020	2.3	Bookbinding
11030	6.0	Building road, driving heavy machinery
11035	2.0	Building road, directing traffic, standing

CLASSIFICATIE	BETEKENIS	ERGOMETRIE
NYHA I	Geen klachten	> 7 MET [11]
NYHA II	Klachten bij zware inspanning, 3 trappen van 15 treden	4-7 MET
NYHA III	Klachten bij geringe inspanning, 1 trap van 15 treden	2-4 MET
NYHA IV	Klachten in rust	1 MET

Multidisciplinaire richtlijn hartrevalidatie; de Rijk 2020 Handbook of Disability, work and Health; NVAB ischemische hartziekten

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A static load >15% of the person's (LVEF<49%) maxmum strenght negatively affects the pump function of the heart.

Cox regression analysis, after stratification, of the impact of different variables on left ventricular function and the risk of retirement

	Retired	
Variables	LVEF ⩽ 35%, adjusted risk ratio[a] (95% CI)	LVEF > 35%, adjusted risk ratio[a] (95% CI)
Age, years		
<50	1.0 (reference)	1.0 (reference)
50–60	1.72 (0.44–6.65)	1.57 (0.85–2.88)
>60	4.20 (1.00–17.34)	3.74 (1.94–7.19)
Female vs. male	3.90 (1.18–12.62)	1.32 (0.69–2.55)
Physical job demands		
Sedentary	1.0 (reference)	1.0 (reference)
Light	1.12 (0.45–2.81)	1.01 (0.61–1.68)
Heavy	3.83 (1.02–14.30)	1.08 (0.58–1.99)

Multidisciplinaire richtlijn hartrevalidatie; de Rijk 2020 Handbook of Disability, work and Health; NVAB ischemische hartziekten

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Table 1. Estimation of maximum cardiopulmonary capacity and full-time working capacity on the basis of the achieved peak VO_2, German recommendations.

Maximum capacity on the ergometer[14]	Maximum capacity in relation to BW	Endurance capacity on the ergometer	Estimated energy expenditure (METs)*[15]	Work intensity
<50 Watts	About 1 Watt/kg BW	Up to 50 Watts	<3.1	Very light
>50–75 Watts	>1–1.5 Watts/kg BW	>50–75 Watts	<4.3	Light
>75–125 Watts	>1.5–2 Watts/kg BW	<75–100 Watts	<6.4	Moderate
125–150 Watts	>2 Watts/kg BW	>100 Watts	<7.4	Heavy

BW: body weight; MET: metabolic equivalent.
*Exemplary for patients with a body weight of 80 kg (adapted from Löllgen[14] and Haskell et al.[15]).

Multidisciplinaire richtlijn hartrevalidatie; de Rijk 2020 Handbook of Disability, work and Health; NVAB ischemische hartziekten

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- ***(Ventricular) Arrhytmias***
- Resistent hypertension
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Increased Incidence of Life-Threatening Ventricular Arrhythmias in Implantable Defibrillator Patients After the World Trade Center Attack

Jonathan S. Steinberg, MD, FACC,*† Aysha Arshad, MBBS,* Marcin Kowalski, MD,* Atul Kukar, DO,* Valentin Suma, MD,* Margot Vloka, MD,*† Frederick Ehlert, MD,*† Bengt Herweg, MD,*† Jacqueline Donnelly, BA,* Julie Philip, PA-C,* George Reed, PHD,‡ Alan Rozanski, MD, FACC*

New York, New York; Ridgewood, New Jersey; and Worcester, Massachusetts

Emotional and Physical Precipitants of Ventricular Arrhythmia

Rachel Lampert, MD; Tammy Joska, MS; Matthew M. Burg, PhD; William P. Batsford, MD; Craig A. McPherson, MD; Diwakar Jain, MD

Background—Observational studies have suggested that psychological stress increases the incidence of sudden cardiac death. Whether emotional or physical stressors can trigger spontaneous ventricular arrhythmias in patients at risk has not been systematically evaluated.

Methods and Results—Patients with implantable cardioverter-defibrillators (ICDs) were given diaries to record levels of defined mood states and physical activity, using a 5-point intensity scale, during 2 periods preceding spontaneously occurring ICD shocks (0 to 15 minutes and 15 minutes to 2 hours) and during control periods 1 week later. ICD-stored electrograms confirmed the rhythm at the time of shock. A total of 107 confirmed ventricular arrhythmias requiring shock were reported by 42 patients (33 men; mean age, 65 years; 78% had coronary artery disease) between August 1996 and September 1999. In the 15 minutes preceding shock, an anger level ≥3 preceded 15% of events compared with 3% of control periods ($P<0.04$; odds ratio, 1.83; 95% confidence intervals, 1.04 to 3.16) Other mood states (anxiety, worry, sadness, happiness, challenge, feeling in control, or interest) did not differ. Patients were more physically active preceding shock than in control periods. Anger and physical activity were independently associated with the preshock period.

Conclusions—Anger and physical activity can trigger ventricular arrhythmias in patients with ICDs. Future investigations of therapies aimed at blocking a response to these stressors may decrease ventricular arrhythmias and shocks in these patients. **(*Circulation*. 2002;106:1800-1805.)**

Multidisciplinaire richtlijn hartrevalidatie; de Rijk 2020 Handbook of Disability, work and Health; NVAB ischemische hartziekten

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- Low physical endurance tolerance
- Medication
- (Ventricular) Arrhytmias
- ***Resistent hypertension***
- ICD/Pacemaker

The maximum "safe" blood pressure for resuming work with moderate/heavy physical work and/or increased workload =< RR 160/100 mmHg

Multidisciplinaire richtlijn hartrevalidatie; de Rijk 2020 Handbook of Disability, work and Health; NVAB ischemische hartziekten

