Prognosis of asthma and COPD according to organic particulate exposure

Vested A, Kolstad H, Basinas I, Burdorf A, Elholm G, Heederik D, Jacobsen G, Kromhout H, Omland Ø, Sigsgaard T, Vestergaard JM, Wouters MI, Schlünssen V

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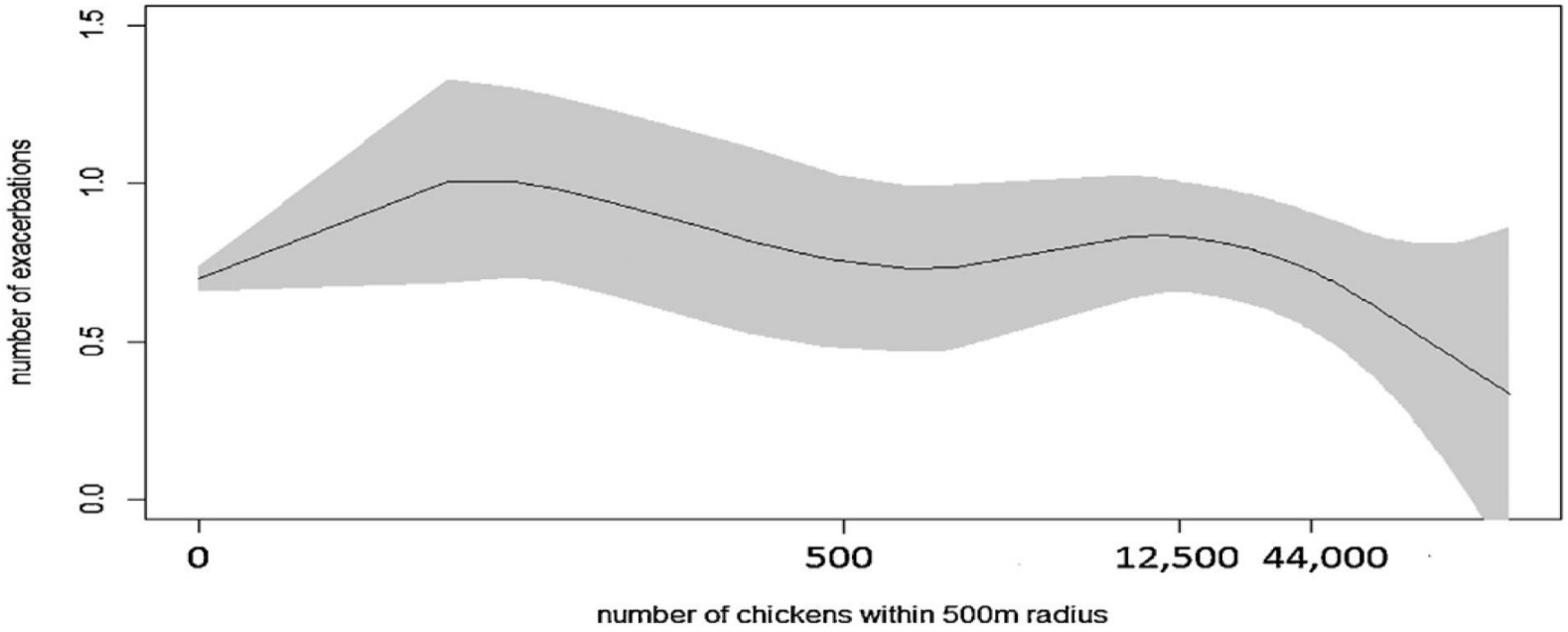
Background

- Air pollutants at work can contribute to onset of asthma and COPD
- How occupational air pollutants affect the prognosis of asthma or COPD among exposed workers is not well established

Risk of exacerbations in COPD and asthma patients living in the neighbourhood of livestock farms: Observational study using longitudinal data

Christel E. van Dijk[a,*], Judith Garcia-Aymerich[b,c,d], Anne-Elie Carsin[b,c,d], Lidwien A.M. Smit[e], Floor Borlée[a,e], Dick J. Heederik[e], Gé A. Donker[a], C. Joris Yzermans[a], Jan-Paul Zock[a,b,c,d]

