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INDOOR AIR AND HEALTH

Grethe Elholm
Public Health, Aarhus University

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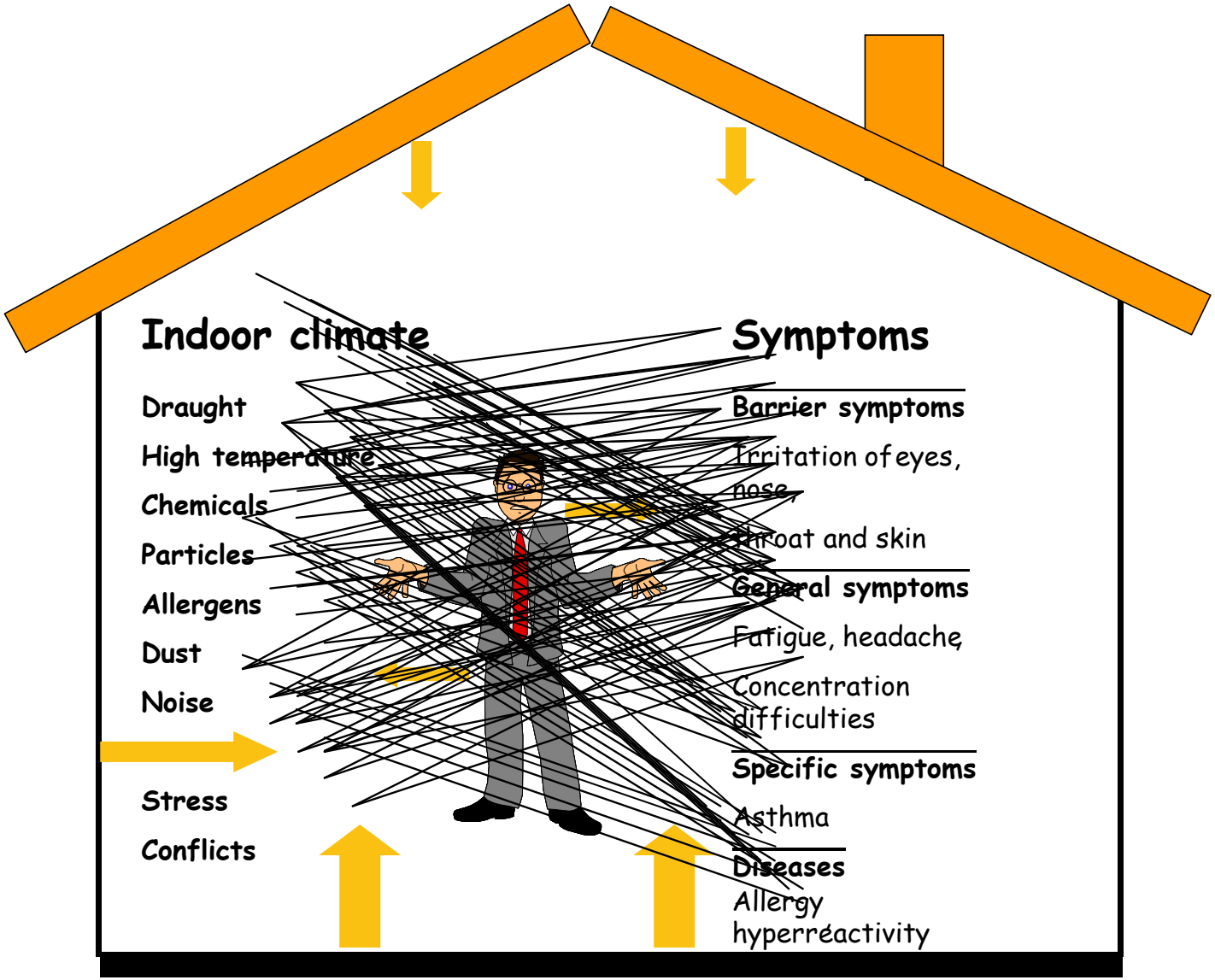
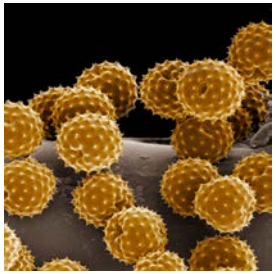
PROLOGUE

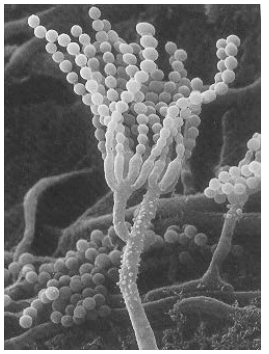
It is a challenge to evaluate indoor air exposure !