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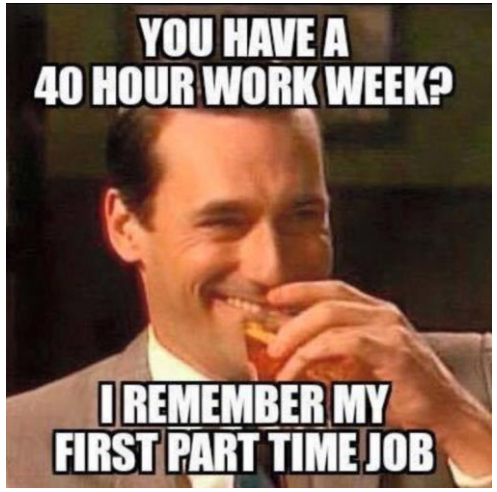
Multidisciplinaire richtlijn hartrevalidatie; de Rijk 2020 Handbook of Disability, work and Health; NVAB ischemische hartziekten

Occupational CVD risk factors

And risk for recurrent events

- Job strain
- Effort-reward imbalance
- Irregular working hours
- Occupational physical activity
- Long working hours



- Smoking, alcohol, drug
- Obesity
- Sleeping
- Diet
- leisure physical activity

Occupational CVD risk factors

And risk for recurrent events

- ***Job strain*** ✓
- Effort-reward imbalance
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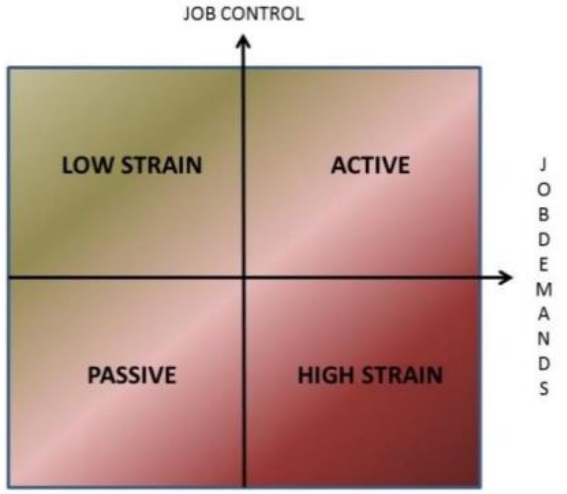
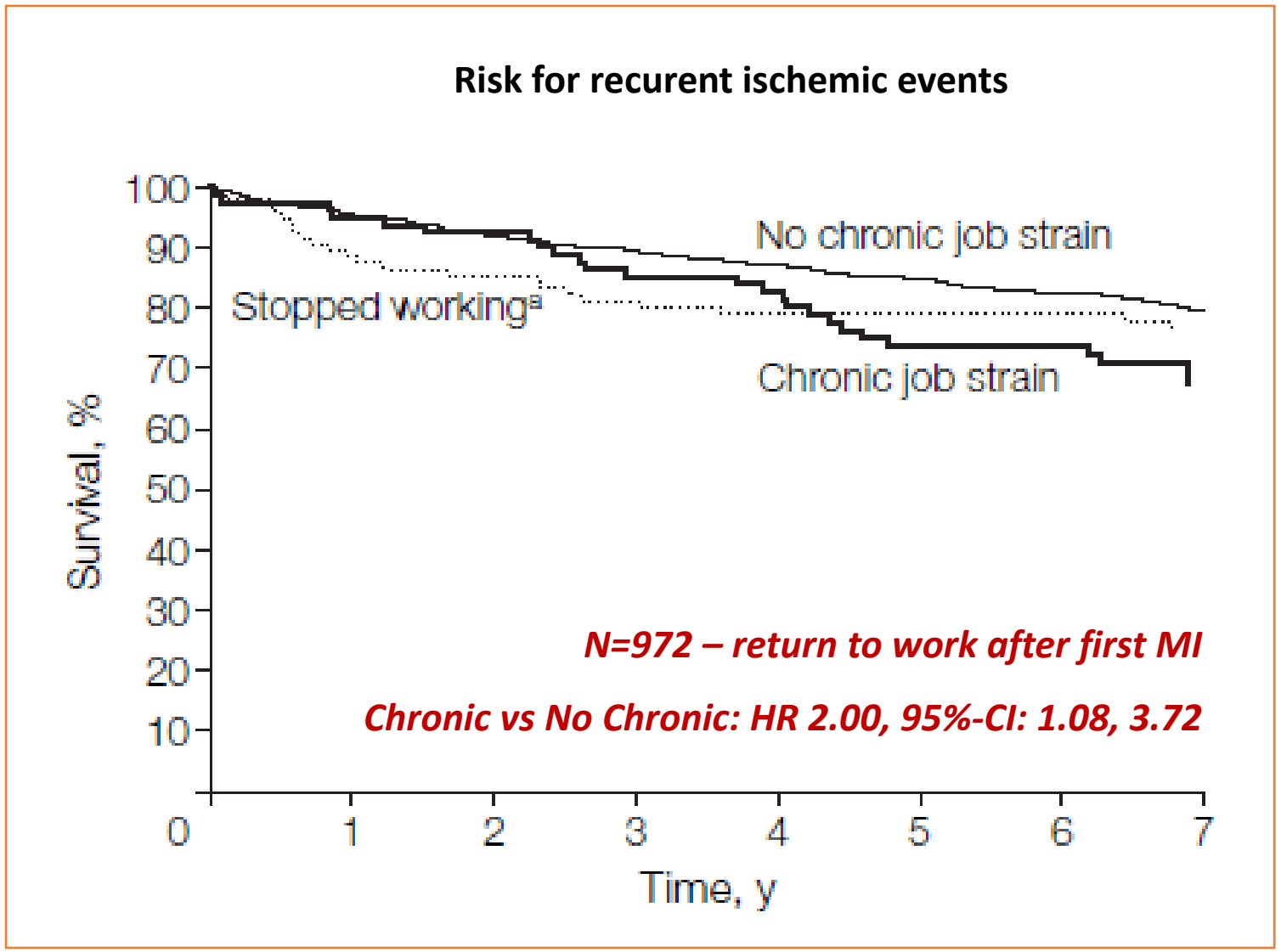