International Journal of Hygiene and Environmental Health 219 (2016) 278–287



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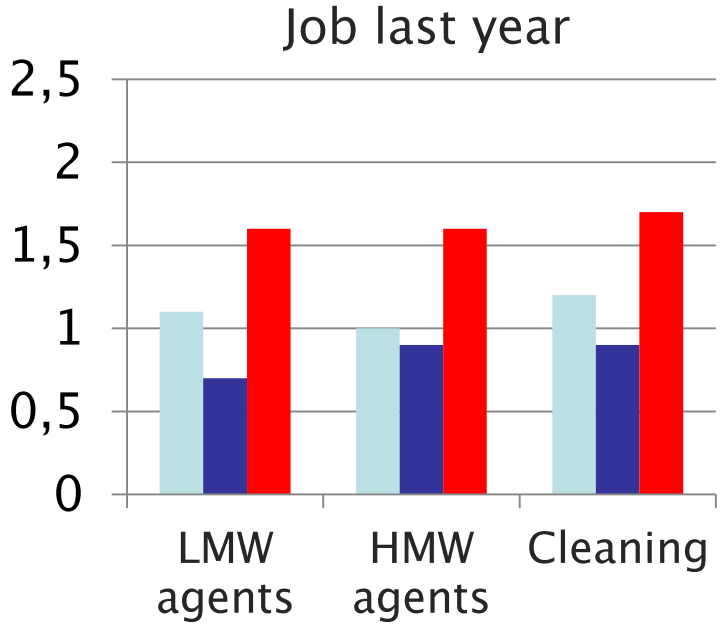
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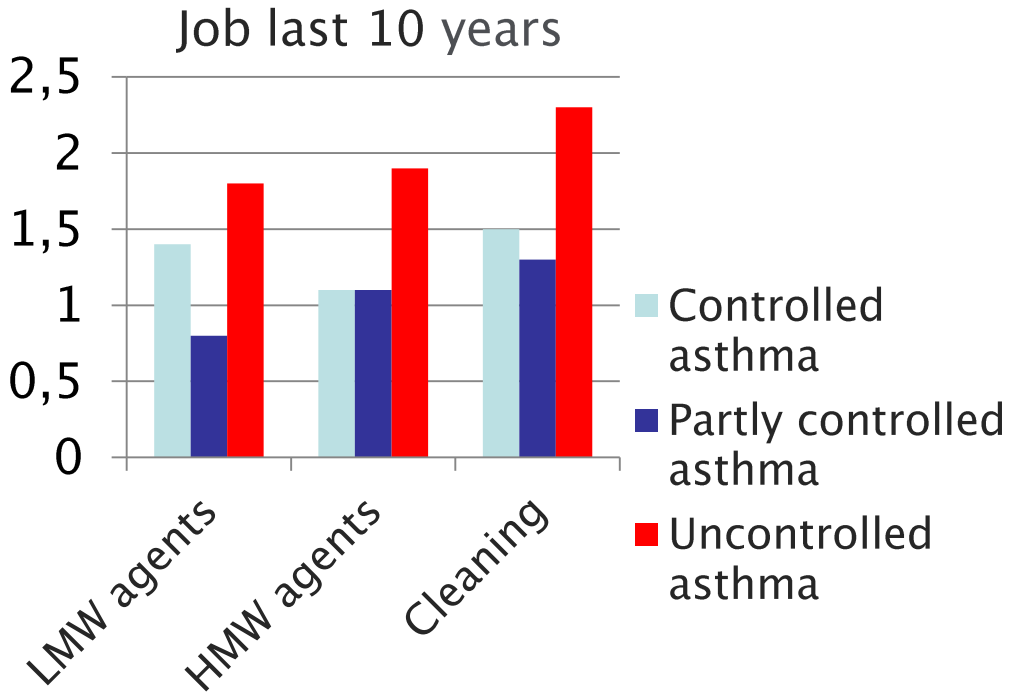
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Occupational exposures and uncontrolled adult-onset asthma in the European Community Respiratory Health Survey II

Nicole Le Moual, Anne-Elie Carsin, Valérie Siroux, Katja Radon, Dan Norback, Kjell Torén, Mario Olivieri, Isabel Urrutia, Lucia Cazzoletti, Bénédicte Jacquemin, Geza Benke, Hans Kromhout, Maria C. Mirabelli, Amar J. Mehta, Vivi Schlünssen, Torben Sigsgaard, Paul D. Blanc, Manolis Kogevinas, Josep M. Antó and Jan-Paul Zock

