

SEMINAR THE 19TH OF FEBRUARY 2013

CENTRE FOR PUBLIC HEALTH RESEARCH NEW ZEALAND



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND



PRESENTER:

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Section of Environment, Occupation and Health
Aarhus University, Denmark







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Comparison











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	Denmark 	New Zealand 
Country		
Area	43,098 km ²	268,021 km ²
Population	5,580,516	4,451,017
Age	800 AD	1,250 AD
Avarage household income (yearly)	83,300 NZD	62,853 NZD
Drives in	Right side of the road	Left side of the road
Highest point	Møllehøj 170 m	Mt. Cook 3,600 m

Comparison







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	Aarhus  	Wellington  
Highest point	Jelshøj 128 m	Hawkins Hill 495 m
Population (urban)	252,213	395,600
Urban density	681 per km ²	890 per km ²
Area (urban)	468 km ²	444 km ²
University	 	 
Number of students	35,000	33,904 (all campus')
Age of University	1933	1927

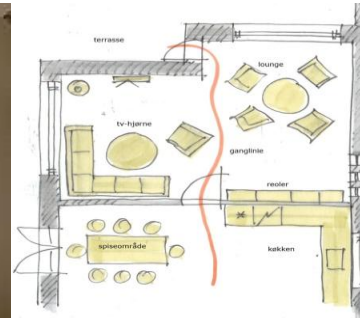
Comparison



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Mean values	Aarhus  	Wellington  
Wind speeds	5.6 km ² per hour	22 km ² per hour
Temperature	8.3 °C	12.5 °C
Summer month temperature	17 °C	20 °C
Winter month temperature	0 °C	5 °C
Frost	59 days	0 days
Rainy days (monthly)	14 days	13 days
Precipitation	818 mm	1251 mm
Sunny hours (daily)	5 hours	5.5 hours

RISK FACTORS OF ASTHMA AND ALLERGY RELATED TO INDOOR ENVIRONMENT – WITH SPECIAL EMPHASIS ON MICROBIAL EXPOSURE IN EPIDEMIOLOGICAL STUDIES



Aim of the presentation



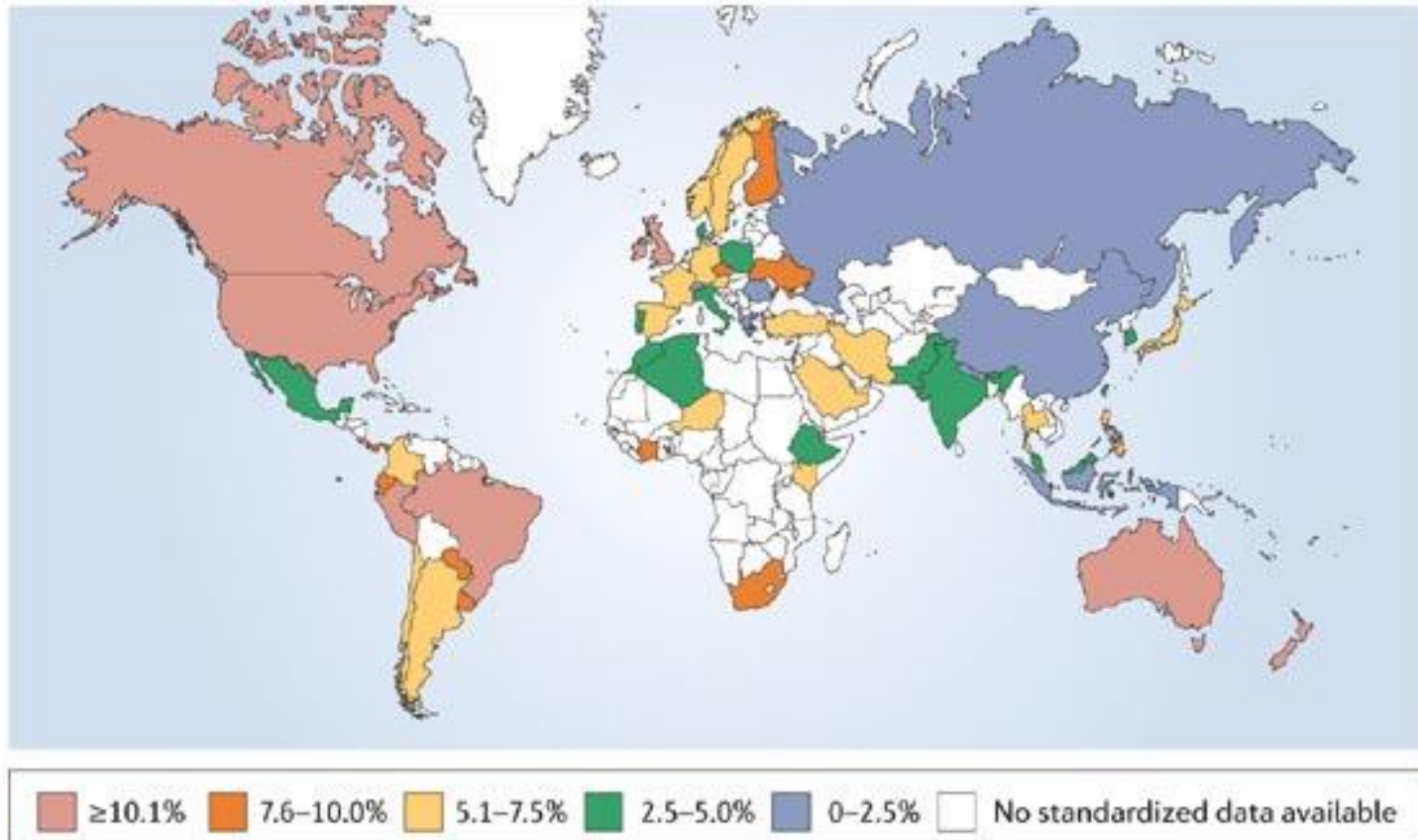
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- 1) Prevalences of asthma and allergy
- 2) Indoor environmental risk factors of asthma and allergy
- 3) Microbial exposure
- 4) The hygiene hypothesis
- 5) Results from a Danish children study
- 6) Volunteers

Increasing prevalence of asthma



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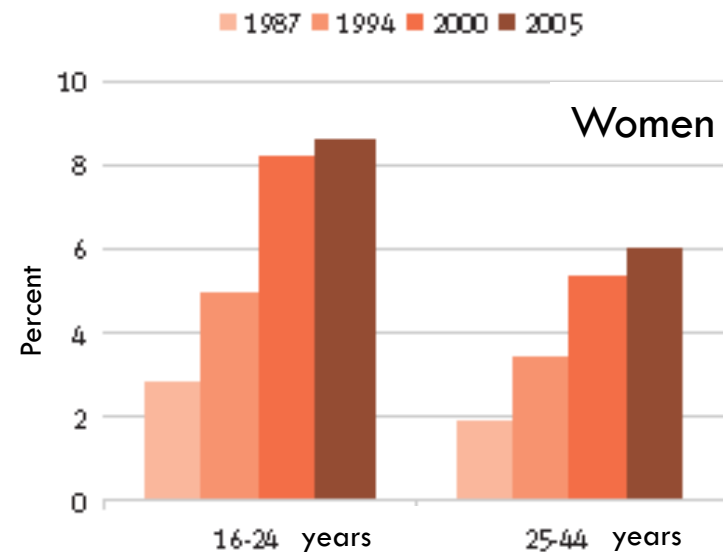
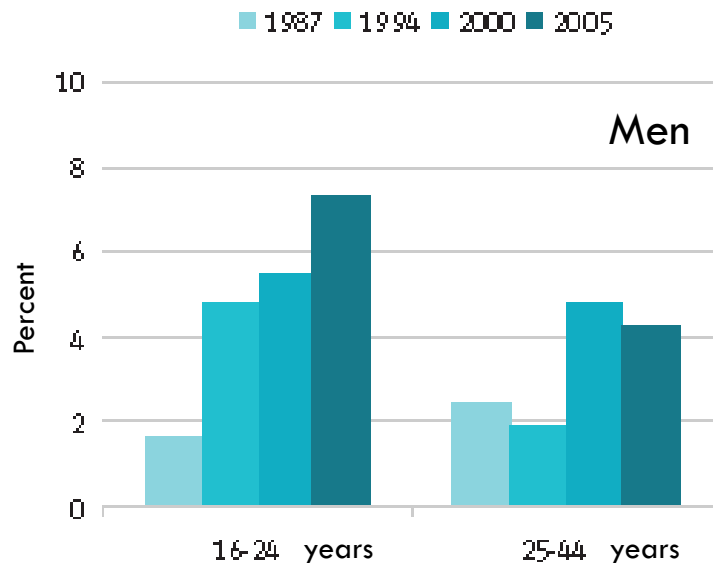
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Nature Reviews | Immunology

Prevalence in Denmark



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Increasing prevalence of asthma in Denmark



Source: Ekholm et al, 2006.

Why this increase?



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□ Hypotheses

- Air pollution increase
- Increased urbanisation and westernisation
- Diet changes
- Obesity and increased physical inactivity
- Change in indoor environment (e.g. ventilation, increased humidity)
- Smoking
- Alcohol consumption increase
- Increased allergen exposure (longer more intense)
- Psychological factors (e.g. stress)
- Change in family patterns (e.g. fewer siblings, higher age when giving birth)

Risk factors in indoor environment?