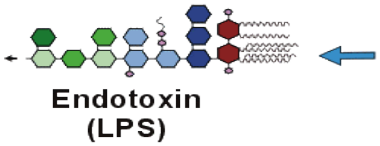


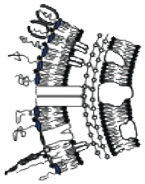
Fra Kjell Andersson, Örebro

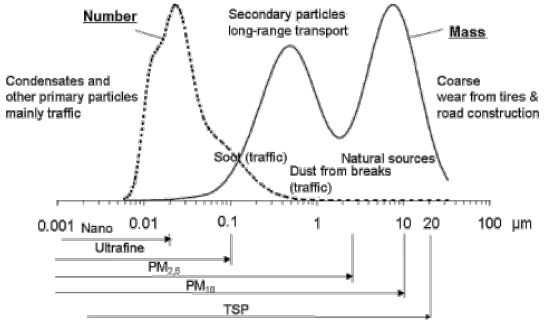
Important airborne exposures

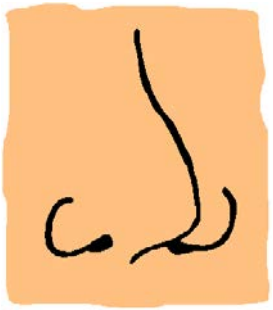












Health effects

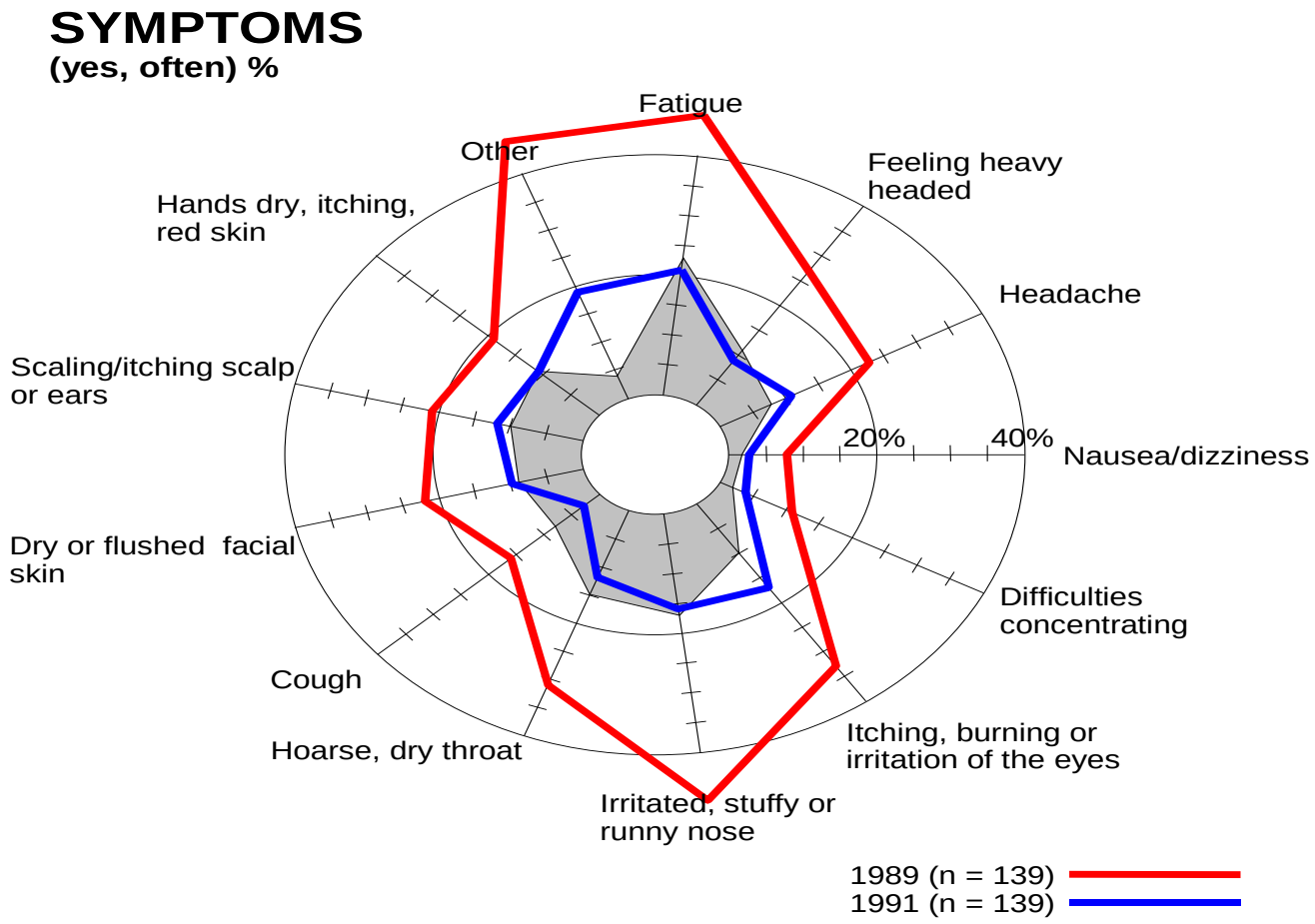
- Annoyance
- Irritation, general symptoms
- Infectious disease
- Allergy, allergic disease
  - *Asthma*
  - *Nasal problems (hay fever)*
- Heart disease
- Chronic obstructive lung disease - COPD
- Cancer

Increasing severity

INDOOR SYNDROME (WHO 1986)

- **Sensoric irritation in eyes, nose, throat** (pain, feeling of dryness, horseness, irritation, problems with the voice)
- **Neurological or uncharacteristic symptoms** (head egg, sleepeness, decreased concentration, nausea, vomiting)
- **Skin irritation** (pain, redness, itching, dry skin)
- **Unspecific hypersensitivity reactions** (Runny nose and eyes, asthma-like symptoms
- **Smell and taste symptoms** (Changed smell and taste sensation)

Annoyance, irritation, general symptoms



From Kjell Andersson, Arbejds- og miljømedicinsk klinik, Ôrebro Universitets Sygehus

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INFECTIONS

- A common cold far most frequent
- Spread of infectious disease
  - A common cold
  - Flu
  - Meningitis
  - Legionellae

- Most important determinants: Person density, ventilation, hygiejne

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WHAT IS ALLERGY?