Figure 1. The job demand-control model according to Karasek



Aboa-Eboule 2007 JAMA

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And risk for recurrent events

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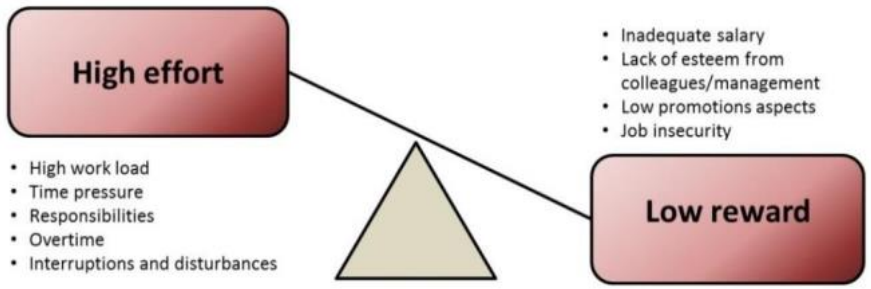


Figure 2. The effort-reward imbalance model according to Siegrist

Risk for recurent ischemic events

N=738 – return to work after first MI

Follow-up: 4 years

High versus low reward: HR 1.77, 95%-CI: 1.16, 2.71

		Unadjusted			Multivariate Model	
ERI Components	*n* = 738	Event Rate	HR[a]	95% CI	HR[a]	95% CI
Extrinsic effort						
Low	483	2.92	1.00	Reference	1.00	Reference
High	255	3.07	1.05	0.69–1.60	1.17[b]	0.59–2.34
Reward						
High	485	2.26	1.00	Reference	1.00	Reference
Low	253	4.44	1.96	1.32–2.93	1.77[b]	1.16–2.71
ERI ratio						
Low	596	2.65	1.00	Reference	1.00	Reference
High	142	4.45	1.68	1.07–2.63	1.75[b]	0.99–3.08

Aboa-Eboule 2011 Psychosomatic Medicine

Occupational CVD risk factors

And risk for recurrent events

- Job strain ✓
- Effort-reward imbalance ✓
- ***Irregular working hours*** ✓
- Occupational physical activity
- Long working hours