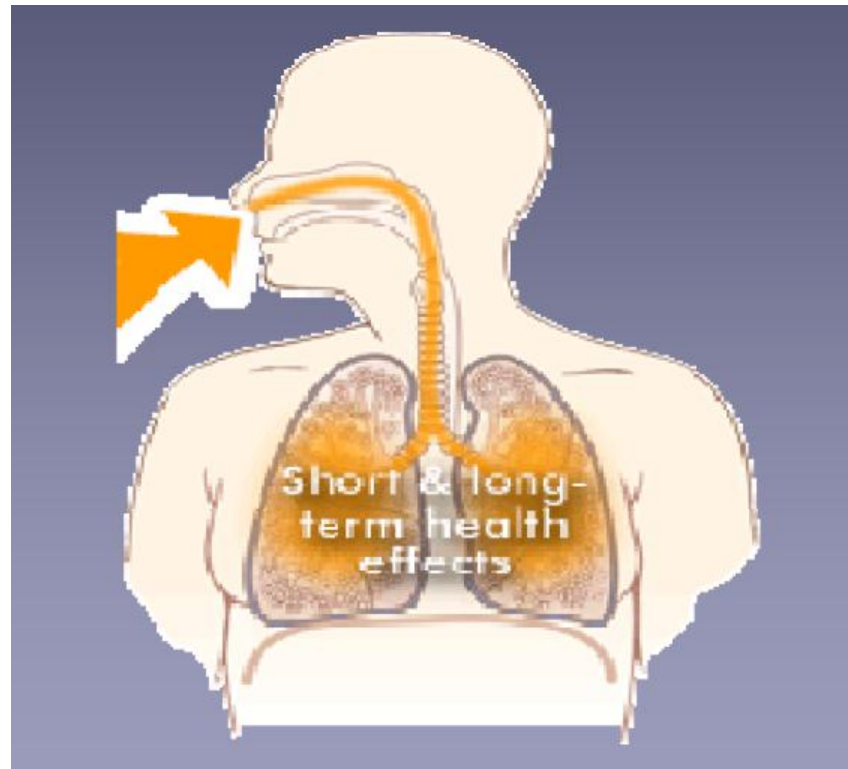


Why indoor environments?



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- We spend most of our time indoors

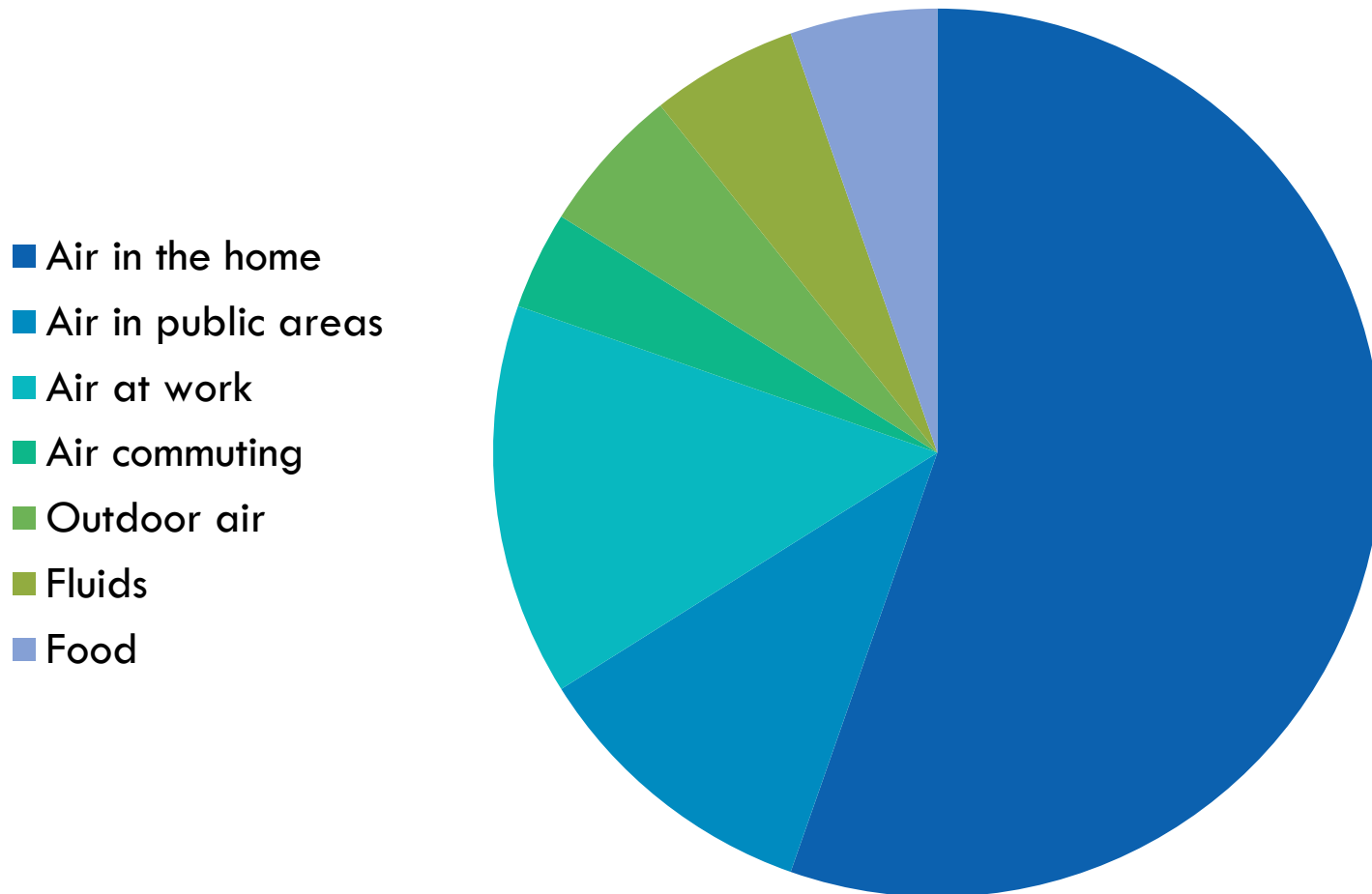


High intake of air in the home



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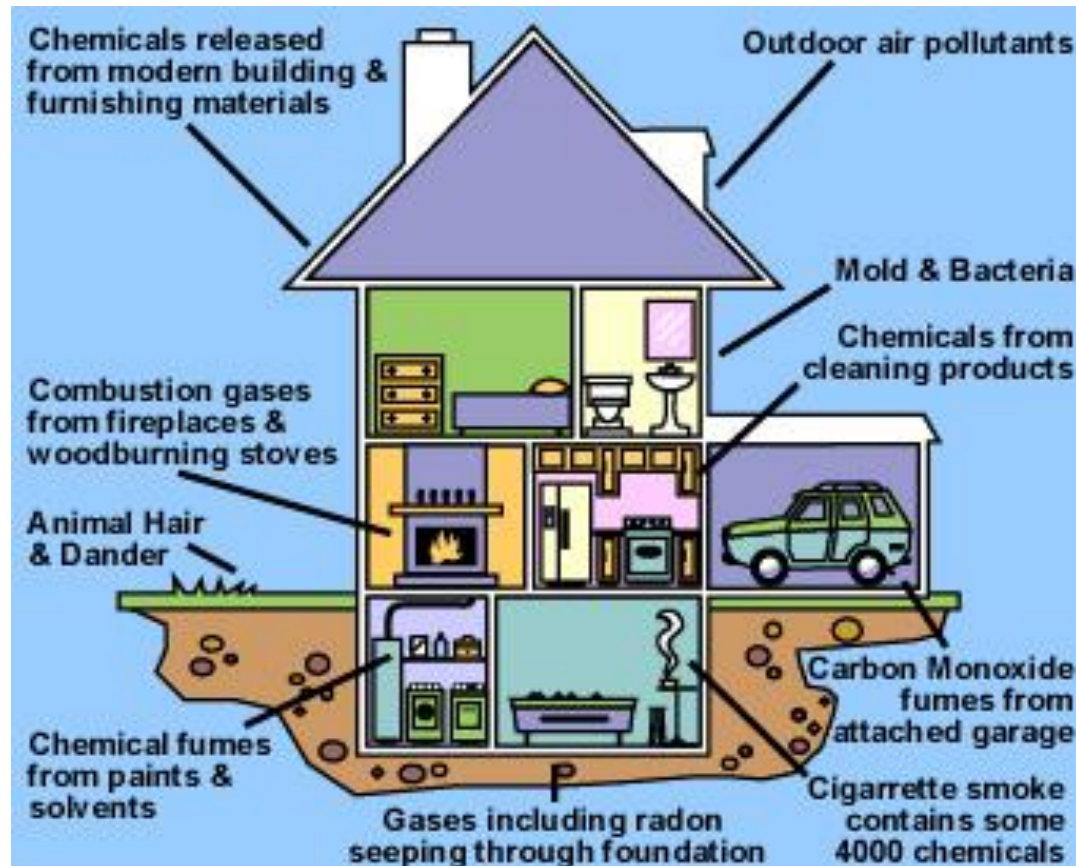
Estimation of relative intakes per day in terms of quantity



Sources of air pollution



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Ref.: United States, Environmental Protection Agency

□ INDOOR CHEMICAL POLLUTANTS

- ▣ Environmental tobacco smoke (ETS)
- ▣ Cleaning activities
- ▣ Emissions from gas cooking (NO_2 , HONO, UFP)
- ▣ Renovation and re-decoration activities (VOC's)
- ▣ Traffic related air pollution, which penetrate to indoors (NO_2 , PM, diesel soot)
- ▣ Indoor chemicals with multiple sources (phthalates, formaldehyde)

□ INDOOR BIOCONTAMINANTS

- ▣ Pets
- ▣ Mites
- ▣ Dampness and mould

Dampness and mould



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Historically been looked at:

1. Qualitatively (Visible mould)
2. Quantitatively (Concentrations of different agents)



Dampness and mould



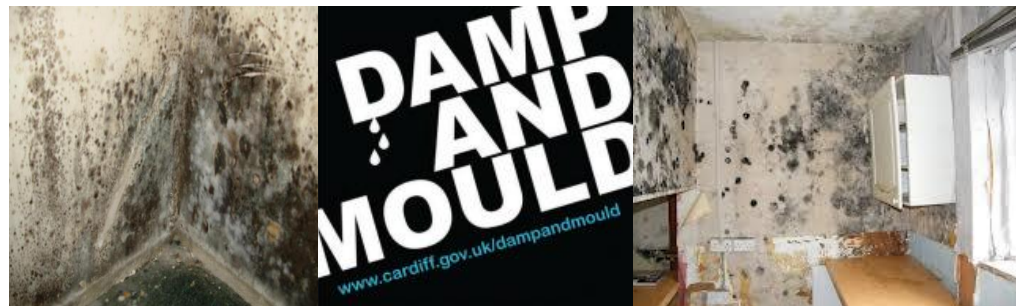
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Prevalence:

- 10% - 20% of dwellings

Causes:

- Water damage by leakage on roofs or water pipes, Weather incidents
- Condensation (e.g. inadequate ventilation)
- Insufficient insulation or other failures in the structure of the building
- Occupant behaviour e.g. clothes drying, bath taking, cooking, cleaning



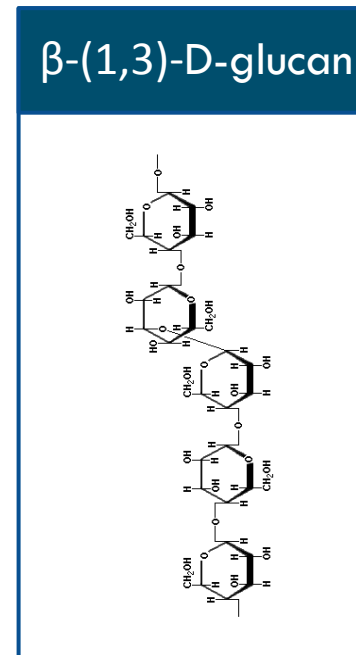
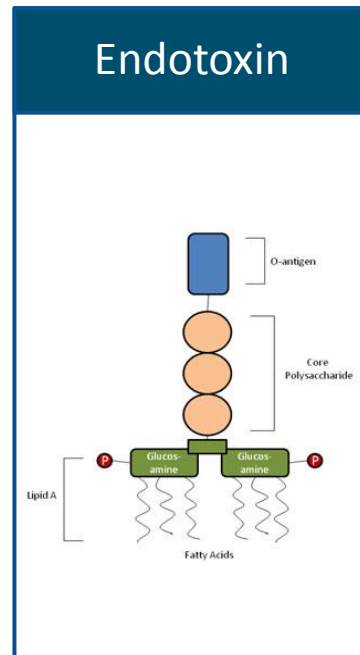
Components of interest



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Markers of microbial exposure:

- Endotoxins are lipopolysaccharide components of the outer membrane of gram-negative bacteria.



- Potent biological properties (potential stimulation of the reticuloendothelial system, activation of neutrophils, macrophages and eosinophils)

- Beta-Glucans are non-allergenic water-insoluble structural cell wall components of most fungi, some bacteria, most higher plants and many lower plants.

Previous epidemiological studies



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(1→3)- β -D-Glucan and Endotoxin in House Dust and Peak Flow Variability in Children

JEROEN DOUWES, ARJAN ZUIDHOF, GERT DOEKES, SAS
and BERT BRUNEKREEF

Environmental & Occupational Health Group, Wageningen University
Epidemiology, University of Groningen, Groningen, The Netherlands
of Medicine, Wellington, New Zealand

House dust-associated bacterial endotoxins have been shown
be associated with asthma severity, and a similar role has been
suggested for fungal (1→3)- β -D-glucans. In this study the relationship between
suggested for fungal (1→3)- β -D-glucans. In this study the relationship between
suggested for fungal (1→3)- β -D-glucans. In this study the relationship between



Toxicology 152 (2000) 47–52

**(1→3)- β -D-glucan — relationship to indoor air-related
symptoms, allergy and asthma**

Ragnar Rylander ^{a,*}, Rong-Hwa Lin ^b

^a Department of Environmental Medicine, Box 414, University of Gothenburg, 40530 Gothenburg, Sweden
^b Graduate Institute of Immunology, College of Medicine, National Taiwan University, Taipei, Taiwan

Eur Respir J 2011; 37: 1050–1059
DOI: 10.1183/09031936.00091210
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**Respiratory health in children, and indoor
exposure to (1,3)- β -D-glucan, EPS mould
components and endotoxin**

C. Tischer, U. Gehring, C.-M. Chen, M. Kerkhof, O. Herbarth, B. Schaaf, S. Koletzko, H.-E. Wichmann

ABSTRACT: For a long
was considered a risk factor
recent studies suggested

Mediators of Inflammation, 11, 000–000 (2002)

**Effects after inhalation of
(1→3)- β -D-glucan and relation to
mould exposure in the home**

Lena Beijer ^{CA}, Jörgen Thorn and Ragnar Rylander

Department of Environmental Medicine, Göteborg
University, Box 414, 405 30 Gothenburg, Sweden

The hygiene hypothesis



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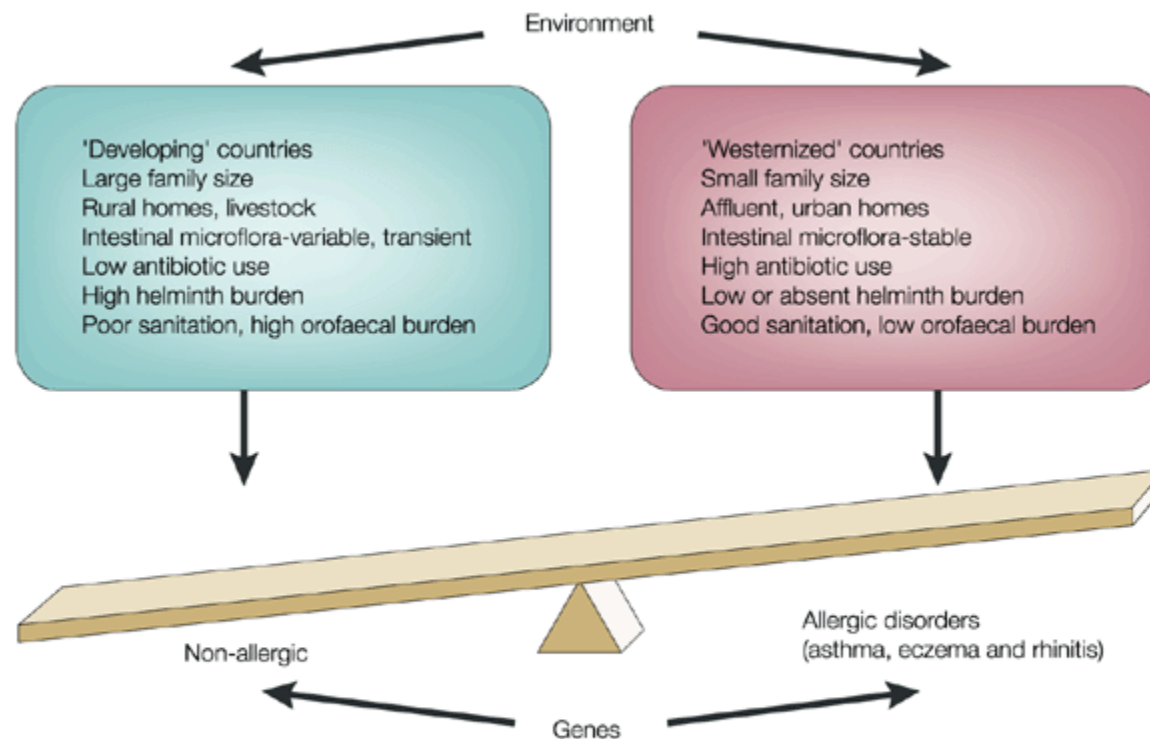
- The hygiene hypothesis states that lack of exposure to infectious agents, microorganisms and parasites increases the susceptibility to develop allergic diseases.