- Undesirably reactions from the immune system
- Is (partly) the cause of a range of disease, for example:
  - Asthma
  - Rhinitis (hay fever)
  - Atopic eczema
- These diseases are called allergic disease, although they are not always caused by allergic mechanisms!

Exposure to multiple indoor allergens in US homes and its relationship to asthma

Päivi M. Salo, PhD,[a] Samuel J. Arbes, Jr, DDS, MPH, PhD,[b] Patrick W. Crockett, PhD,[c] Peter S. Thorne, PhD,[d] Richard D. Cohn, PhD,[c] and Darryl C. Zeldin, MD[a] *Research Triangle Park, Chapel Hill, and Durham, NC, and Iowa City, Iowa*

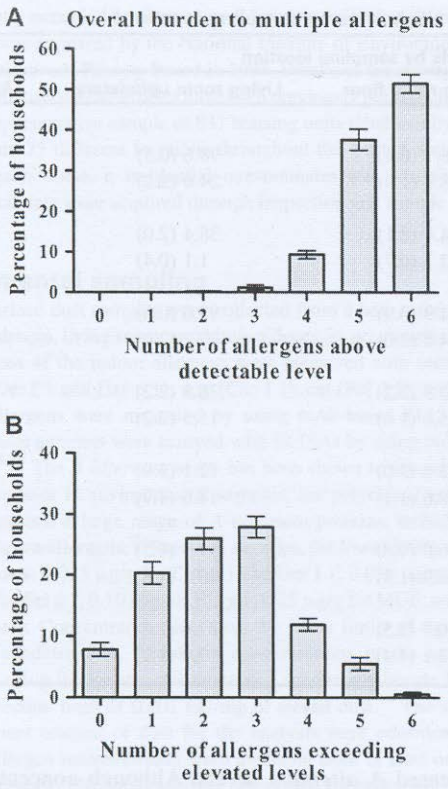


FIG 1. Overall burden of multiple allergens in US homes. The bar graph shows percentages (± SEs) of homes with detectable **(A)** and increased **(B)** levels of allergens by numbers of allergens exceeding allergen-specific thresholds.

TABLE IV. Current asthma in relation to high allergen burden (≥4 allergens exceeding increased levels in the home) stratified by atopic status

Logistic models	Current asthma, OR (95% CI)	*P* value for interaction
Unadjusted model		
All subjects	1.57 (0.99-2.50)	
Diagnosed allergies*		.03
No	0.65 (0.25-1.69)	
Yes	2.18 (1.28-3.69)	
Adjusted model†		
All subjects	1.39 (0.91-2.14)	
Diagnosed allergies*		.07
No	0.62 (0.24-1.60)	
Yes	1.81 (1.04-3.15)	

*Atopy assessed by reported doctor-diagnosed allergies.
†Adjusted for age, sex, race, education, smoking, season, and endotoxin levels (current asthma/no current asthma [n/N] = 165/1788).