Eur Respir J 2014;43:374-83

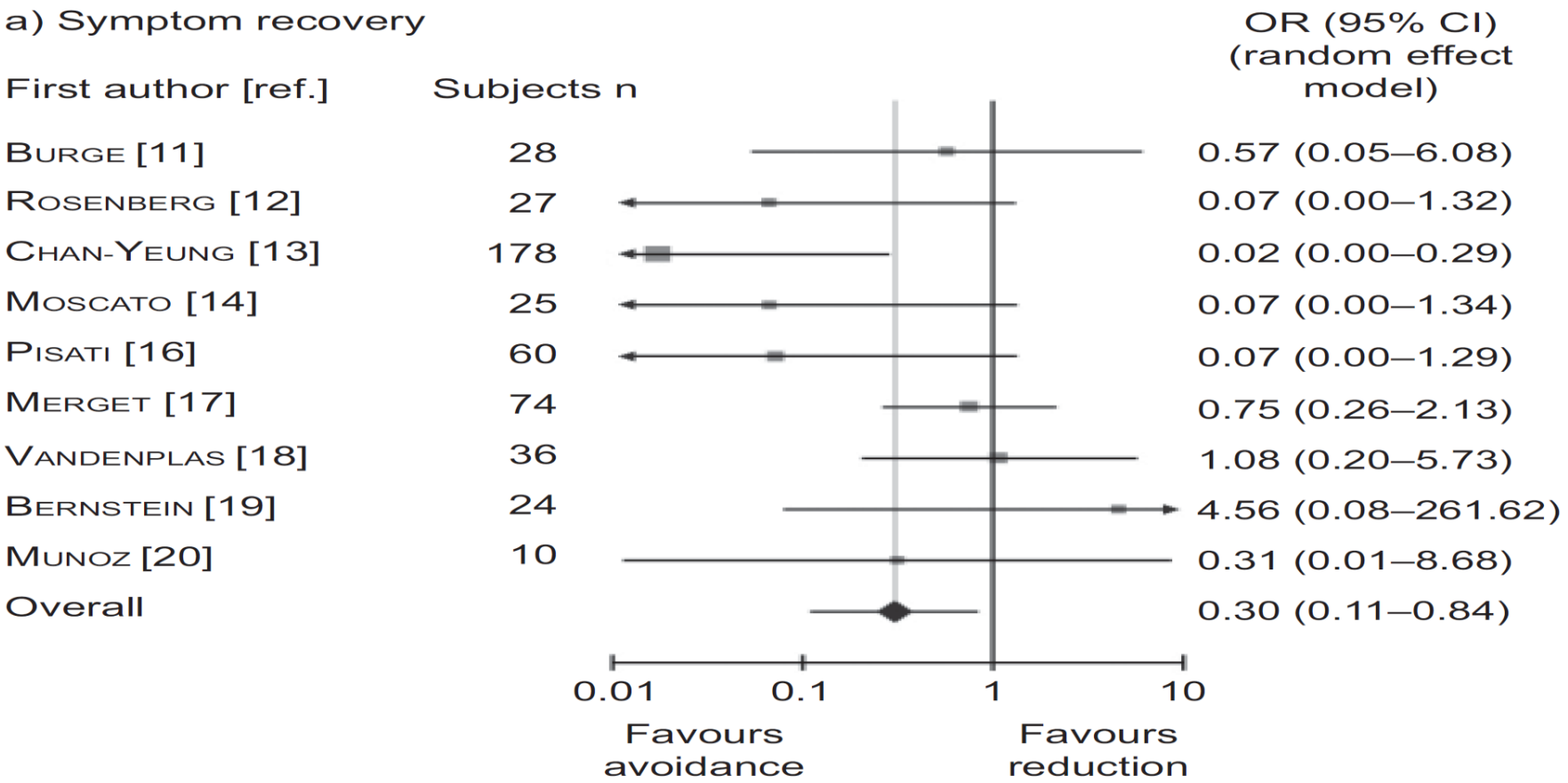




Management of occupational asthma: cessation or reduction of exposure? A systematic review of available evidence

O. Vandenplas*, H. Dressel#, D. Wilken¶, J. Jamart+, D. Heederik§, P. Maestrelli^{f}, T. Sigsgaard, P. Henneberger## and X. Baur¶**

Eur Respir J 2011; 38: 804–811



Organic dust exposure















Objectives

Study the association between recent exposure to organic dust and hospital readmission and overall mortality among individuals with a hospital diagnosis of asthma or COPD

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The cohort

The Supplementary Pension Fund Register: industry

Subjects born 1933-77 ever employed in farming or wood industry 1964-2007 in Denmark

N = 535,918

Employment statistic (RAS, AKM): Occupation (Disco 88 code, blue collar status)

The Danish Civil Registration System: Age, gender, censoring due to dead, disappearance, emigration

The National Patient Register: Asthma and COPD diagnosis

Blue-collar workers with first asthma diagnosis (n = 4002) or COPD diagnosis (n = 2429) between 1997-2007

