# The HESE Study

## Health Effecs of School Environment

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DG-SANCO IAQ Expert Meeting, Luxembourg, 6 Nov 2007

# Study Rationale

## Background

- Evidence of the potential presence of a variety of pollutants (EFA 2002)
- European data scarce & sparse
  - Geographical coverage (mostly Scandinavia)
  - Different measurements
  - Different design and methods
- Need for a standardized protocol to compare data from different countries/regions
- Need for risk assessment (health measurements, risks and perceptions)

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# RATIONALE

## Aims

- Develop standardized protocols for assessment of indoor air quality and health outcomes in schools
- Demonstrate the feasibility of an European study
- Provide preliminary data from a subset of European schools with a variety of geographical, cultural and environmental conditions
- Promote awareness in school operators, families, communities and policy makers

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# METHODS

## The HESE Group


Respiratory Diseases, University of Siena, Italy


CNR Institute of Clinical Physiology, Pisa


Folkehelsa, Oslo, NO


Dipartimento di Pediatria. University of Udine


University of Aharus, DK


University of Uppsala, SW


Medical School St-Antoine, University Pierre et Marie Curie, Paris, F

# METHODS

## Study design

- 6 Centers
- 4 Schools/center
- 2 Classrooms/school
- Age 9-11
- Questionnaires to all
- Environmental measures
- 5 children/class clinical measurements

# METHODS

## Environmental measurements

| | |
|---|---|
| CO2 | Q-Track sampler |
| Allergens dust | Vacuum cleaner |
| Allergens air | Petri dishes |
| Temperature | Q-Track sampler |
| Humidity | Q-Track sampler |
| Moulds/bacteria | Nuclepore filters |
| PM | Dust-track and p-Track samplers |
| NO2 | Passive samplers |
| Formaldehyde | Passive samplers |
| Ozone | Passive samplers |

# METHODS

## Questionnaires

- Pupils:
  Respiratory and irritative symptoms
- Parents:
  Also questions on familial and environmental factors
- Teachers:
  Characteristics of the school and classroom, school policies

# METHODS

## Clinical studies Biomarkers

5 Children randomized per class:

- Spirometry
- Exhaled condensate (IL1, IL8, pH)
- Allergic skin tests
- Acoustic rhinometry
- Nasal lavage
- Tearscope & Break-up Time

# RESULTS

## Study population

- 6 Surveys
- 21 Schools
- 46 classrooms
- Suitable samples >95%
- 654 pupils
- 234 pupils with clinical data

# RESULTS

## Difficulties

- Different languages
- Different school systems
  - Classwork organization
  - School size
  - Reading ability
- Different building construction
- Ethical committees (3/6)
- Privacy paranoia