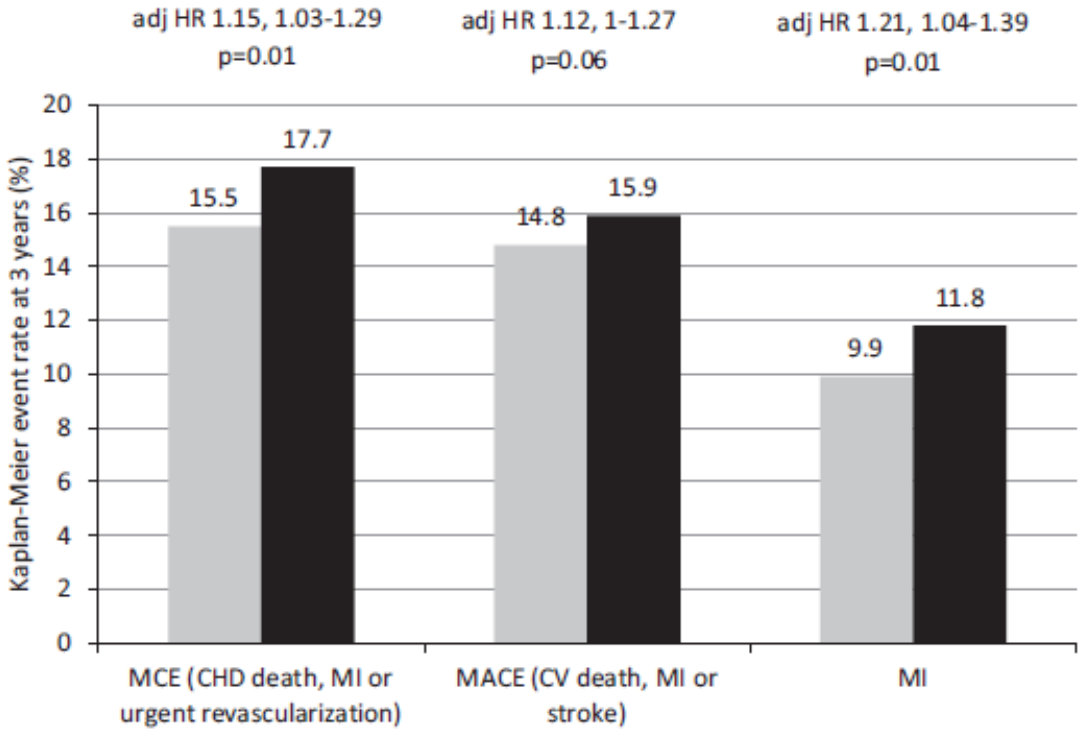
Risk for recurent ischemic events

SOLID-TIMI 52-trial

N=13 026 – return to work after first ACS

Follow-up: 2.5 years

Night work (≥3 night shifts/week for ≥1 year) vs day work



Barger JAHA 2017

Recurrent ischemic events

Vragenlijst knelpunten voor nachtdienst	
1	Hoe staat de werkende tegenover nachtdiensten: vindt hij/zij het zwaar (vermoeidheid, stress) of voelt hij/zij zich er goed bij?
2	Welke diensten hebben zijn/haar voorkeur (ochtend-/avondmensen)?
3	Heeft de werkende zeggenschap over werktijden en de mogelijkheid om de werktijden aan te passen en verstoringen te beperken? En wordt die zeggenschap verstandig gebruikt?
4	Is er de angst om de baan te verliezen als de nachtdiensten niet meer gedaan mogen worden?
5	Zijn er financiële gevolgen als de werkende geen nachtdiensten meer uitvoert?
6	Zijn er sociale gevolgen: is het werk bijvoorbeeld afgestemd op dat van de partner of op de kinderopvang?
7	Is er cardiale comorbiditeit (hartfalen, slechte linker ventrikel functie, significante ritme stoornissen)?
8	Is er sprake van comorbiditeit?
9 a b c	In geval van therapie voor cardiometabole risicofactoren of comorbiditeit: is de betreffende klacht of risicofactor onder controle met behandeling? volgt de medewerker de behandelvoorschriften trouw aangaande gerapporteerde klachten of risicofactoren? is de medewerker in staat om goed in te spelen op bestaande klachten en eventuele onderliggende ziekten?
10	Hoe is de fysieke conditie?
11	Zijn er stressgerelateerde problemen, depressieve klachten, angsten?
12	Hoe is de slaapkwaliteit en slaapduur?
13	Welk soort werk wordt 's nachts uitgevoerd (bijvoorbeeld fysiek zwaar werk, veiligheidsfunctie)?
14	Zijn aanpassingen mogelijk (zoals lichter rooster, minder nachtdiensten, kortere diensten, meer hersteltijd, langere pauzes, minder fysieke belasting)?

Shift work vs. Financial stress vs. Job insecurity?

Occupational CVD risk factors

And risk for recurrent events

- Job strain ✓
- Effort-reward imbalance ✓
- ***Irregular working hours*** ✓
- Occupational physical activity
- Long working hours

Risk for recurent ischemic events

SOLID-TIMI 52-trial

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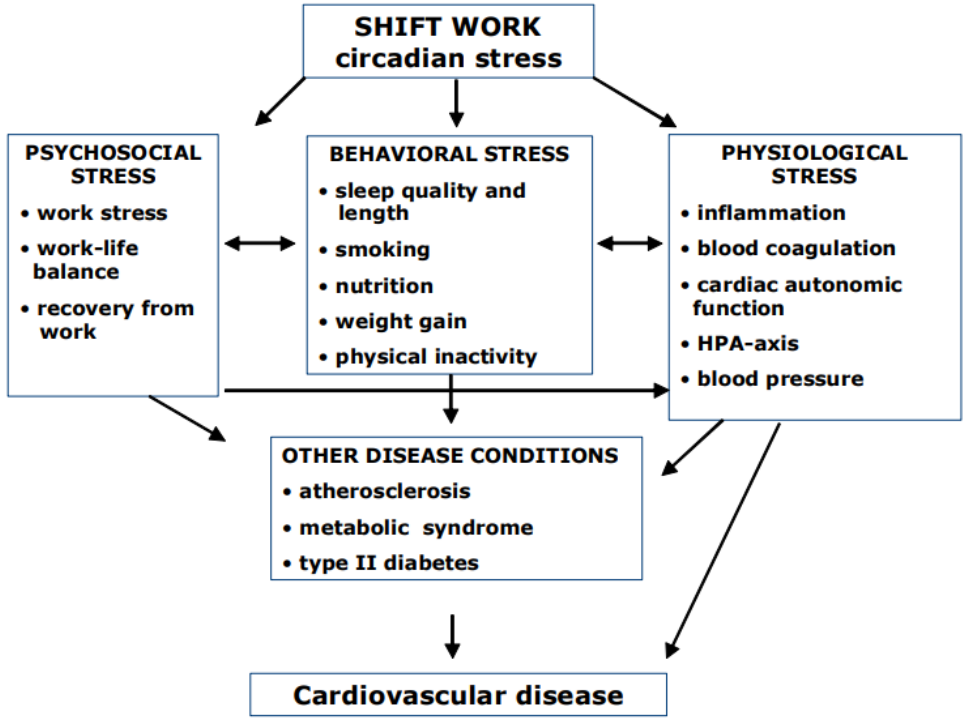


Puttonen Scand J Work Environ Health 2010

Occupational CVD risk factors

And risk for recurrent events

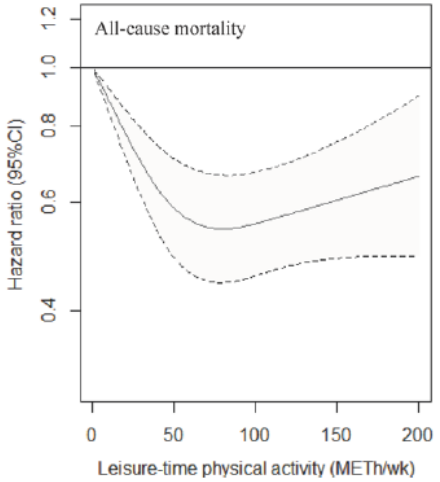
- Job strain ✓
- Effort-reward imbalance ✓
- Irregular working hours ✓
- ***Occupational physical activity*** ✓
- Long working hours

Risk for recurent ischemic events

UCC-SMART cohort with established CVD → **Prospective cohort study** N = 7,058, 73% male, age 61 ±10 years → **8.6 years follow-up** IQR 4.6-12.5 years

Leisure-time physical activity

Reduced risk of all-cause mortality, recurrent vascular events and incident T2D



Occupational physical activity

Trend towards increased risk of all-cause mortality, recurrent vascular events and incident T2D

Sedentary work
Reference

Standing work
Mortality: HR 1.14 (0.99-1.31)
Recurrent events: HR 1.02 (0.87-1.20)
Type 2 diabetes: HR 0.93 (0.72-1.20)

Manual work
Mortality: HR 0.98 (0.84-1.14)
Recurrent events: HR 1.10 (0.94-1.28)
Type 2 diabetes: HR 0.98 (0.77-1.25)

Heavy manual work
Mortality: HR 1.08 (0.86-1.35)
Recurrent events: HR 1.10 (0.94-1.28)
Type 2 diabetes: 1.04 (0.72-1.50)

Barger JAHA 2017

……..Work anamnesis, questionnaires, RIE

Occupational CVD risk factors

And risk for recurrent events

- Job strain ✓
- Effort-reward imbalance ✓
- Irregular working hours ✓
- Occupational physical activity ✓
- ***Long working hours*** ✓