The National Register on Public Transfer Payments: labour market attachment

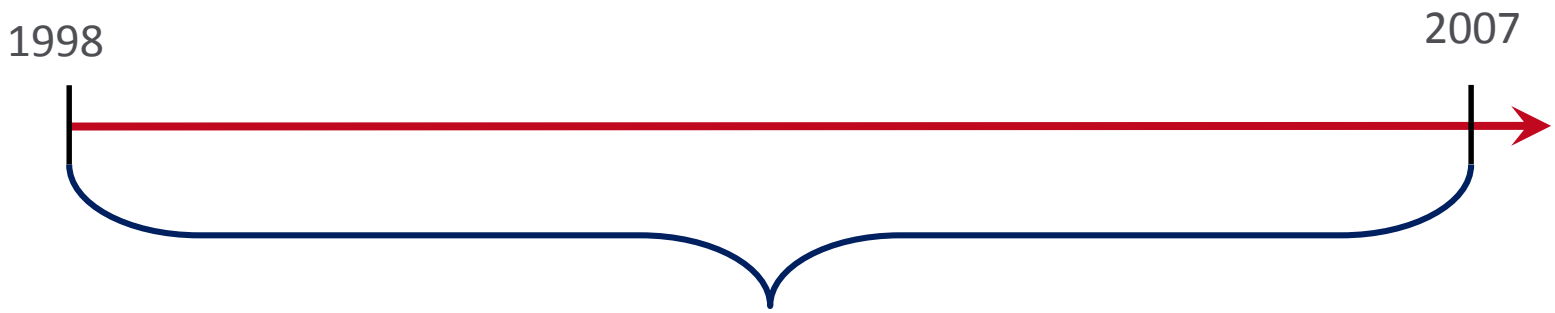
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Follow-up



- Follow-up until first asthma or COPD readmission, death, disappearance, or December 31st 2007
- Exposure lagged one year (trigger exposure)

Exposure: Industry and 2 quantitative time dependent industry exposure matrixes

Nace rev. 2	General industry description
16.10	Sawmilling and planing of wood
16.21	Manufacture of veneer boards and wood-based boards
16.22;16.23	Manufacture of builders carpentry and joinery, parquet floors
16.24	Manufacture of wooden packaging
31.01;31.02: 31.09	Furniture industry
43.32	Carpenter and joiner business/construction
01.11	Crop farming
01.41;01.42	Cattle farming
01.46	Pig farming
01.47	Poultry farming
01.50	Mixed farming
01.49.20	Fur-animal farming

Kauppinen et al Ann Occup Hyg 2006
Basinas et al JEM 2012
Basinas et al JESEE 2013
Schlünssen Ann Occup Hyg 2008

Analysis

- Discrete time hazard logistic regression with person-years as the unit of analysis providing RRs
- Adjusted for age, calendar year, sex, mineral dust exposure, (using ALOHA-JEM), socioeconomic status, and labour-force participation
- Further adjusted for duration of organic dust exposure between first and second hospital admission

Characteristics of the cohort

	Asthma, n = 4002 (19,298 PY)	COPD, n = 2429 (7894 PY)
Age at first diagnosis, mean (range)	42 (21–71)	46 (21–74)
Sex, % female	33%	24%
Readmissions, N	663	471
Deaths, N	64	117

RR (95% CI) of next asthma diagnosis, or overall mortality

Recent exposure level, mg/m³	Readmission Asthma			Overall mortality		
	RR crude	RR adj [a]	RR adj [b] (95% CI)	RR crude	RR adj [a]	RR adj [b] (95% CI)
0	1.0	1.0	1.0	1.0	1.0	1.0
< 0.7	1.3	1.2	3.0 (2.0–4.6)	0.8	1.0	1.5 (0.3–6.5)
> 0.7–5.7	1.4	1.1	3.0 (2.0–4.7)	0.3	0.4	0.6 (0.1–5.0)

a) age, calendar year, sex, mineral dust, SES, labour force participation
b) a) + duration of organic exposure

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RR (95% CI) of next COPD diagnosis, or overall mortality

Recent exposure level, mg/m³	Readmission COPD			Overall mortailty		
	RR crude	RR$_{adj}$[a]	RR$_{adj}$[b] (95% CI)	RR crude	RR adj[a]	RR$_{adj}$[b] (95% CI)
0	1.0	1.0	1.0	1.0	1.0	1.0
< 0.7	0.7	0.7	2.0 (1.0–3.8)	1.9	2.6	2.5 (0.9–6.5)
> 0.7–4.9	0.7	0.6	1.9 (0.9–3.7)	0.3	0.5	0.5 (0.1–2.6)

a) age, calendar year, sex, mineral dust, SES, labour force participation
b) a) + duration of organic exposure

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To sum up....

- A trigger effect of organic dust exposure is suggested for both readmissions for asthma and COPD after accounting for duration of exposure
- No indications of a dose dependent relation
- No clear association to overall mortality

Strength and limitations

- Relatively well powered study
- Nearly complete follow-up
- Quantitative exposure estimates
- A young cohort
- Low exposure levels
- No smoking information

Conclusion

- Recent exposure to organic dust might be related to readmission for both asthma and COPD, but does not affect the overall mortality
- Work in progress!