J Allergy Clin Immunol 2008

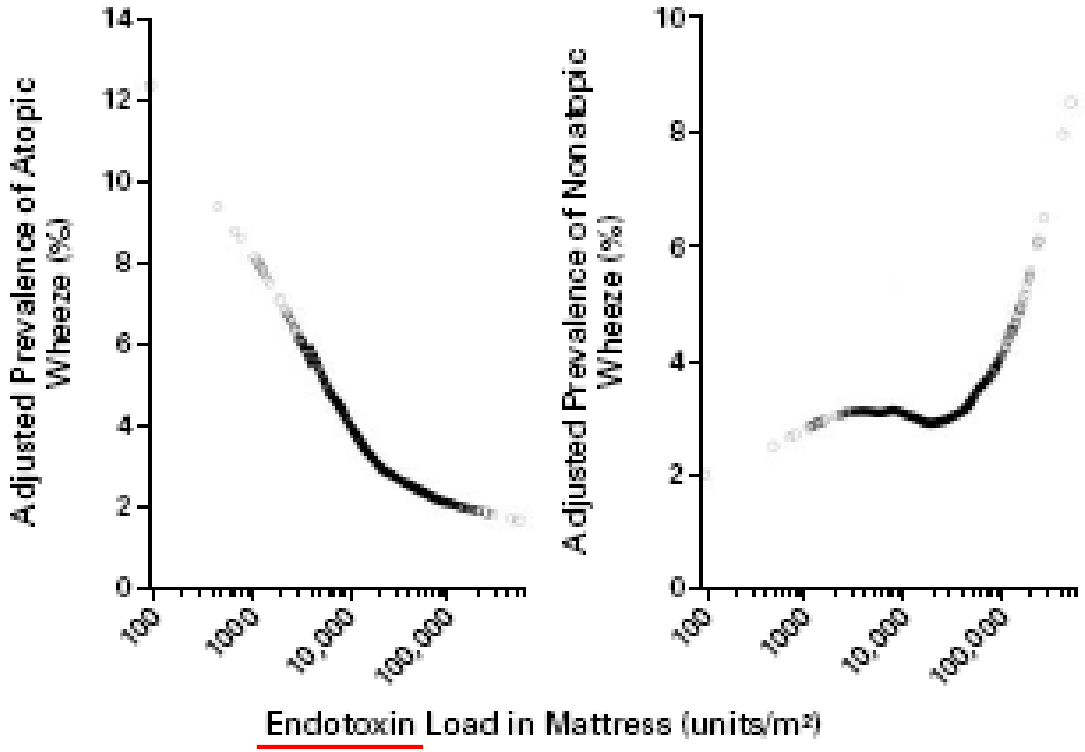
The New England
Journal of Medicine

VOLUME 347 SEPTEMBER 19, 2002 NUMBER 12

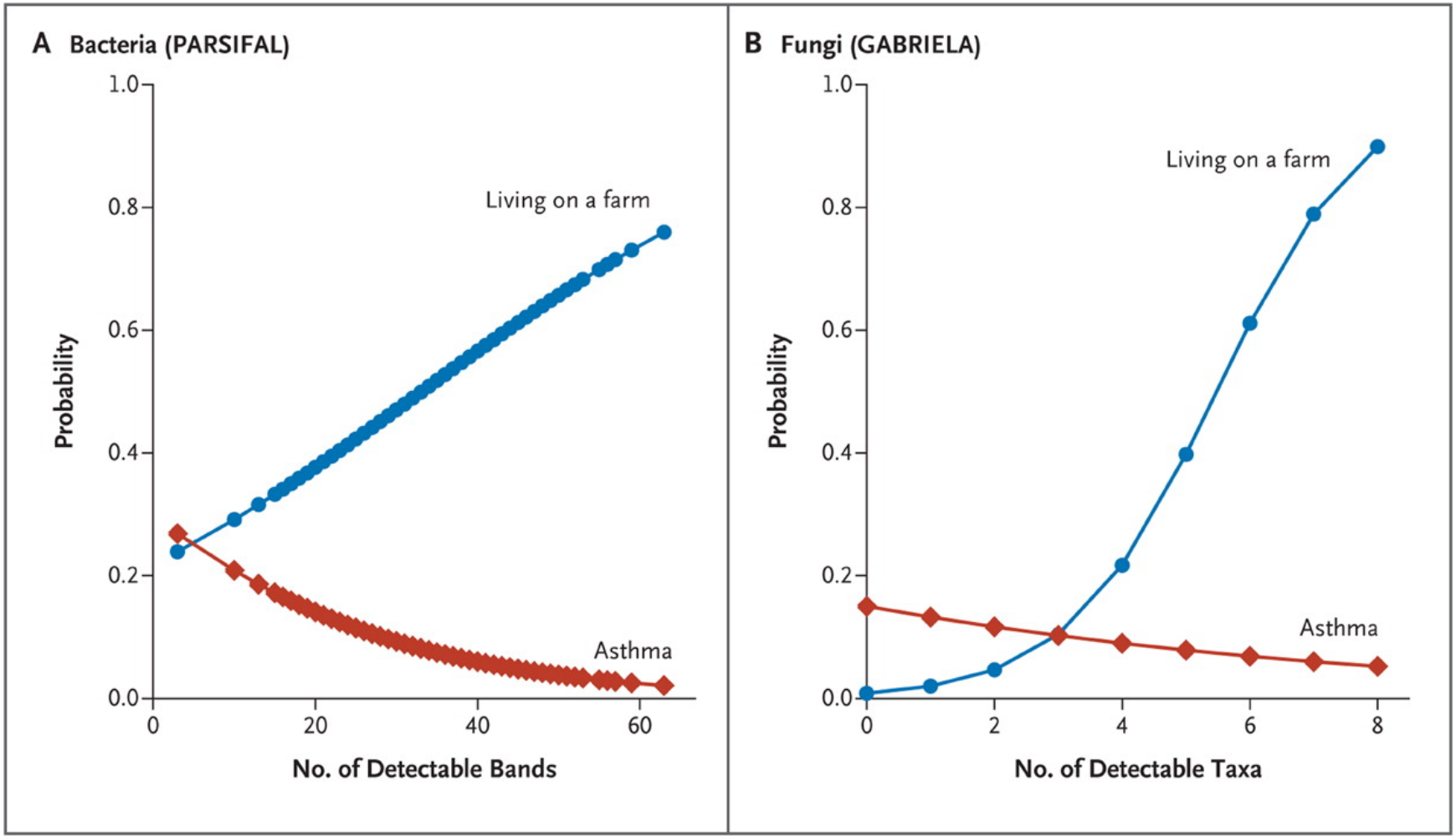
ENVIRONMENTAL EXPOSURE TO ENDOTOXIN AND ITS RELATION TO ASTHMA IN SCHOOL-AGE CHILDREN