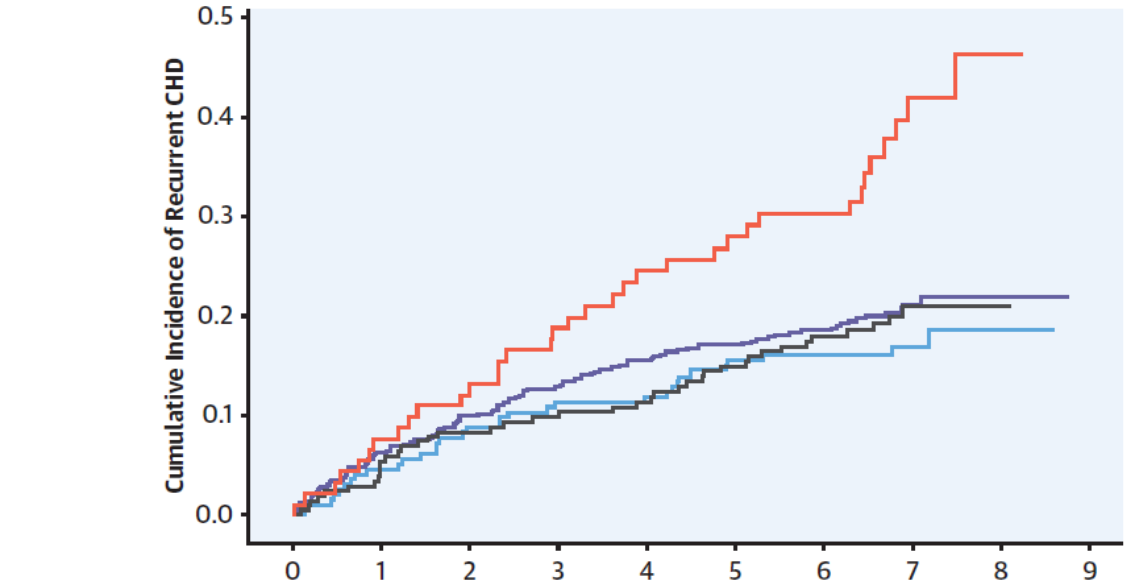
Risk for recurent ischemic events

N=967– return to work after first MI

Follow-up: 5.9 years

fatal or nonfatal MI and unstable angina

HR vs. 35 to 40 h/week: 1.67; 95%-CI: 1.10 to 2.53



Number of Worked Hours										
<35 h/Week	195	184	176	171	169	161	157	73	4	0
35-40 h/Week	474	441	423	404	390	376	363	155	6	0
41-54 h/Week	204	192	184	179	176	166	158	68	2	0
≥55 h/Week	94	84	79	72	66	62	59	26	2	0

Trudel JACC 2021

Occupational CVD risk factors

Particulate Matter ($PM_{2.5}$)

Contents lists available at ScienceDirect
Environmental Research
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Atherosclerotic process in taxi drivers occupationally exposed to air pollution and co-morbidities

Natália Brucker [a,b], Mariele F. Charão [a,b], Angela M. Moro [a,b], Pedro Ferrari [c], Guilherme Bubols [a], Elisa Sauer [a,f], Rafael Fracasso [a,b], Juliano Durgante [a,f], Flávia V. Thiesen [c], Marta M. Duarte [d], Adriana Gioda [e], Iran Castro [f], Paulo H. Saldiva [g], Solange C. Garcia [a,f,*]

Heath/Cold

Circulation

ORIGINAL RESEARCH ARTICLE

Associations Between Extreme Temperatures and Cardiovascular Cause-Specific Mortality: Results From 27 Countries

Barrak Alahmad, MD, MPH, PhD; Haitham Khraishah, MD; Dominic Royé, PhD; Ana Maria Vicedo-Cabrera, PhD; Yuming Guo, PhD; Stefania I. Papatheodorou, MD; Souzana Achilleos, ScD; Fiorella Acquaotta, PhD; Ben Armstrong, PhD; Michelle L. Bell, PhD; Shih-Chun Pan, PhD; Micheline de Sousa Zanotti Stagliorio Coelho, PhD; Valentina Colistro, PhD; Tran Ngoc Dang, PhD; Do Van Dung, PhD; Francesca K. De' Donato, PhD; Alireza Entezari, PhD; Yue-Liang Leon Guo, PhD; Masahiro Hashizume, PhD; Yasushi Honda, PhD; Ene Indermitte, PhD; Carmen Íñiguez, PhD; Jouni J.K. Jaakkola, PhD; Ho Kim, PhD; Eric Lavigne, PhD; Whanhee Lee, PhD; Shanshan Li, PhD; Joana Madureira, PhD; Fatemeh Mayvaneh, PhD; Hans Orru, PhD; Ala Overcenco, PhD; Martina S. Ragettli, PhD; Niilo R.I. Ryti, PhD; Paulo Hilario Nascimento Saldiva, PhD; Noah Scovronick, PhD; Xerxes Seposo, PhD; Francesco Sera, PhD; Susana Pereira Silva, MSc; Massimo Stafoggia, PhD; Aurelio Tobias, PhD; Eric Garshick MD; Aaron S. Bernstein, MD; Antonella Zanobetti, PhD; Joel Schwartz, PhD; Antonio Gasparrini, PhD; Petros Koutrakis, PhD

Occupational noise (85dB)

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journal homepage: www.elsevier.com/locate/envint

The effect of occupational exposure to noise on ischaemic heart disease, stroke and hypertension: A systematic review and meta-analysis from the WHO/ILO Joint Estimates of the Work-Related Burden of Disease and Injury

Liliane R. Teixeira [a,1], Frank Pega [b,*], Angel M. Dzhambov [c,d], Alicja Bortkiewicz [e], Denise T. Correa da Silva [a], Carlos A.F. de Andrade [f,g], Elzbieta Gadzicka [e], Kishor Hadkhale [h], Sergio Iavicoli [i], Martha S. Martínez-Silveira [j], Małgorzata Pawlaczyk-Łuszczyńska [k], Bruna M. Rondinone [i], Jadwiga Siedlecka [e], Antonio Valenti [i], Diana Gagliardi [i,1]