The hygiene hypothesis – Balance/Imbalance



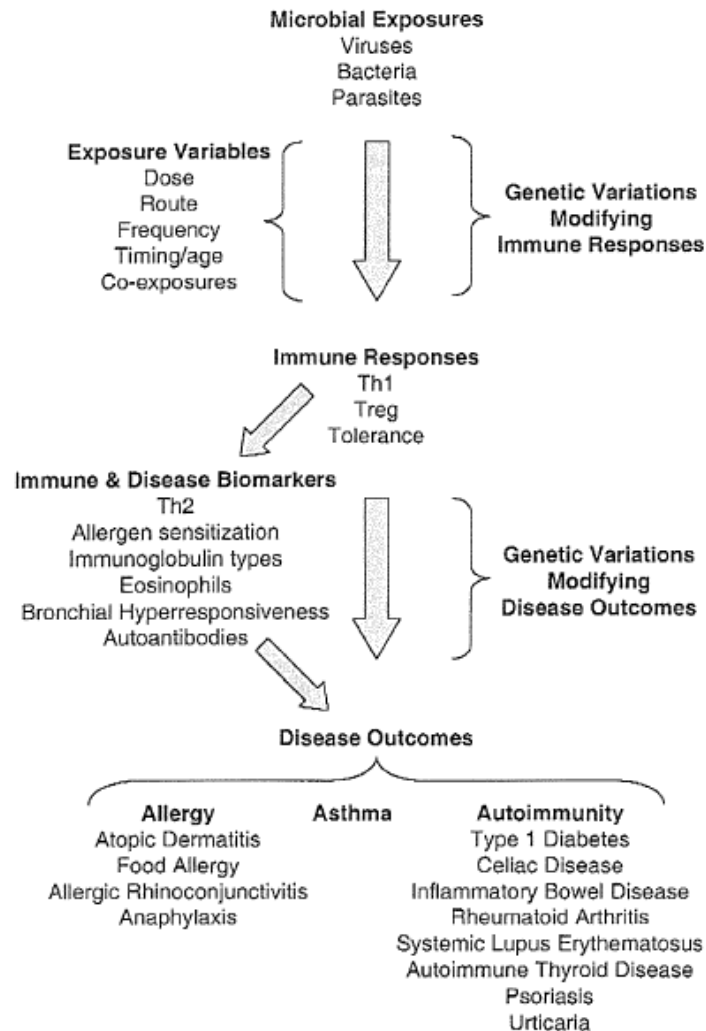
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The hygiene hypothesis – Mechanism



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Previous studies



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Current perspectives

Hygiene hypothesis: Fact or fiction?

Andrew H. Liu, MD,^a and James R. Murphy, PhD^b *Denver, Colo*

The hygiene hypothesis of asthma and allergy has recently received a swell of popularity and published supporting evidence, and has been extended to autism.

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PEDIATRIC ALLERGY AND IMMUNOLOGY
ISSN 0905 6157

used
atopic dermatitis
National Health and Nutrition Examination
survey

miologic criteria need to be established
relationship can be considered

Pediatric Allergy Immunology 2003; 14: 145-146
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Editorial

The Hygiene Hypothesis

We have published many papers on the hygiene hypothesis and this forms the basis of many presentations at allergy congresses, including the Paris EAACI Annual Meeting. Recently the Royal Institute of Public Health in the UK ran

atopy, the group
nature, extent of
microbial exposure
critical period
infancy or early

Current Opinion in Allergy & Clinical Immunology:
April 2005 - Volume 5 - Issue 2 - p 147-151
Pediatric asthma and development of atopy

The hygiene hypothesis: does it function worldwide?

Bresciani, Megan^a; Parisi, Claudio^{a,b}; Manghi, Ginevra^a; Bonini, Sergio^{a,c}

☐ Abstract

Purpose of review: This article intends to be a systematic review of papers published during

Aim of my Ph.D. project



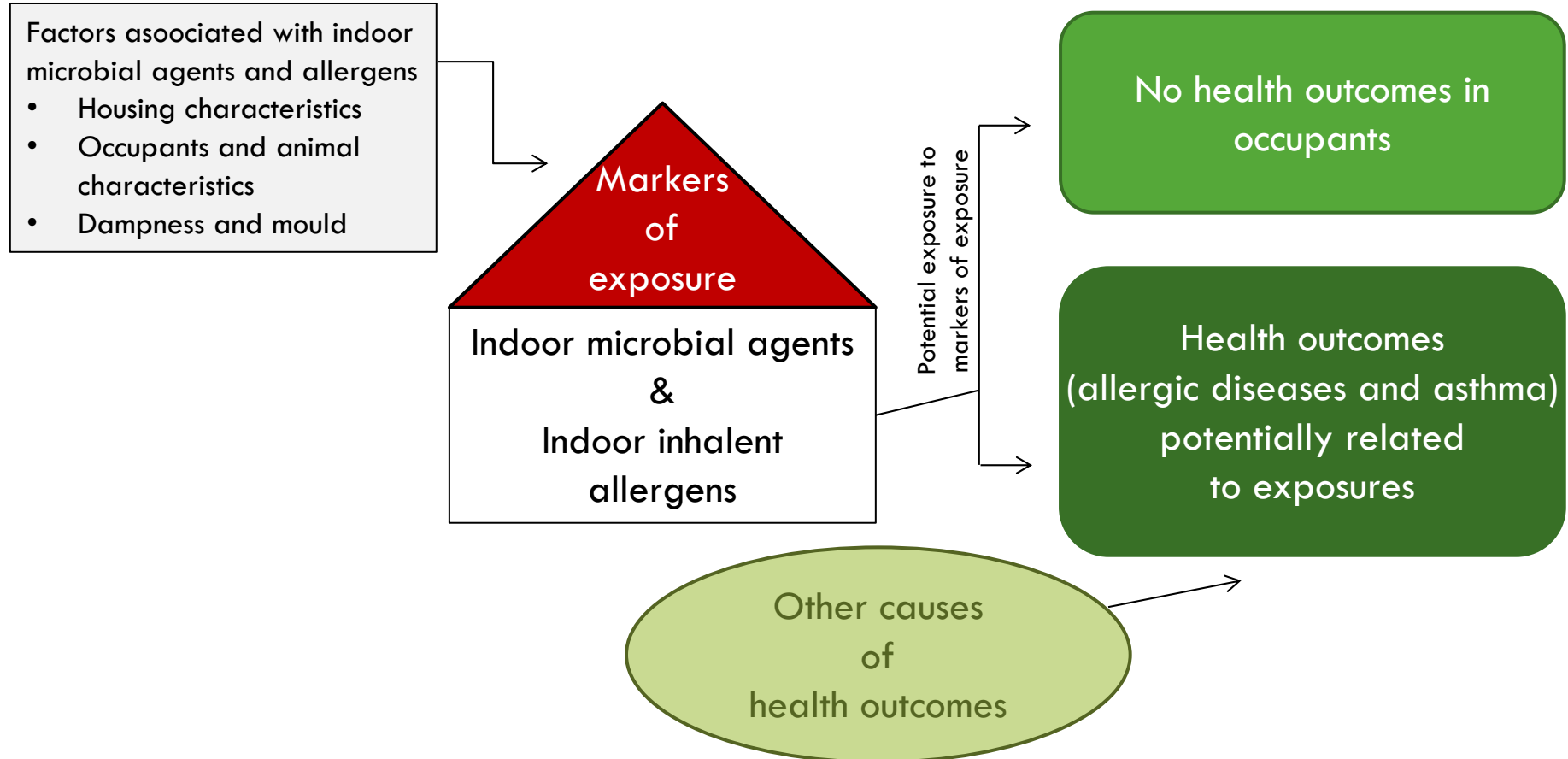
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- To investigate the impact of indoor markers of microbial exposure on allergy and asthma in children and adults



**ASTHMA, ALLERGY &
INDOOR ENVIRONMENT**

Illustrating the indoor markers of exposure's potential to cause adverse health effects



□ Study populations

The adult study

SUS

Healthy Stable Cohort



Region
Hovedstaden

HELBRED2006
5 års genundersøgelse

The children study



Danish Mould in Buildings

Children study



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Study population

- 330 pupils (response rate 79%)
- 5-10 years old
- Wet and dry schools (n=8, n=7)

Preliminary analysis aiming:

- To investigate the impact of urbanisation on allergy and asthma prevalence
- To investigate microbial markers of exposure's association with allergy and asthma.
- Which other factors are related to allergic disease and respiratory disease



Danish Mould in Buildings

Markers of Exposure



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Dust collected by the parents with vacuum cleaner using sampling nozzles and filter boxes from ALK (Allergologisk Laboratorium Copenhagen, Denmark):

- 1 m² of child's bedroom floor

Dust was analysed for:

- Dust (gram)
- Endotoxin (EU/m² and EU/g)
- Glucan (ug/m² and ug/g)

Urbanisation defined by children living in:

- Urban area
- Rural area
- Farm



Atopy defined by:

- A positive skin-prick-test against common allergens: cat, birch, grass, house dust mite (der p1, der f1), moulds (a alt, c herb)