Occupational air pollutant JEMS available in DOC-X

- ALOHA JEM: organic and mineral dust, gases and fumes
- Wood dust: QJEM and QIEM
- Endotoxin: QJEMs and QIOM
- Organic dust: QIOM

http://doc-x.dk/

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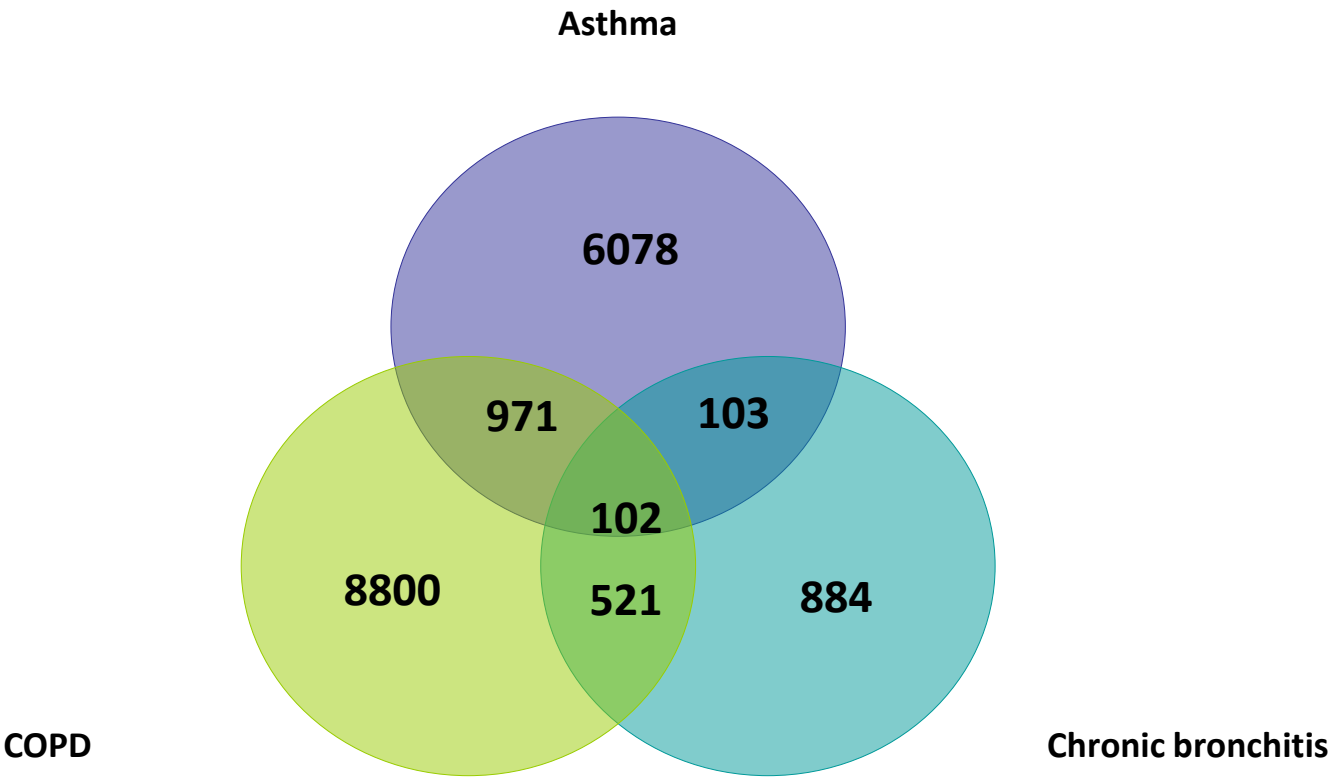


Asthma and COPD diagnosis

- COPD ICD10 codes: emphysema (J43, J43.0, J43.1, J43.2, J43.8, J43.9), other chronic obstructive pulmonary disease (J44, J44.0, J44.1 J44.8, J44.9)

- Asthma ICD10 codes: Asthma (J45), Predominantly allergic asthma (J45.0), Nonallergic asthma (J45.1), Mixed asthma (J45.8), asthma unspecified (J45.9), and status asthmaticus (J46, J46.9)