Crystalline silica

Open access Original research
BMJ Open

Occupational exposure to silica and risk of heart disease: a systematic review with meta-analysis

Kai Liu [1], Min Mu [2], Kehong Fang [3], Yuanyuan Qian [1], Song Xue [4], Weijiang Hu [5], Meng Ye [1]

Radiation

Journal of the American Heart Association

CONTEMPORARY REVIEW

Radiation-Induced Cardiovascular Disease: Review of an Underrecognized Pathology

Eve Belzile-Dugas, MD; Mark J. Eisenberg, MD, MPH

Whole body vibrations

Occupational Medicine 2006;**56**:338–344
Published online 22 May 2006 doi:10.1093/occmed/kql024

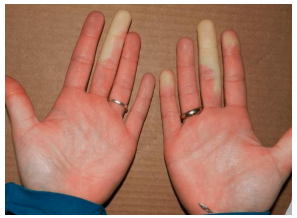
Vibration exposure and myocardial infarction incidence: the VHEEP case–control study

Bodil Björ[1], Lage Burström[2], Tohr Nilsson[3] and Christina Reuterwall[4]

&... Asbestos, CO/CS_2, metals (lead, arsenic, cadmium, aluminium), pulp and paper

The Nordic Expert Group for Criteria Documentation of Health Risks from Chemicals

153. Occupational chemical exposures and cardiovascular disease



Workers at risk

Table 2. Occupations with an increased incidence of a first myocardial infarction among the men. (95% CI = 95% confidence interval)

Occupation[a]	Relative risk (RR) adjusted for age, county and calendar year		Relative risk (RR) adjusted for age, county and socioeconomic group	
	RR	95% CI	RR	95% CI
Certain metal processing workers[b]	2.8	1.4—5.8	2.8	1.4—5.6
Stonecutters and carvers[c]	2.0	1.2—3.6	1.9	1.1—3.4
Frame and circular sawyers and planers	1.8	1.0—3.0	1.7	1.0—3.0
Paper and paperboard workers	1.8	1.1—2.9	1.6	1.0—2.7
Ship's deck officers	1.8	1.0—3.2	1.9	1.0—3.4
Road traffic supervisors	1.7	1.1—2.6	1.9	1.2—2.9
Air traffic controllers, flight dispatchers[c]	1.7	1.0—2.9	1.8	1.1—3.3
Bus and tram conductors, traffic assistants[c]	1.6	1.0—2.5	1.5	0.9—2.3
Farm managers and supervisors[c]	1.5	1.0—2.5	1.6	1.0—2.6
Plastics product workers[c]	1.5	1.1—2.0	1.4	1.0—1.9
Railroad engineers and assistants	1.4	1.1—1.8	1.3	1.0—1.7
Motor-vehicle drivers, tram drivers	1.4	1.2—1.5	1.3	1.1—1.4
Construction machine operators	1.4	1.0—1.9	1.3	1.0—1.8
Catering supervisors[c]	1.4	1.1—1.7	1.5	1.1—1.9
Building caretakers	1.3	1.1—1.6	1.3	1.0—1.5
Working proprietors, retail trade	1.3	1.0—1.6	1.3	1.0—1.6
Paper pulp workers[c]	1.3	1.0—1.7	1.3	1.0—1.7
Butchers and meat preparers[c]	1.3	1.0—1.6	1.2	1.0—1.5
Mechanical engineers and technicians	1.2	1.0—1.3	1.3	1.1—1.5
Property managers, store managers	1.2	1.0—1.5	1.3	1.0—1.6
Furnacemen[c]	1.2	1.0—1.5	1.2	1.0—1.4
Toolmakers, machine-tool setters and operators, machinery fitters and machine assemblers	1.2	1.1—1.3	1.1	1.0—1.2
Certain civilian protective service workers[c, d]	1.2	1.0—1.5	1.2	1.0—1.4
Welders and flame cutters[c]	1.1	1.0—1.3	1.0	0.9—1.2
Secretaries, typists and related work[c]	1.1	1.0—1.2	1.2	1.1—1.3
Truck and conveyor operators[c]	1.1	1.0—1.3	1.1	0.9—1.2
Store and warehouse workers	1.1	1.0—1.3	1.1	0.9—1.3

[a] Persons working in a certain occupation in both 1970 and 1975 unless marked with superscript c.
[b] Excludes furnacemen, metal annealers, temperers and case-hardeners, rolling-mill workers, smiths and forgers, metal casters and molders and wire and tube drawers.
[c] Individuals working in the occupation in 1970 or 1975, compared with others employed in 1970 or 1975.
[d] Excludes firefighters, policemen, customs surveillance officials, and prison and reformatory officials.

Hammar Scand J Work Environ Health 1992

Workers at risk

Table 3. Occupations with a decreased incidence of a first myocardial infarction among the men. (95% CI = 95% confidence interval)