Self-reported asthma and allergy

- Rhinitis and eczema
- Doctor diagnosed asthma, general respiratory symptoms

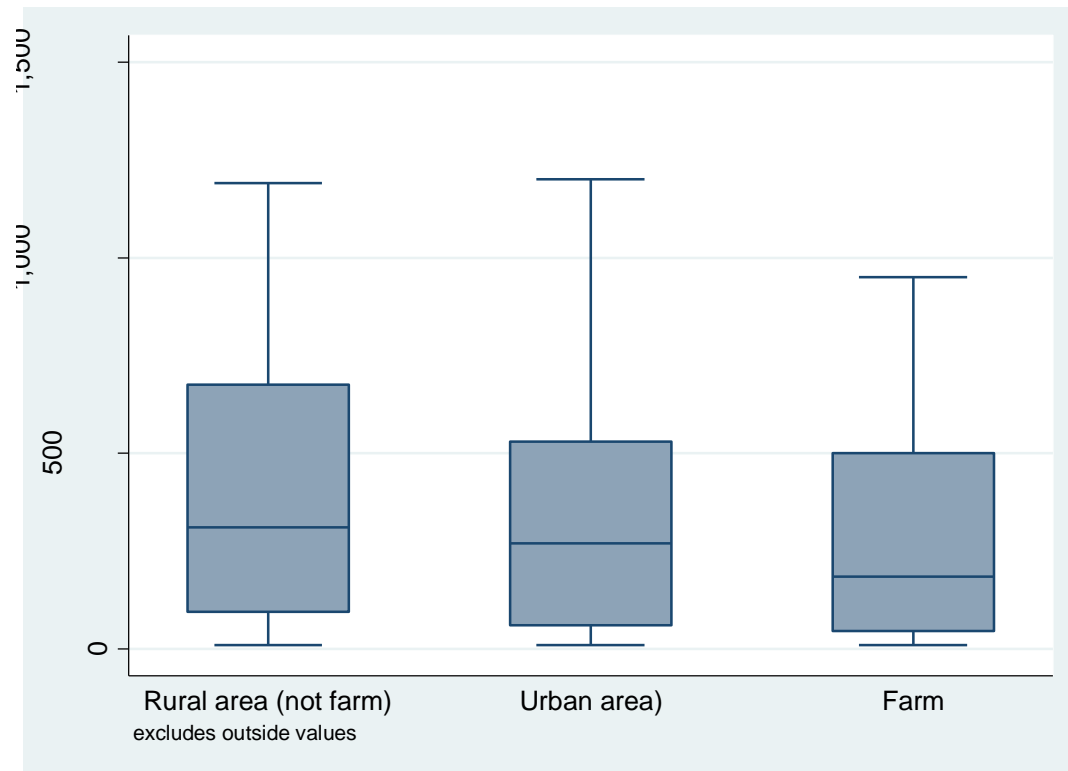


Markers of exposure



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□ Dust



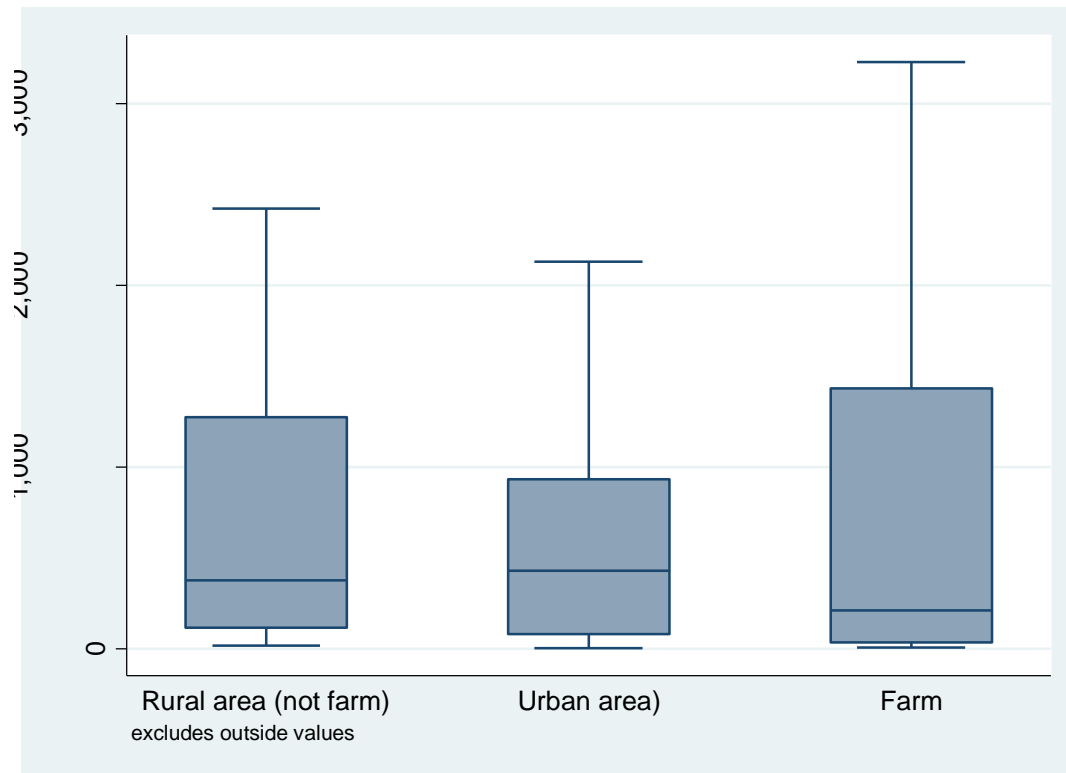
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Markers of exposure



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□ Glucan



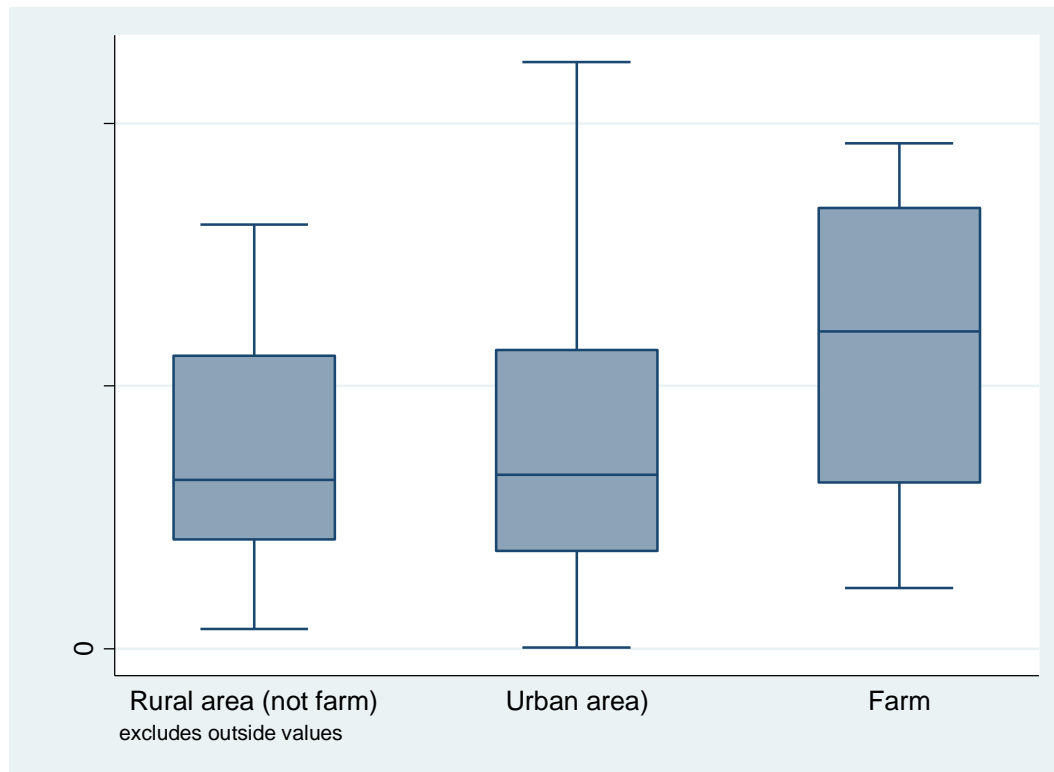
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Markers of exposure