A Atopic wheeze

B Non-atopic wheeze



Microorganism diversity and childhood asthma



Ege et al NEJM 2011

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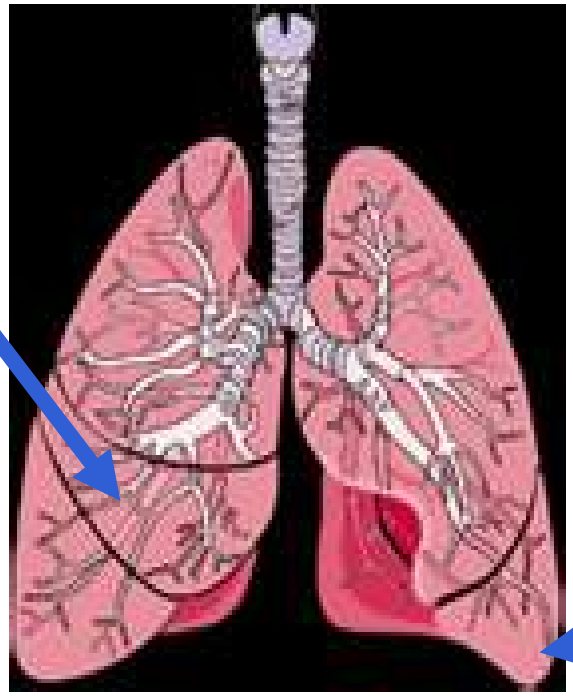
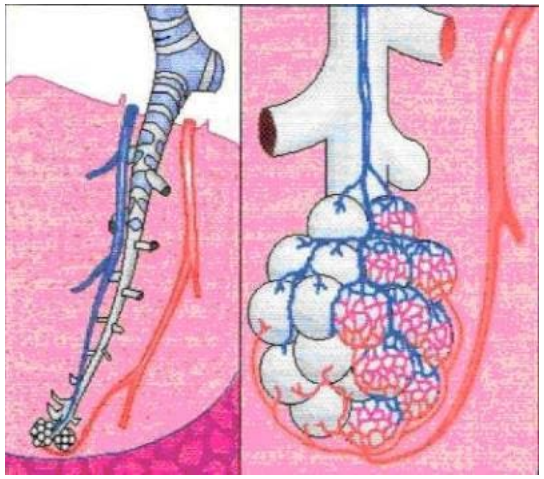
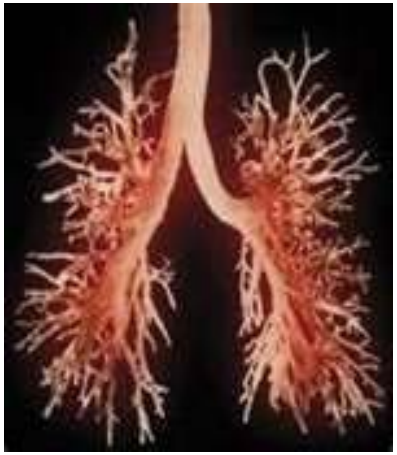
COPD

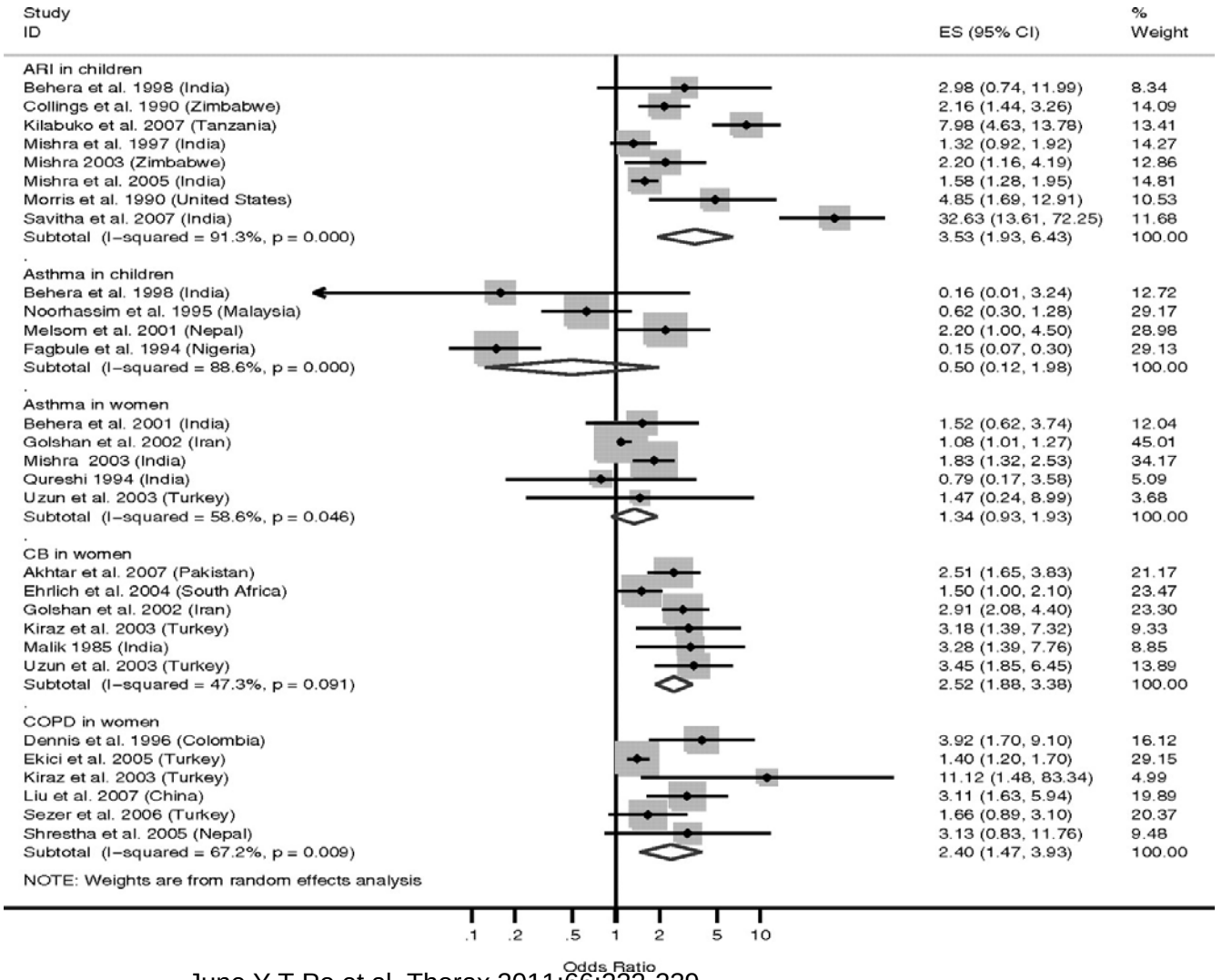
COPD







Forest plot of biofuel compared to other types of fuel, airways disease among women and children