Overlap between Asthma and COPD



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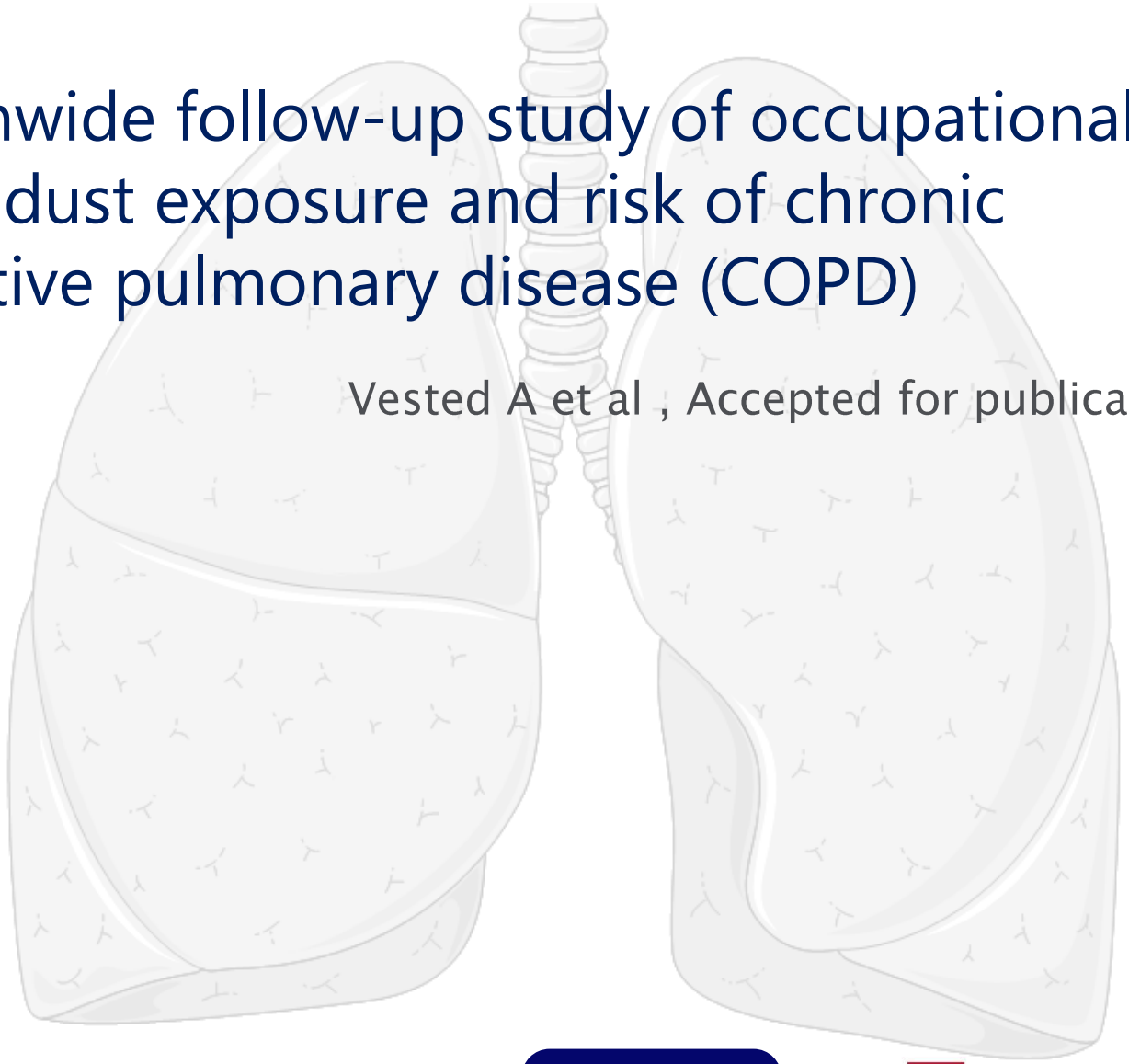
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A nationwide follow-up study of occupational organic dust exposure and risk of chronic obstructive pulmonary disease (COPD)