Occupation[a]	Relative risk (RR) adjusted for age, county and calendar year		Relative risk (RR) adjusted for age, county and socioeconomic group	
	RR	95% CI	RR	95% CI
Judges and other lawyers in courts of law[b]	0.3	0.2—0.6	0.4	0.2—0.6
Corporation and organization lawyers[b]	0.5	0.3—0.8	0.5	0.3—0.9
Chemists, physicists	0.5	0.3—0.8	0.5	0.3—0.9
Physicians and surgeons	0.6	0.5—0.9	0.7	0.5—0.9
Dentists	0.6	0.4—1.0	0.6	0.4—1.0
Designers[b]	0.6	0.4—1.0	0.6	0.4—1.0
Composers and musicians[b]	0.6	0.4—0.9	0.6	0.4—1.0
University and higher education teachers	0.7	0.4—1.0	0.7	0.5—1.1
Other business managers including managers of specific functions[c]	0.7	0.5—0.9	0.7	0.6—0.9
Economists, statisticians[b]	0.7	0.5—1.0	0.8	0.6—1.1
Bank employees[b]	0.7	0.5—1.0	0.8	0.6—1.1
Forest workers and log drivers	0.8	0.6—0.9	0.7	0.6—0.9
Working proprietors, agricultural, horticultural and forestry contractors	0.8	0.7—0.9	0.7	0.6—0.9
Government legislative and administrative workers	0.8	0.7—1.0	0.9	0.8—1.1
Architects, building and construction engineers and technicians	0.8	0.7—1.0	0.9	0.8—1.1
Teachers in theoretical subjects	0.8	0.6—1.0	0.9	0.6—1.1
Sculptors, painters, photographers and commercial artists[b]	0.8	0.6—1.0	0.7	0.6—1.0
Journalists, editors[b]	0.8	0.6—1.0	0.8	0.7—1.0
Accountants and auditors[b]	0.8	0.6—1.0	0.8	0.6—1.1
Librarians, archivists, and curators[b]	0.8	0.6—1.0	0.8	0.6—1.1
Advertising salesmen[b]	0.8	0.7—1.0	0.9	0.7—1.1
General managers	0.8	0.7—1.0	0.9	0.7—1.1
Bricklayers, concrete and construction workers, drivers and pipelayers	0.9	0.8—1.0	0.8	0.7—1.0
Electrical, electronics and telecommunications engineers and technicians	0.9	0.7—1.0	1.0	0.8—1.1
Bookkeepers, office cashiers[b]	0.9	0.7—1.0	0.9	0.8—1.1
Agricultural/livestock workers[b]	0.9	0.7—1.0	0.8	0.7—1.0
Certain engineers and technicians[b, d]	0.9	0.8—1.0	1.0	0.9—1.1
Plumbers and pipe fitters[b]	0.9	0.8—1.0	0.8	0.7—1.0

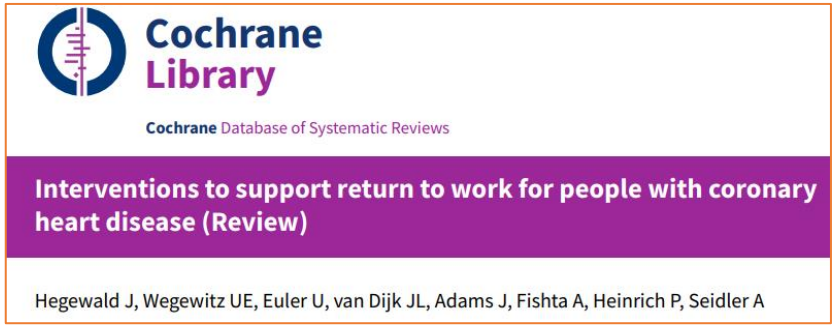
Hammar Scand J Work Environ Health 1992

Workers at risk

Type of economic sector	n	% of total
Agriculture, forestry and fishing	101	0.7
Mining and quarrying	14	0.1
Manufacturing	2650	18.7
Electricity, gas, steam and air conditioning supply	9	0.1
Water supply; sewerage, waste management and remediation activities	234	1.6
Construction	1139	8.0
Wholesale and retail trade; repair of motor vehicles and motorcycles	2270	16.0
Transportation and storage	1025	7.2
Accommodation and food service activities	257	1.8
Information and communication	424	3.0
Financial institutions	831	5.8
Renting, buying and selling of real estate	136	1.0
Consultancy, research and other specialised business services	997	7.0
Renting and leasing of tangible goods and other business support services	867	6.1
Public administration, public services and compulsory social security	409	2.9
Education	584	4.1
Human health and social work activities	888	6.2
Culture, sports and recreation	203	1.4
Other service activities	190	1.3
Unknown	981	6.9