June Y T Po et al. Thorax 2011;66:232-239

THORAX

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Cancer

- ETS
- Radon
- Asbestos

Lung Cancer and cardiac disease

Table 2 PAF and number of deaths attributable to passive smoking among never smoking women, Spain 2002

	Lung cancer (min-max)		Ischaemic heart disease (min-max)		Total (min-max)
	PAF	Deaths	PAF	Deaths	Deaths
Overall ETS exposure					
35–64 years	–	12–31	–	41–84	53–115
⩾65 years	–	37–70	–	730–1349	767–1419
Total	–	49–101	–	771–1433	820–1534
ETS exposure only at home					
35–64 years	0.050–0.073	8–12	0.062–0.090	32–46	40–58
⩾65 years	0.160–0.308	37–70	0.046–0.085	730–1349	767–1419
Total	–	45–82	–	762–1395	807–1477
ETS exposure only at work					
35–64 years	0.021–0.070	3–12	0.011–0.039	6–20	9–32
⩾65 years	–		–	–	–
Total	–	3–12	–	6–20	9–32
ETS exposure at home and at work					
35–64 years	0.008–0.045	1–7	0.011–0.058	3–18	4–25
⩾65 years	–	–	–	–	–
Total	–	1–7	–	3–18	4–25

PAF, population attributable fraction; ETS, environmental tobacco smoke.

López MJ et al Tob Control. 2007

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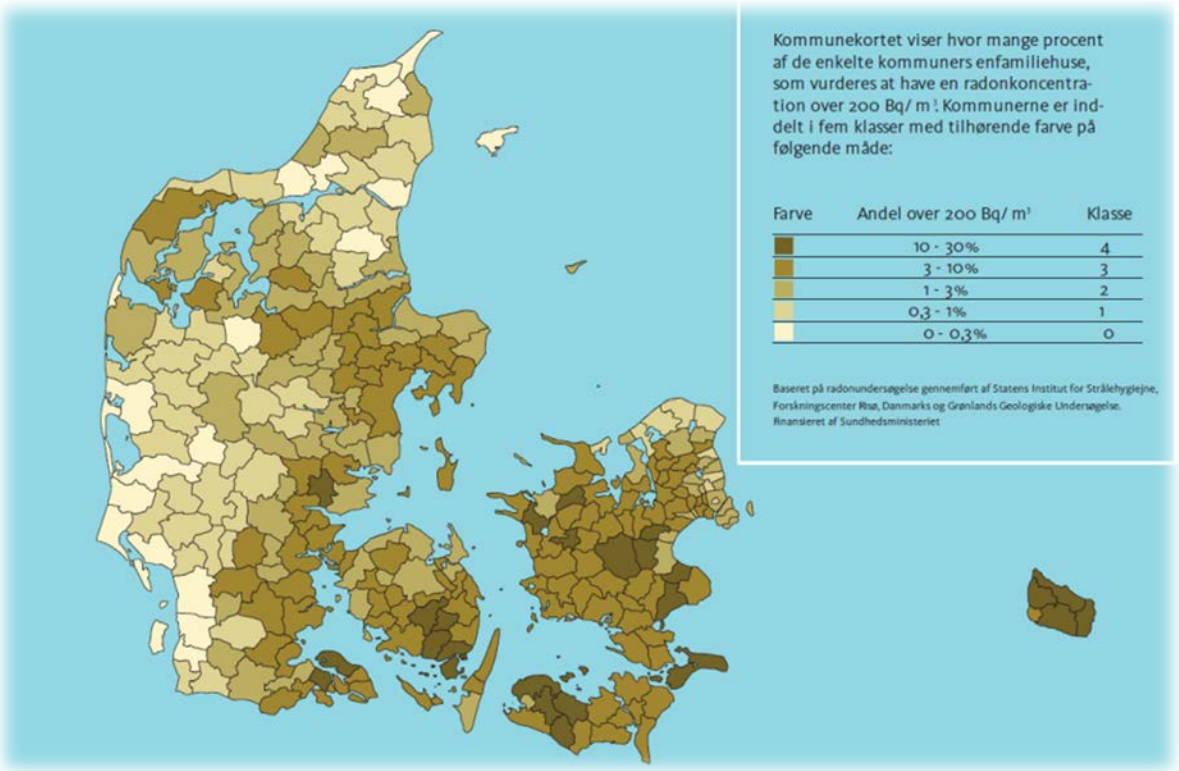
RADON