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□ Endotoxin

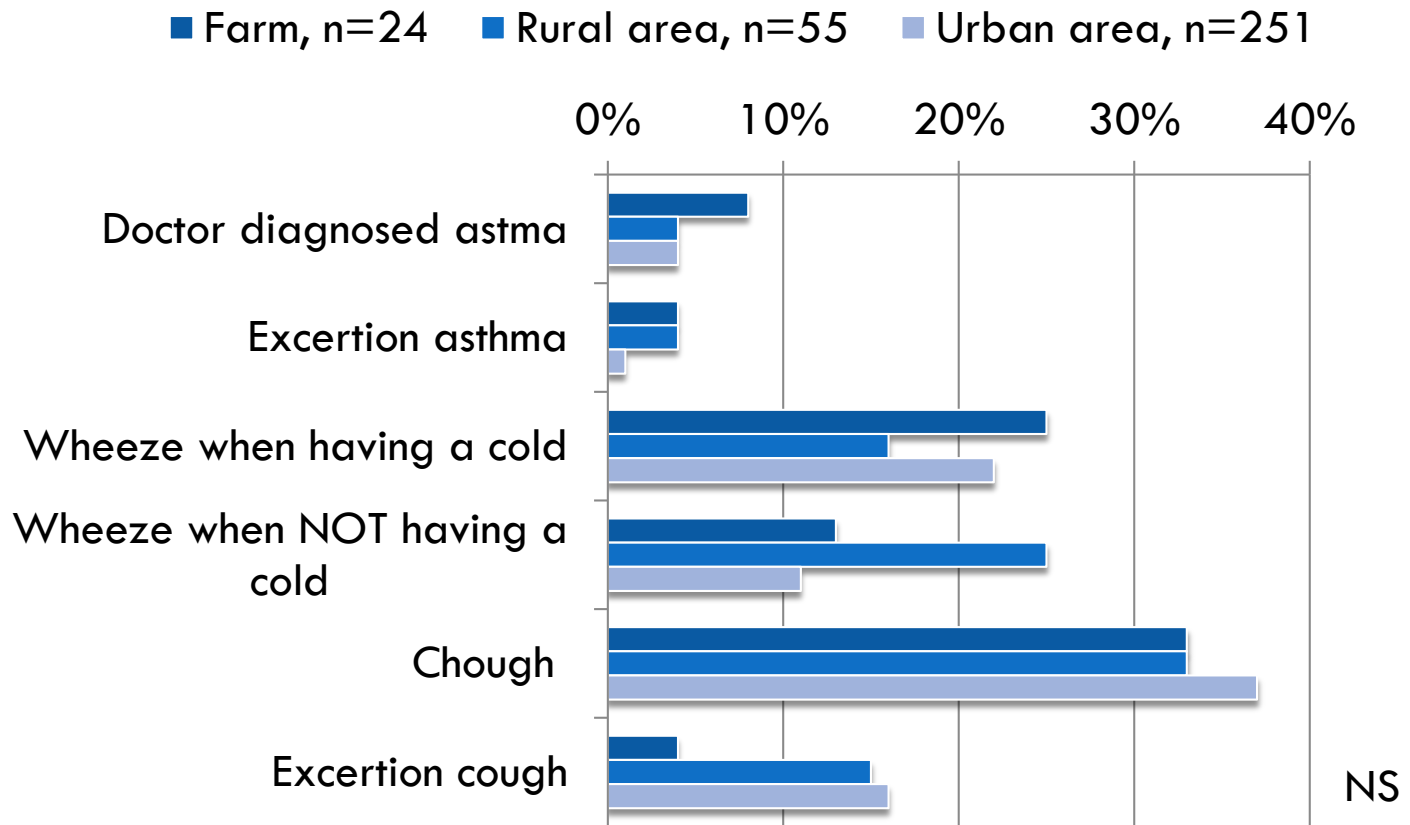


$p=0.008$,
anova

Prevalence of asthma and respiratory symptoms



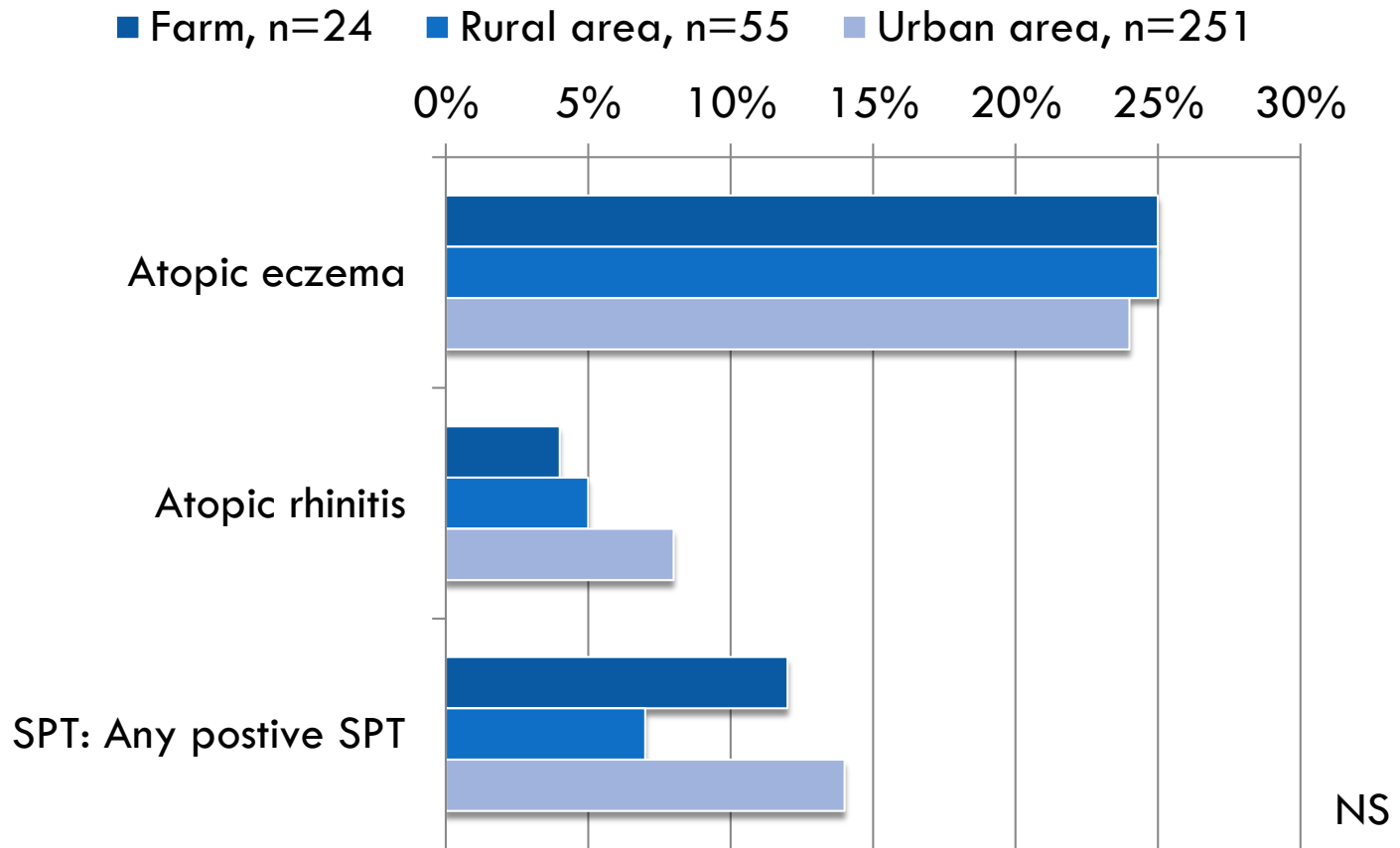
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Prevalence of allergic diseases



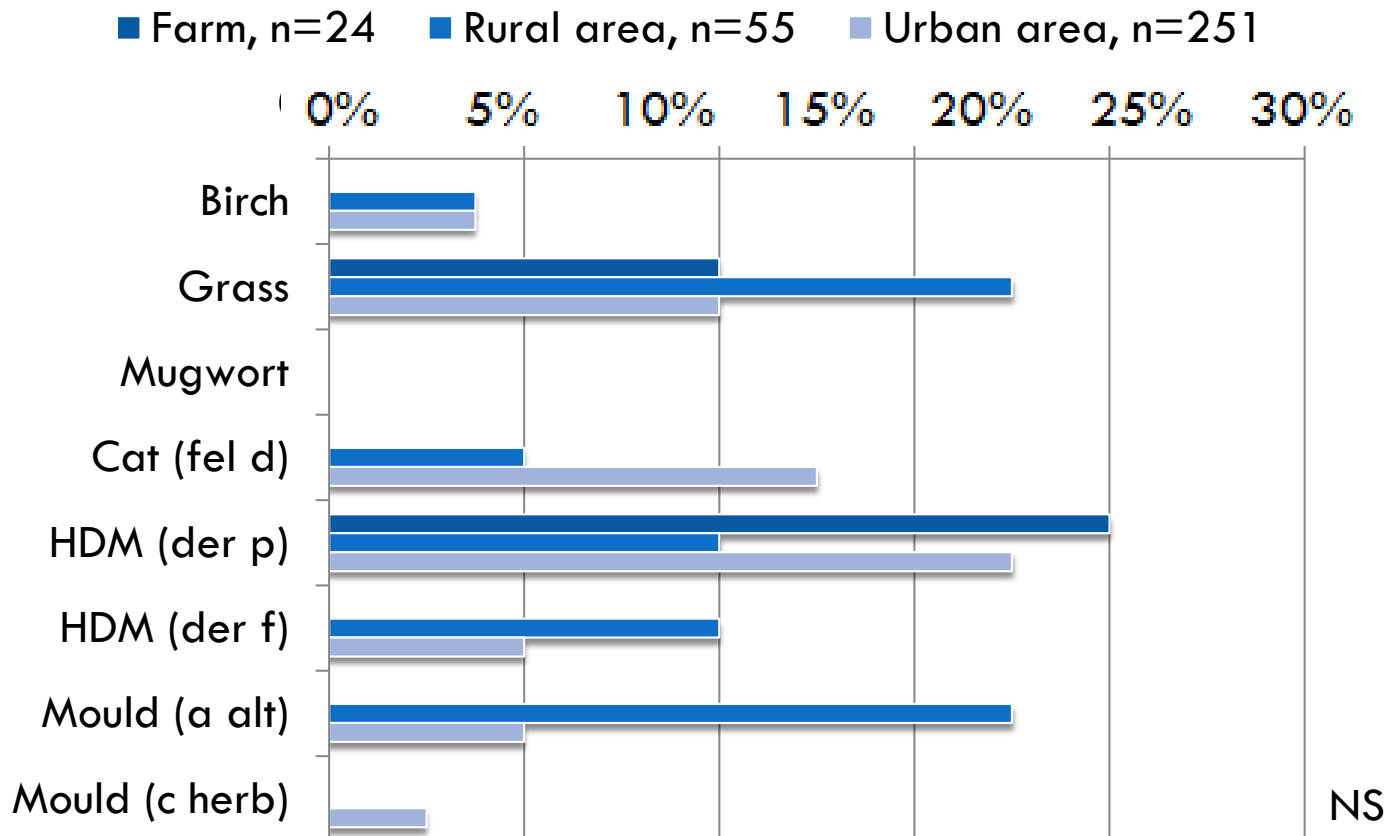
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Prevalence of positive skin-prick-test (SPT)