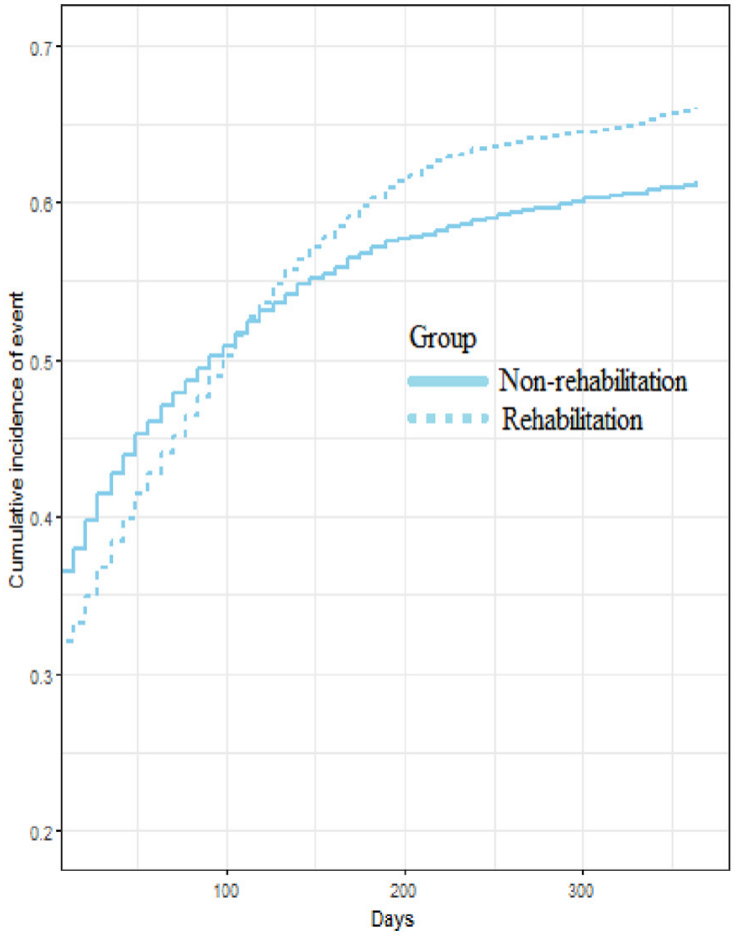
van Dongen, Kok HTC data, 2024

Interventions

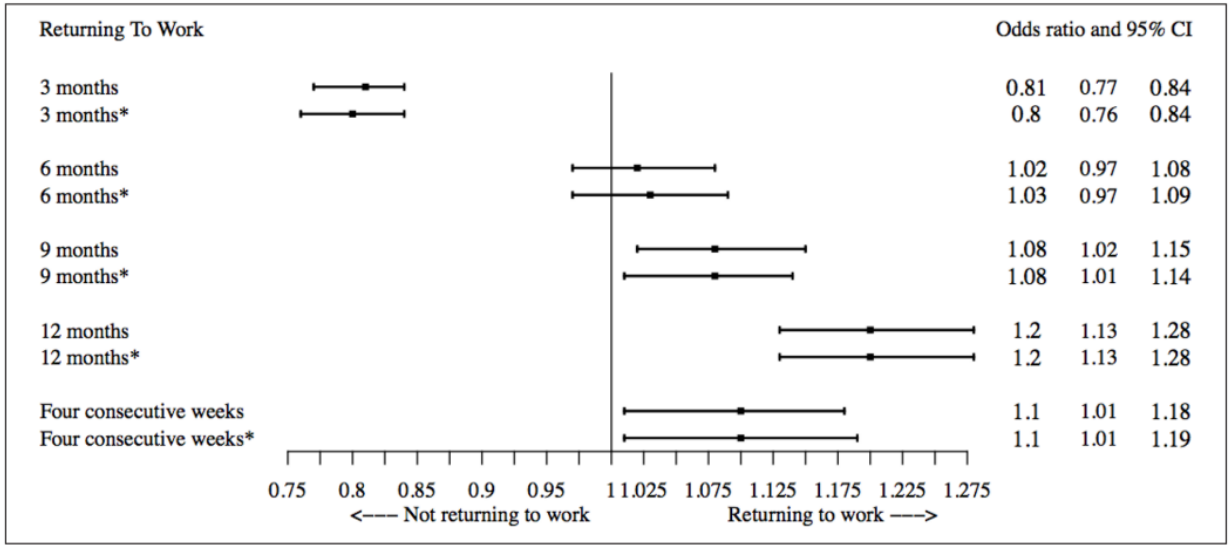


- **Person-directed, psychological counselling versus usual care**
  - *Participants working between one and five years (**RR 1.09, 95% CI 0.88 to 1.34**; three studies; low-certainty evidence).*
- **Person-directed, work-directed counselling versus usual care**
  - *Mean difference (MD) in days until return to work (**MD −7.52 days, 95% CI −20.07 to 5.03 days**; four studies; low-certainty evidence)*
  - *Cardiac death (**RR 1.00, 95% CI 0.19 to 5.39**; two studies; moderate-certainty evidence)*
- **Person-directed, physical conditioning interventions versus usual care**
  - *Return-to-work rates at six to 12 months (**RR 1.09, 95% CI 0.99 to 1.20**; five studies; low-certainty evidence)*
  - *Cardiac death (**RR 1.00, 95% CI 0.35 to 2.80**; two studies; moderate-certainty evidence)*
- **Person-directed, combined interventions versus usual care**
  - *Return to work up to six months (**RR 1.56, 95% CI 1.23 to 1.98**; four studies; low-certainty evidence)*
  - *Reinfarctions (**RR 0.56, 95% CI 0.23 to 1.40**; three studies; moderate-certainty evidence)*
- **Work-directed, interventions**
  - *No studies*

Interventions



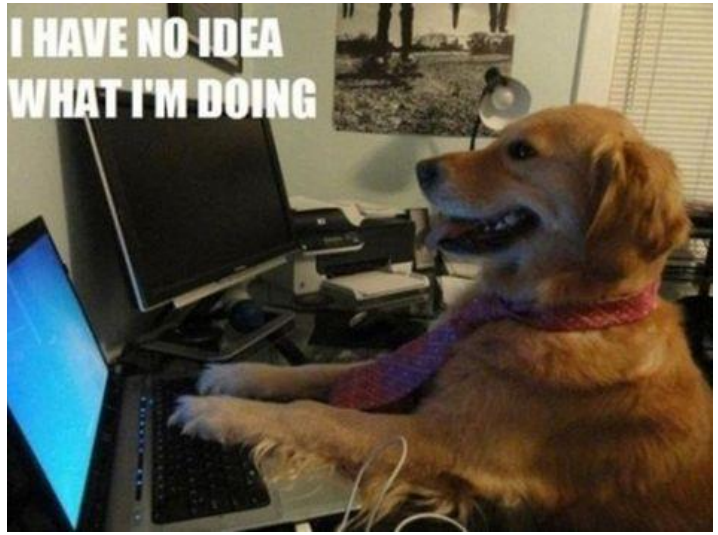
- **N=15,762 matched individuals (18-70 years)**
- **PCI & CABG**



Pedersen Scand J Public Health 2023

Questions Questions Questions

- Combinations of occupational CVD risk factors
- Job insecurity vs occupational CVD risk factors
- Night shift vs vocational rehabilitation
- Leisure vs. occupational physical activity
- Night shift versus rotational shift work
- Dose response relationships
- Can we mitigate the effects of night shift related stress factors
- Occupational counselling vs standard care
- *Individual-tailored return-to-work*



Take home messages

- **Start reintegration during cardiac rehabilitation**
- **Inventorize work capacity and exposure to occupational CVD risk factors**
- **Refer to cardiac rehabilitation (also as Occupational Physicians)**
- **Cooperate: cardiac rehabilitation / occupational hygienist / cardiologist**
- **Shared decision**
- **Refer to expertise centra**

Gilbert Wijntjens
g.w.wijntjens@amsterdamumc.nl; 0623924380