4.6% of homes > **200Bq/m^3** i år 2000

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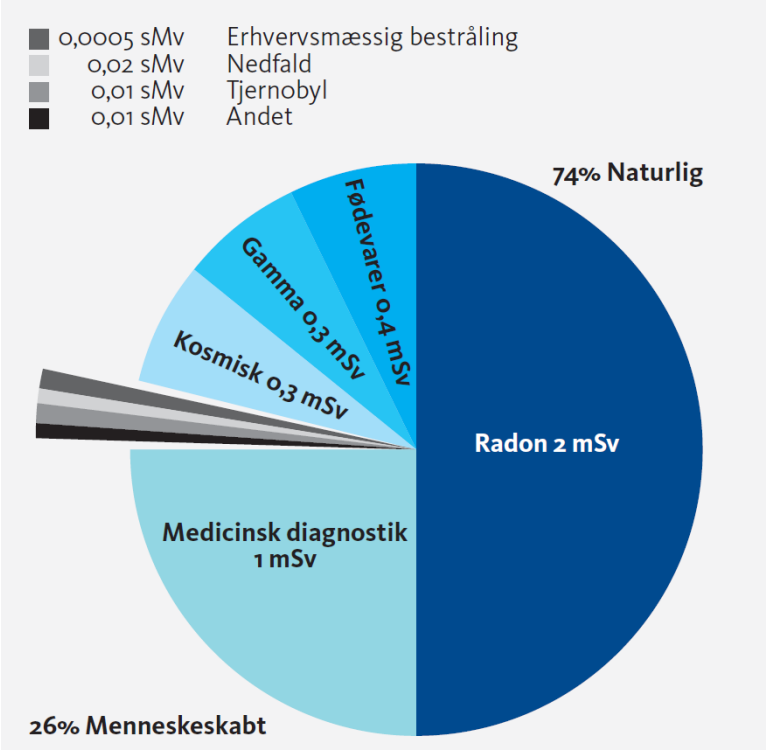
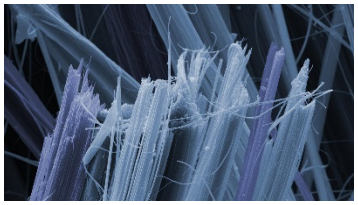
RADIATION EXPOSURE AMONG THE DANISH POPULATION

Total 4 mSv pr year:

- Medical radiation ~ 1 mSv
- Background radiation ~ 1 mSv
- Radon and radon daughters indoor ~ 2 mSv



ASBESTOS EXPOSURE



Prioritering i praksis
- samfundets overordnede prioritering

- **Mål**: Minimering af den samlede optagelse af PCB i populationen
- Bygninger med langvarige ophold, specielt hvis den bruges af primære målgrupper for indsatsen.
- Håndtering af PCB-holdigt bygningsaffald så det ikke ender i fødekæden og dermed i fødevarer
  - også en central sundhedsmæssig prioritet.


JydskeVestkysten
KOLDING
Giftfund i gammelt plejehjem koster millioner


JydskeVestkysten
SØNDERBORG
Embedslæge: 10. klasses skole er sundhedsskadelig


14 GREVE
Høje PCB-forekomster på skole

Håndtering i praksis

"Aktionsværdier" – handle-værdier

Forureningsniveau	Anbefaling
Over 3.000 ng PCB/m³	Det anbefales, at der gribes ind med kildefjernelse og/eller forsegling uden unødig forsinkelse, også i bygninger, som kun anvendes dele af døgnet. Midlertidige afværgeforanstaltninger bør umiddelbart iværksættes.
300 – 3.000 ng PCB/m³	Det må antages, at ophold i længere tid kan medvirke til sundhedsskader. Det anbefales, at der umiddelbart iværksættes midlertidige afværgeforanstaltninger og der må laves planer for mere vedvarende løsninger.
Under 300 ng PCB/m³	Der er PCB i bygningen, men udsættelsen vurderes ikke at medføre en betydende forøget helbredsrisiko.

Opholdstid indgår ikke i aktionsniveauerne

Sundhedsstyrelsen
Danish Health and Medicines Authority

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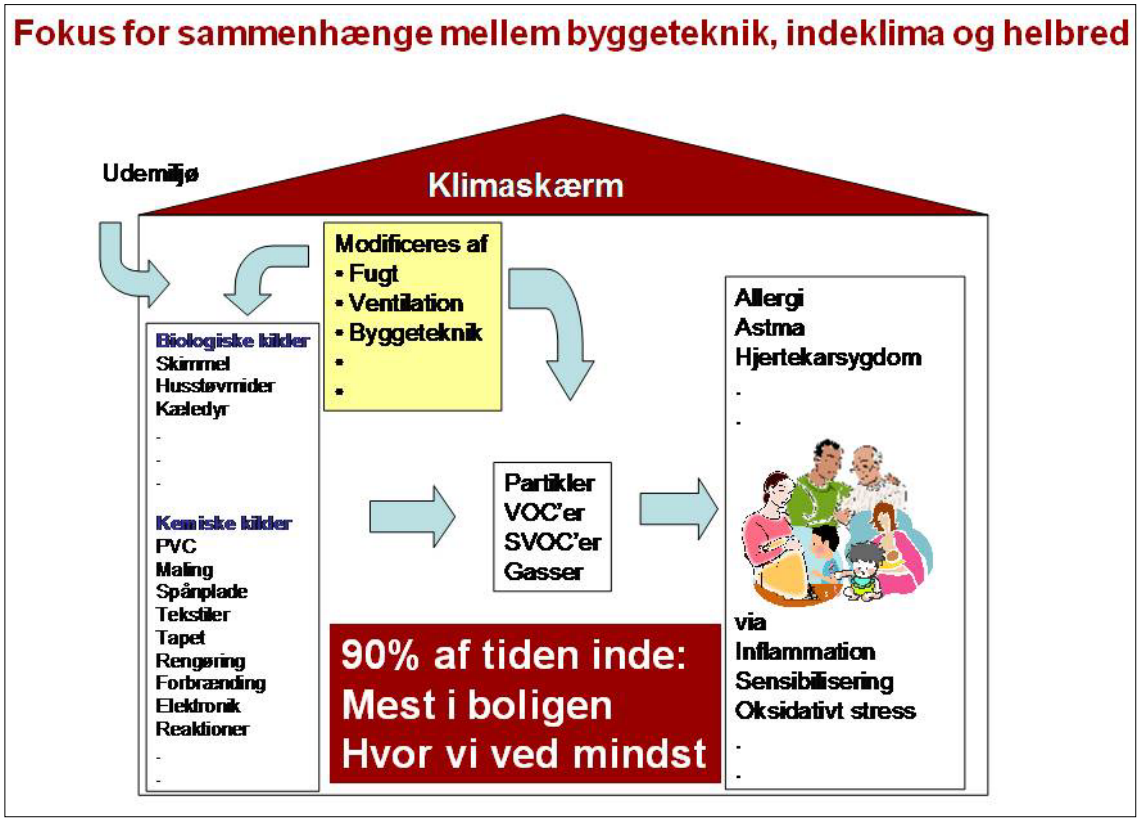
SUMMARY