Vested A et al , Accepted for publication in OEM



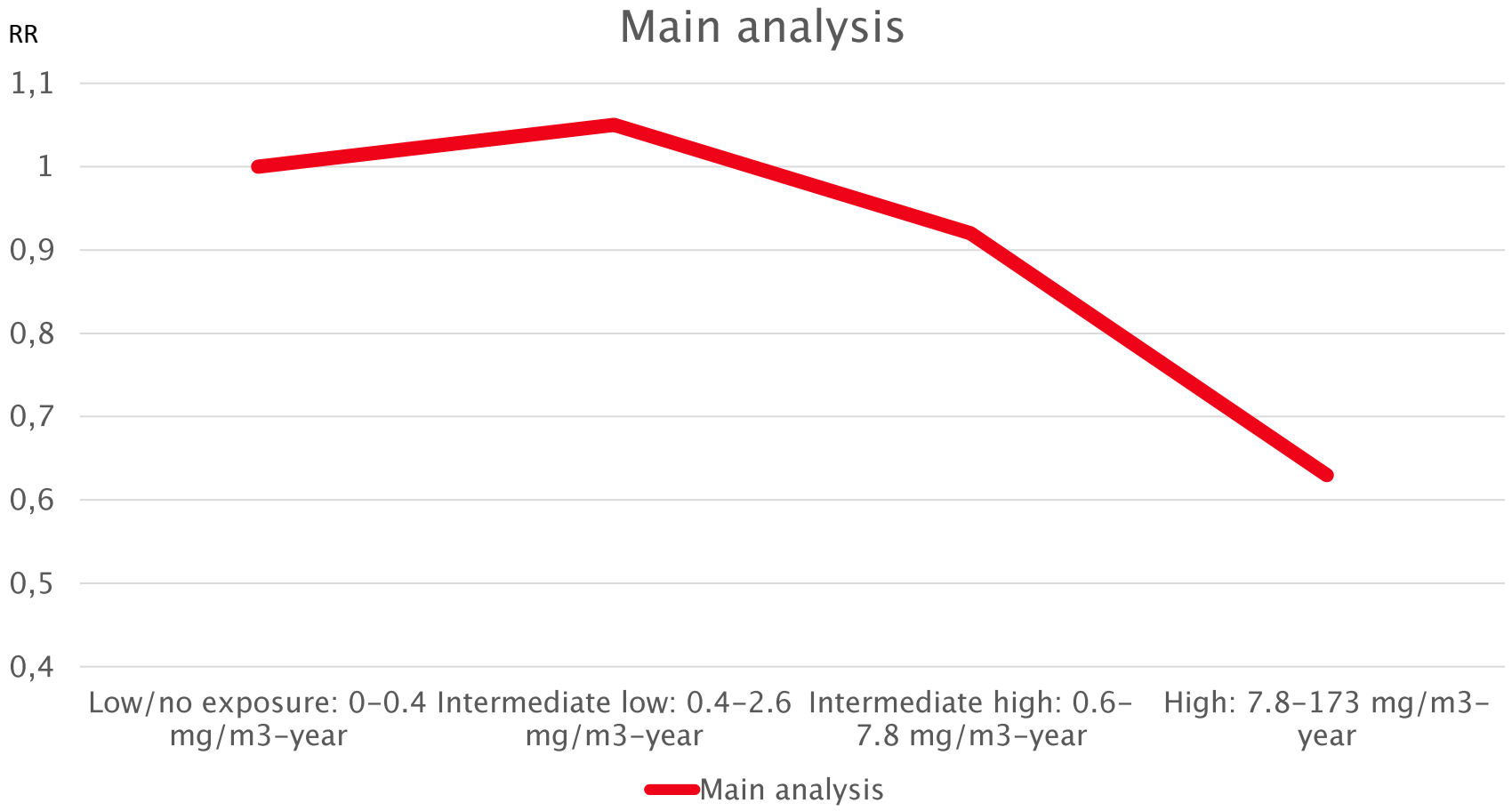
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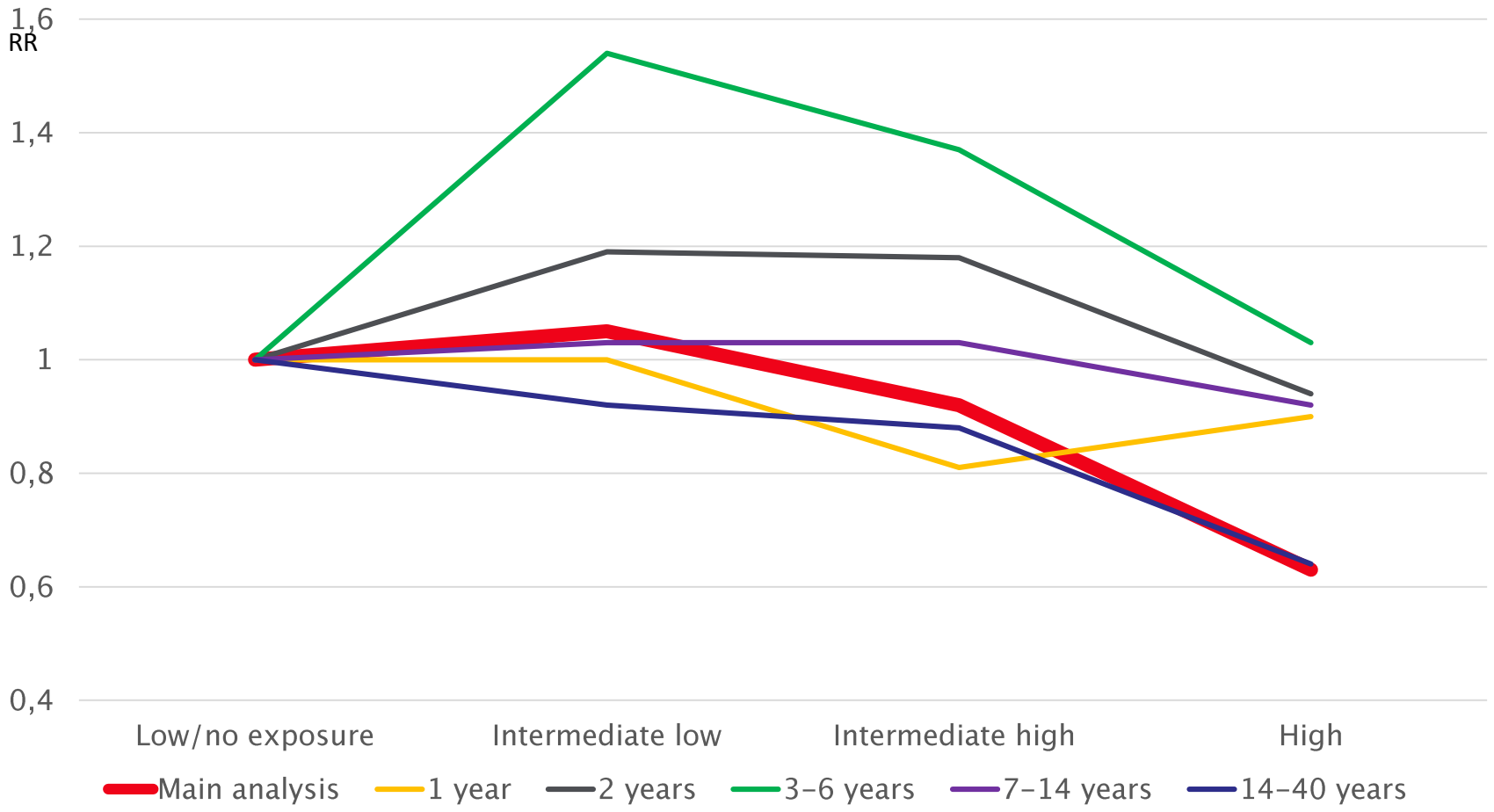
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RR of COPD by quartiles of cumulative organic dust exposure, 10 years lag