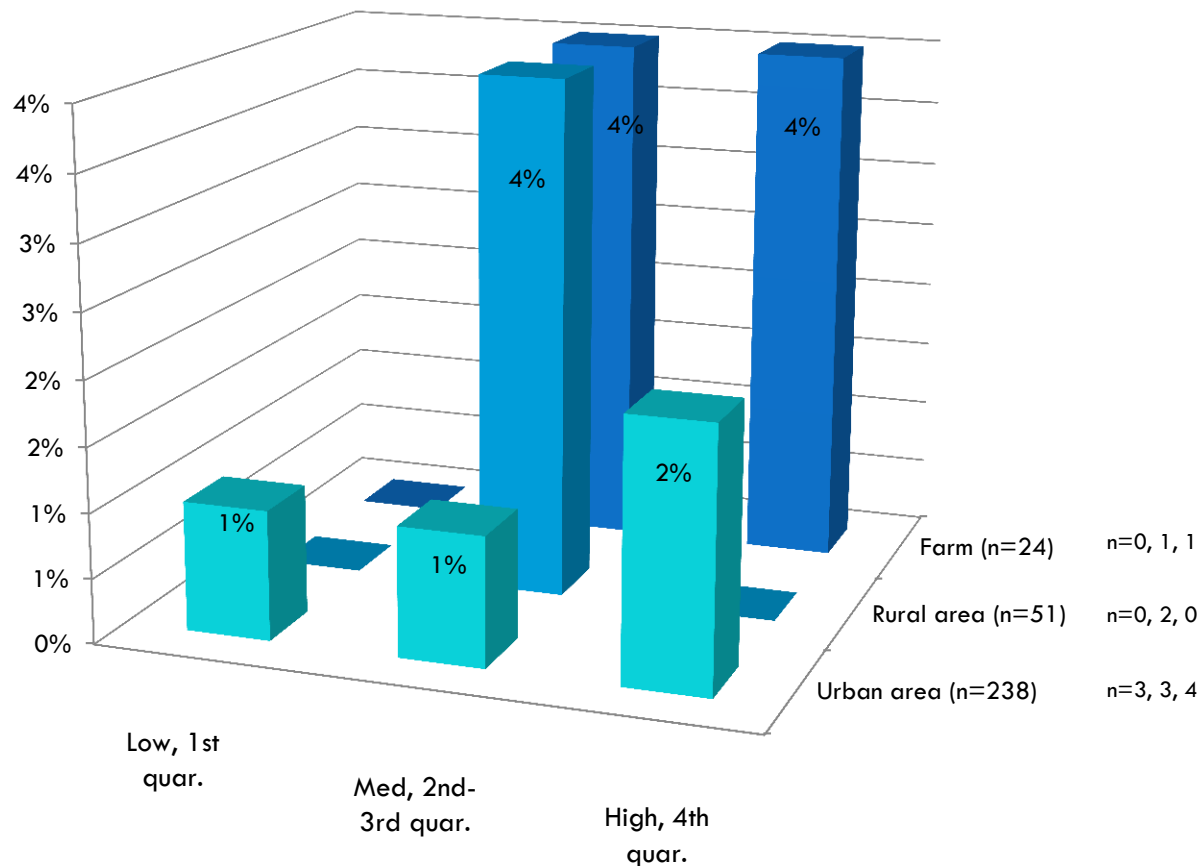
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Associations between endotoxin levels and doctor diagnosed asthma



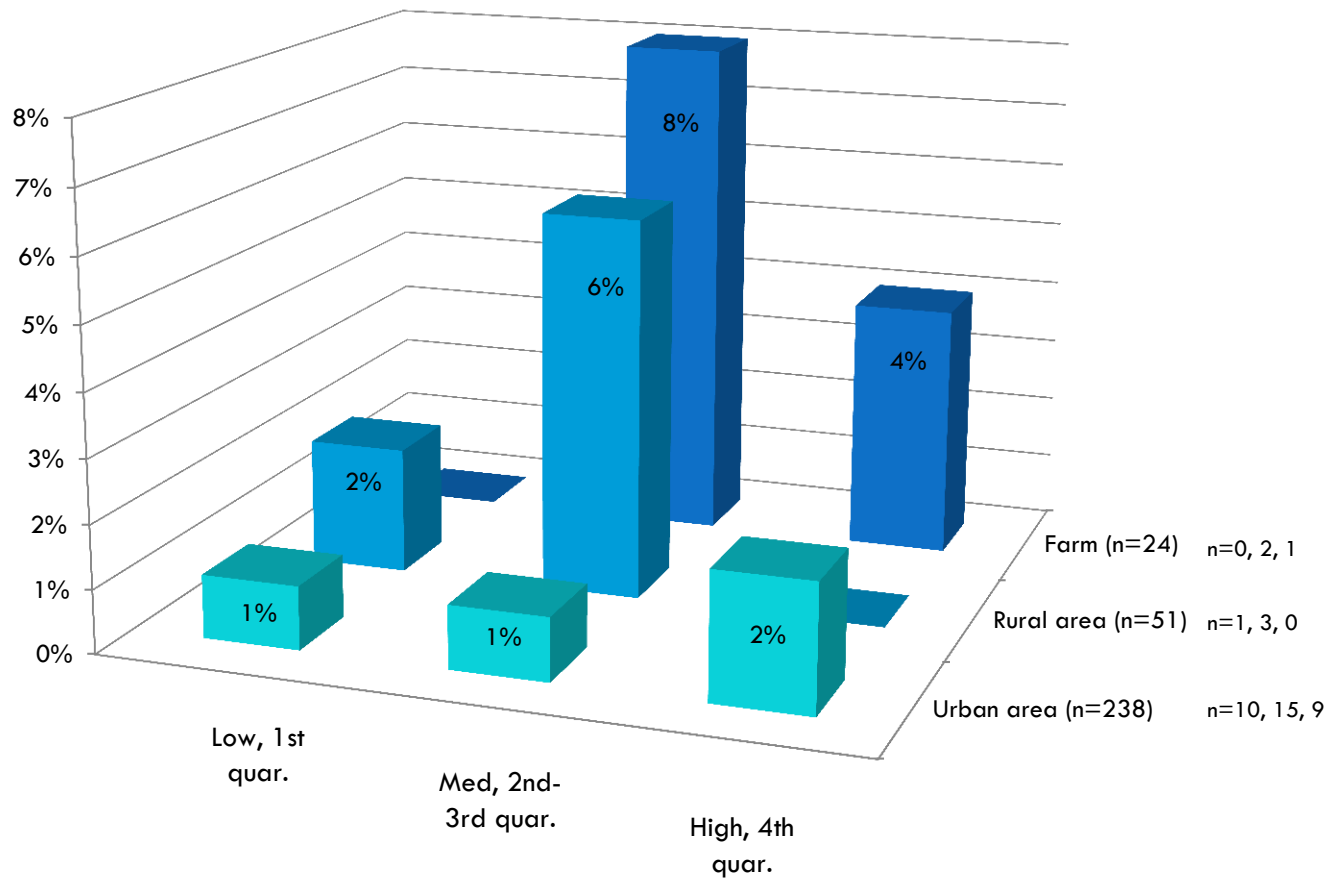
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Associations between endotoxin levels and positive SPT



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Factors associated with asthma and respiratory symptoms



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Respiratory health

- ☐ Doctor-Diagnosed Asthma
- ☐ Exertion Asthma
- ☐ Wheeze when NOT having a cold
- ☐ Exertion Wheeze
- ☐ Cough
- ☐ Exertion Cough

Other symptoms:

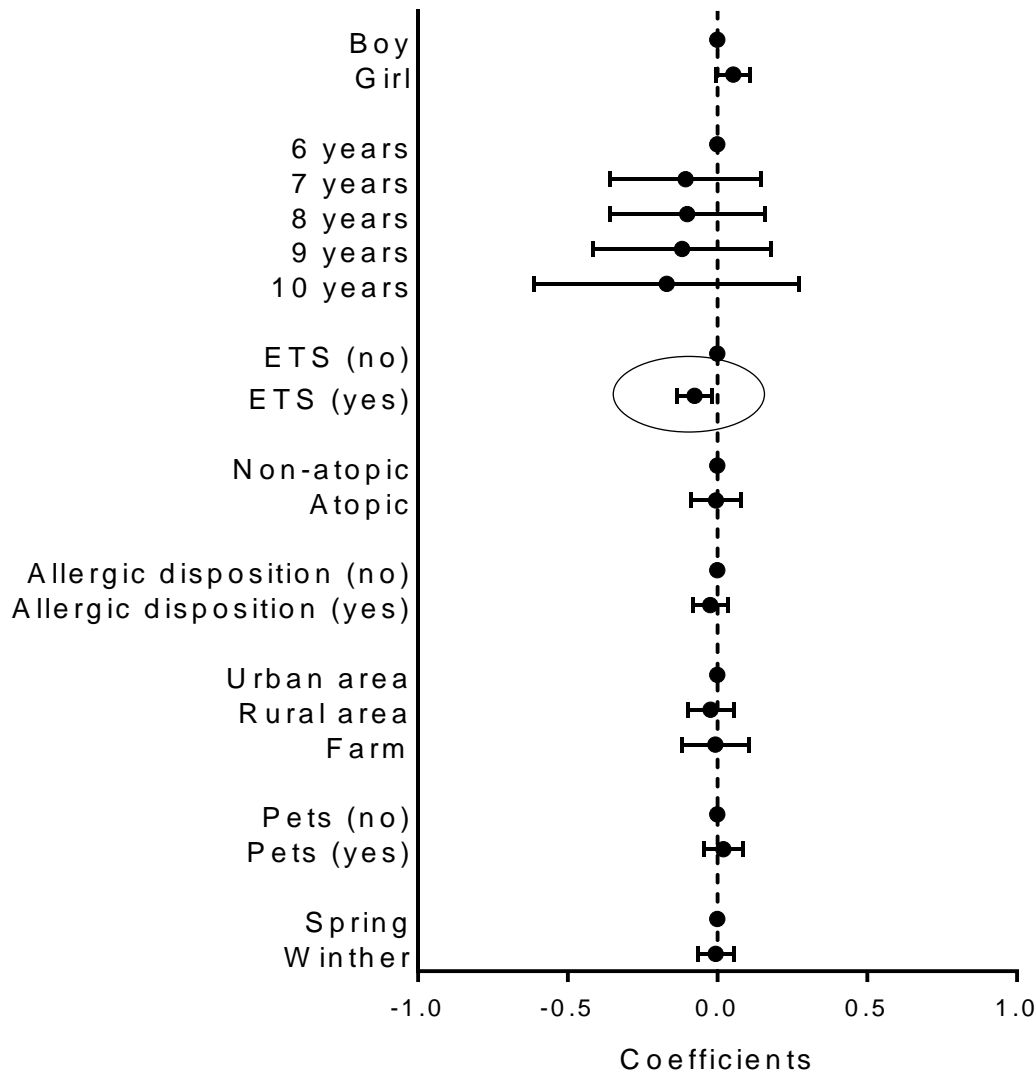
- ☐ Eye
- ☐ Nose
- ☐ Throat
- ☐ Hoarse
- ☐ Dyspnea
- ☐ Body skin
- ☐ Facial skin
- ☐ Tiredness
- ☐ Headache
- ☐ Stomachache
- ☐ Muscleache
- ☐ Dizziness
- ☐ Concentration problems