- Many well documented exposures
- Mostly annoyance – disease not common
- Many well documented and possible disease caused by or exacerbated by indoor air exposures
- Still more knowledge is needed:
  - Better exposure assessment
  - More knowledge about dose response associations
  - More knowledge about simultaneous exposures
  - More knowledge about susceptible groups
  - More knowledge about mechanisms
  - More intervention research

CISBO

Center for Indeklima og Sundhed i Boliger

- Centre for Indoor air and health in dwellings (2009-2016)
- Research director: Torben Sigsgaard, Institut for Folkesundhed, AU
- Other institutions: Statens Byggeforskningsinstitut, Institut for Folkesundhedsvidenskab KU, Det Nationale Center for Arbejdsmiljø



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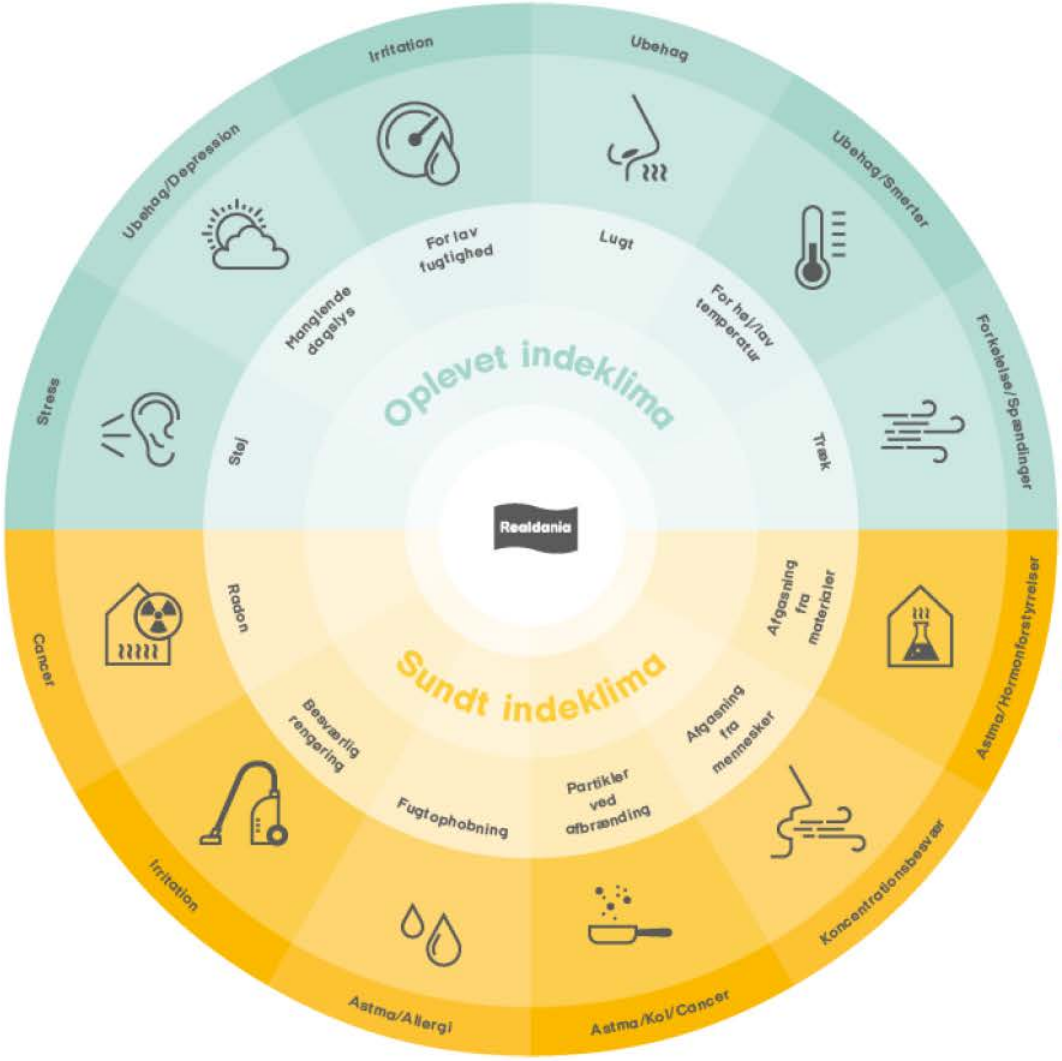
Udvikler og bevarer

Realdania
By & Byg



TEAM:

Pluskontoret Arkitekter

Lendager Group

MOE Rådg. Ing.

Torben Sigsgaard, prof., ÅU

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TAK FOR OPMÆRKSOMHEDEN