RR of COPD by quartiles of cumulative organic dust exposure, 10 years lag by duration



Discrete time hazard logistic regression with person-years as the unit of analysis

idnr	year	KOL_case	cum exp	exposure_grp	Age	age_grp	sex
1	1997	0	170	3	23	1	1
1	1998	0	200	3	24	1	1
1	1999	0	200	3	25	1	1
1	2000	0	200	3	26	2	1
1	2001	0	200	3	27	2	1
1	2002	0	200	3	28	2	1
1	2003	0	200	3	29	2	1
1	2004	0	200	3	30	2	1
1	2005	0	200	3	31	2	1
1	2006	0	200	3	32	2	1
1	2007	1	200	3	33	2	1
2	1997	0	100	1	49	4	2
2	1998	0	100	1	50	4	2
2	1999	0	120	2	51	4	2
2	2000	1	150	2	52	4	2

Stata command: logistic case i.exp_grp i.age_grp year i.sex => Rate ratio

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Estimates in model apart from recent exposure, COPD

	RR (95% CI)
Female	0.95 (0.74-1.23)
agegr	
1 (30-39)	0.41 (0.16-1.04)
2 (40-49)	0.56 (0.23-1.36)
3 (50-59)	0.92 (0.39-2.18)
4 (60-69)	1.06 (0.43-2.58)
5 (70-79)	1.63 (0.17-15.94)
minedust_lag	
1 (low)	1.13 (0.87-1.48)
2 (high)	1.14 (0.82-1.60)
Lag socio_grp	
2 (selvstændig)	1.61 (0.37-7.08)
3 (lønmodt hlj og mellem)	2.25 (0.52-9.72)
4 (lønmodt lavt niv)	2.99 (0.72-12.41)
5 (udd søgende)	3.22 (0.76-13.65)
<25% labor force participation	1.23 (0.87-1.73)
Exposed years cum	0.58 (0.44-0.78)
cons	0.06 (0.01-0.33)
Ref = No exposed, age gr 20-29, follow-up year 1998, No mineral dust exp, SES (Topleder), >25% labor force participation,	

Other estimates in model, asthma

	RR (95% CI)
Female	1.01 (0.84-1.22)
agegr	
1 (30-39)	1.40 (1.01-1.95)
2 (40-49)	1.30 (0.93-1.83)
3 (50-59)	1.59 (1.13-2.26)
4 (60-69)	1.68 (1.04-2.71)
5 (70-79)	Empty
minedust_lag	
1 (low)	0.80 (0.63-1.00)
2 (high)	0.88 (0.66-1.17)
Lag socio_grp	
2 (selvstændig)	4.47 (1.07-18.66)
3 (lønmodt hlj og mellem)	3.63 (0.88-14.91)
4 (lønmodt lavt niv)	4.81 (1.18-19.59)
5 (udd søgende)	5.27 (1.28-21.68)
<25% labor force participation	1.09 (0.85-1.40)
Exposed years cum	0.62 (0.52-0.72)
cons	0.01 (0.004-0.08)
Ref = No exposed, age gr 20-29, follow-up year 1998, No mineral dust exp, SES (Topleder), >25% labor fp	