Factors associated with lung function



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FEV1



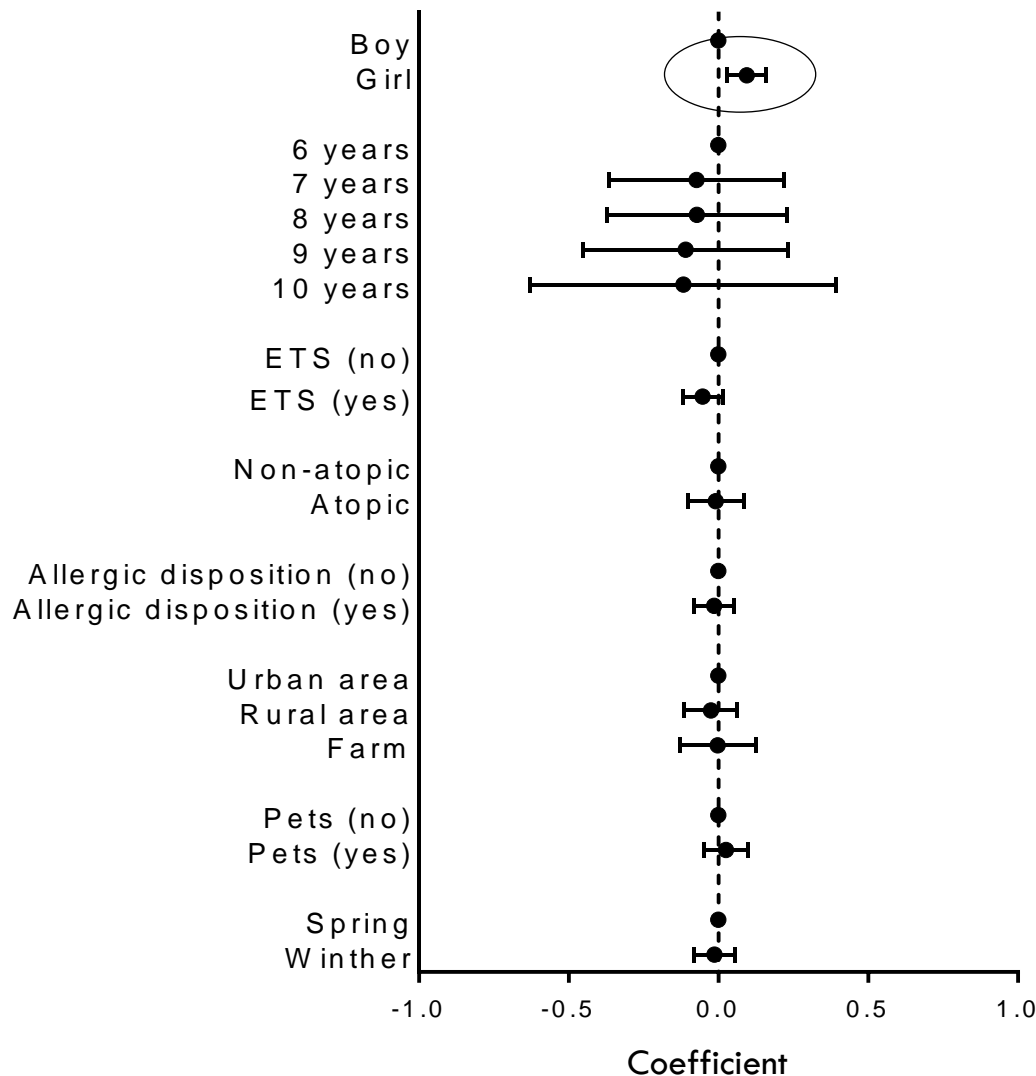
Multiple linear regression analysis adjusted for variables included in the model and height. Data are presented as β -coefficients with CI95%. Significant difference in ETS, ETS (yes) (Coef. -0.075; CI95% -0.133-0.018) and in height (Coef. 0.029 ; CI95% 0.024-0.034)

Factors associated with lung function



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FVC



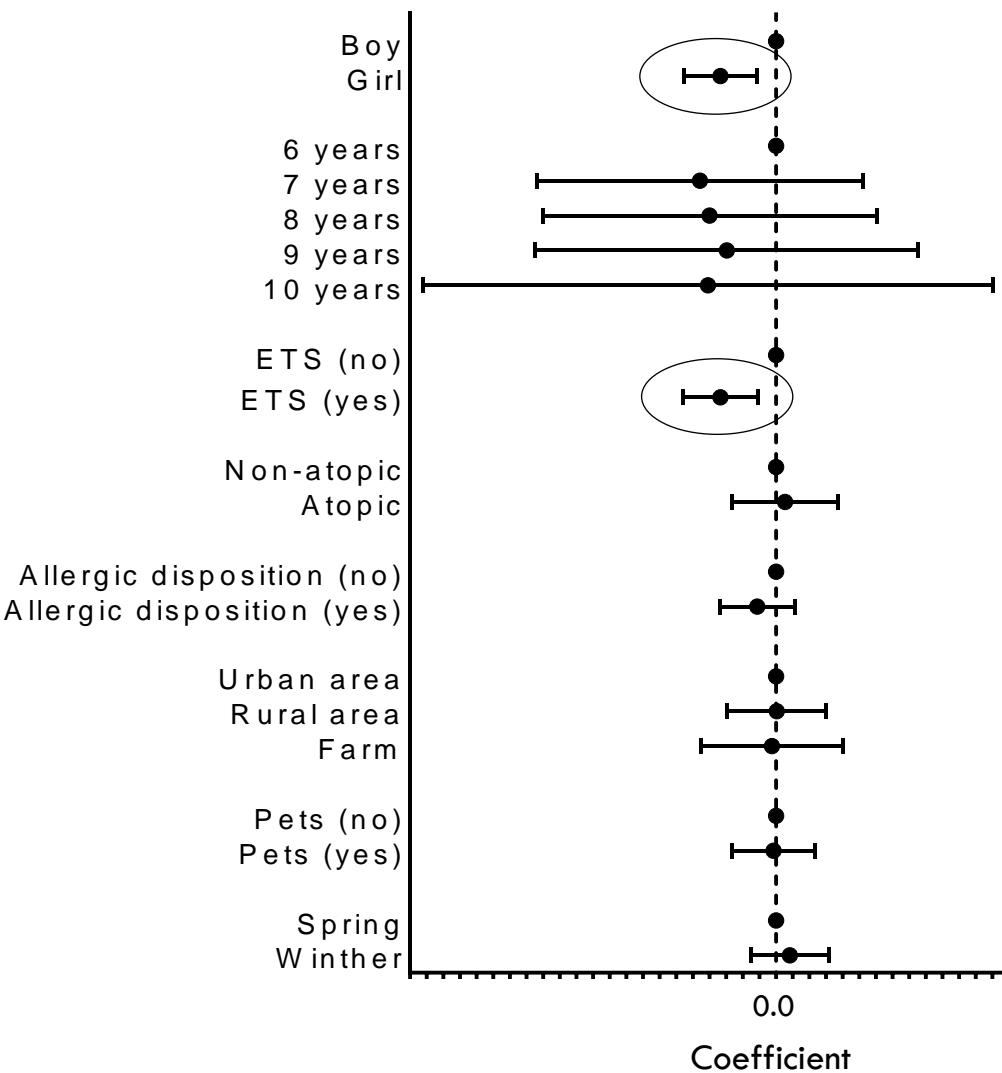
Multiple linear regression analysis adjusted for variables included in the model and height. Data are presented as β -coefficients with CI95%. Significant difference in gender, girls (Coef. 0.094 ; CI95% 0.028-0.159) and in height (Coef. 0.037 ; CI95% 0.030-0.043)

Factors associated with lung function



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FEV1 /FVC ratio



Multiple linear regression analysis adjusted for variables included in the model and height. Data are presented as β -coefficients with CI95%. Significant difference in gender, girls (Coef. -1.66; CI95% -2.77- -0.55) and in ETS, ETS (yes)(Coef. -1.66; CI95% -2.79--0.544) and in height (Coef. -1.55; CI95% -2.60- -0.05)

Conclusion



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- Higher concentrations of endotoxin was found in farm children's houses compared to houses of children living in rural and urban areas.
- Urbanisation didn't have an impact on allergy and asthma prevalence.
- No associations between dust, endotoxin and glucan (categorical and continuous variables) and allergy and asthma.
- Girls and children exposed to ETS had lower fev1/fvc ratio

Questions or comments



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Volunteers for Dust Sampling



Electrostatic Dust Fall Collector



Administration:

- Self-handeling

Placement:

- Location: Bedroom (carpeted)
- Height: aprox. 150 cm above floor level
- Avoid air turbulence

Period:

- 14 days
- Occupants at home

Return:

- In plastic bag