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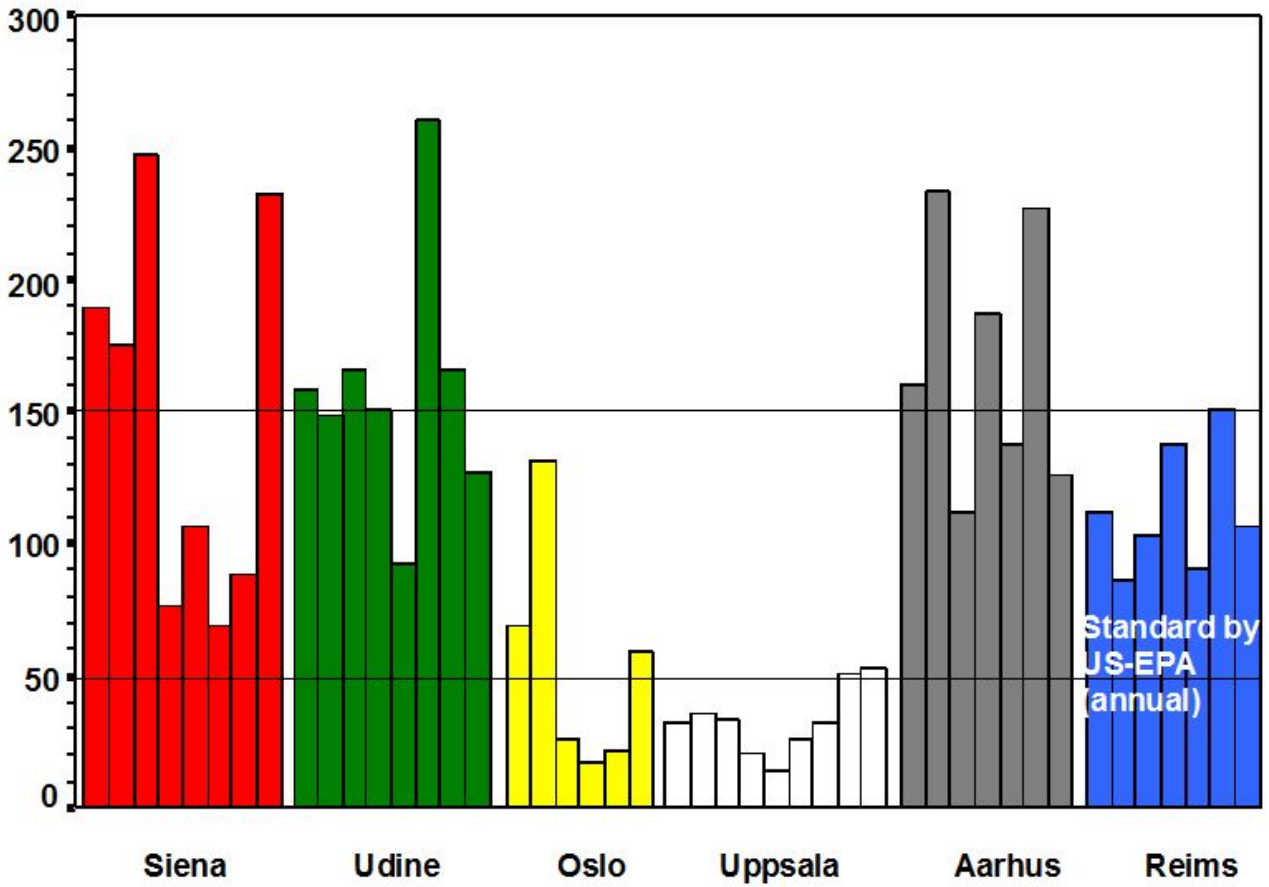
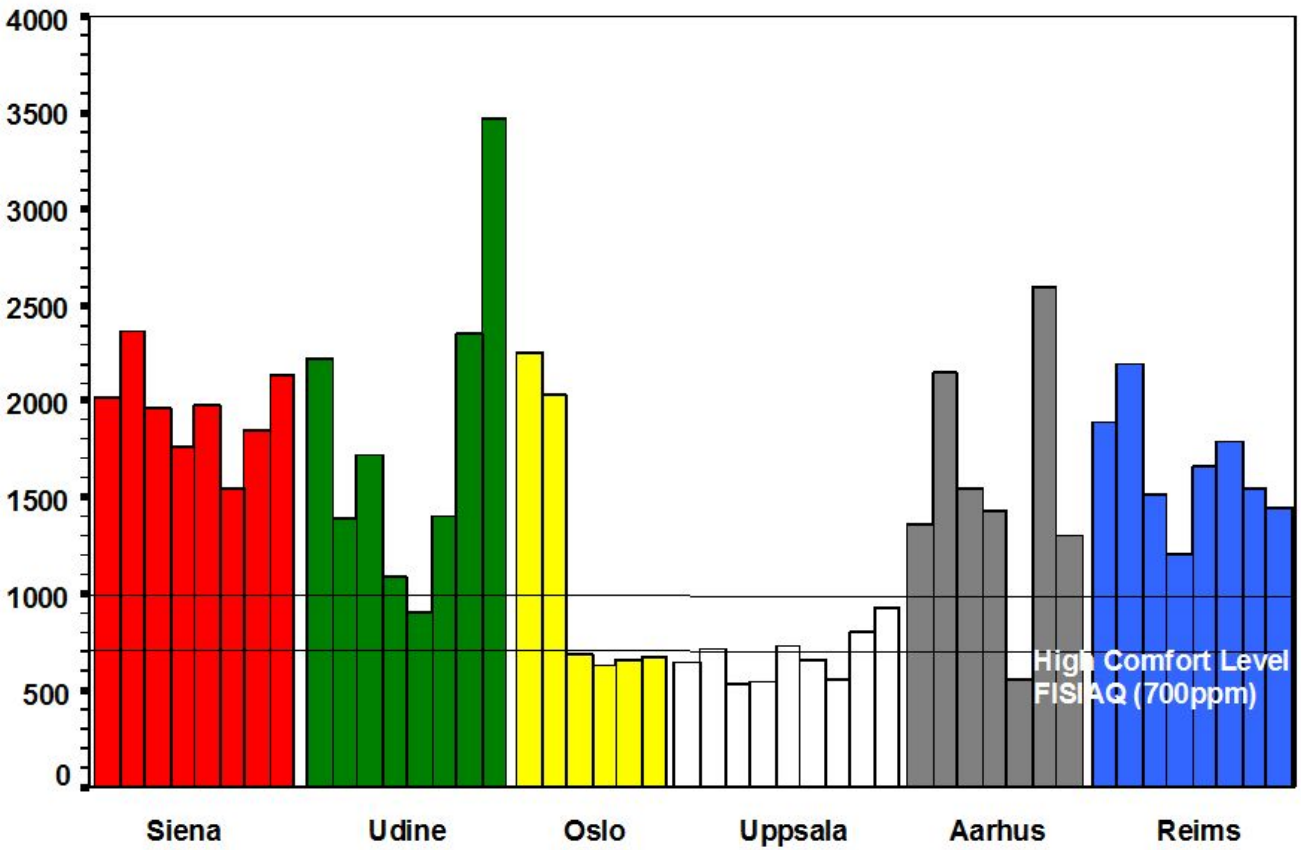
# PM10




Levels > 50ug/m3 (Standard by US-EPA for long-term exposure) in 78% of classrooms

# CO2

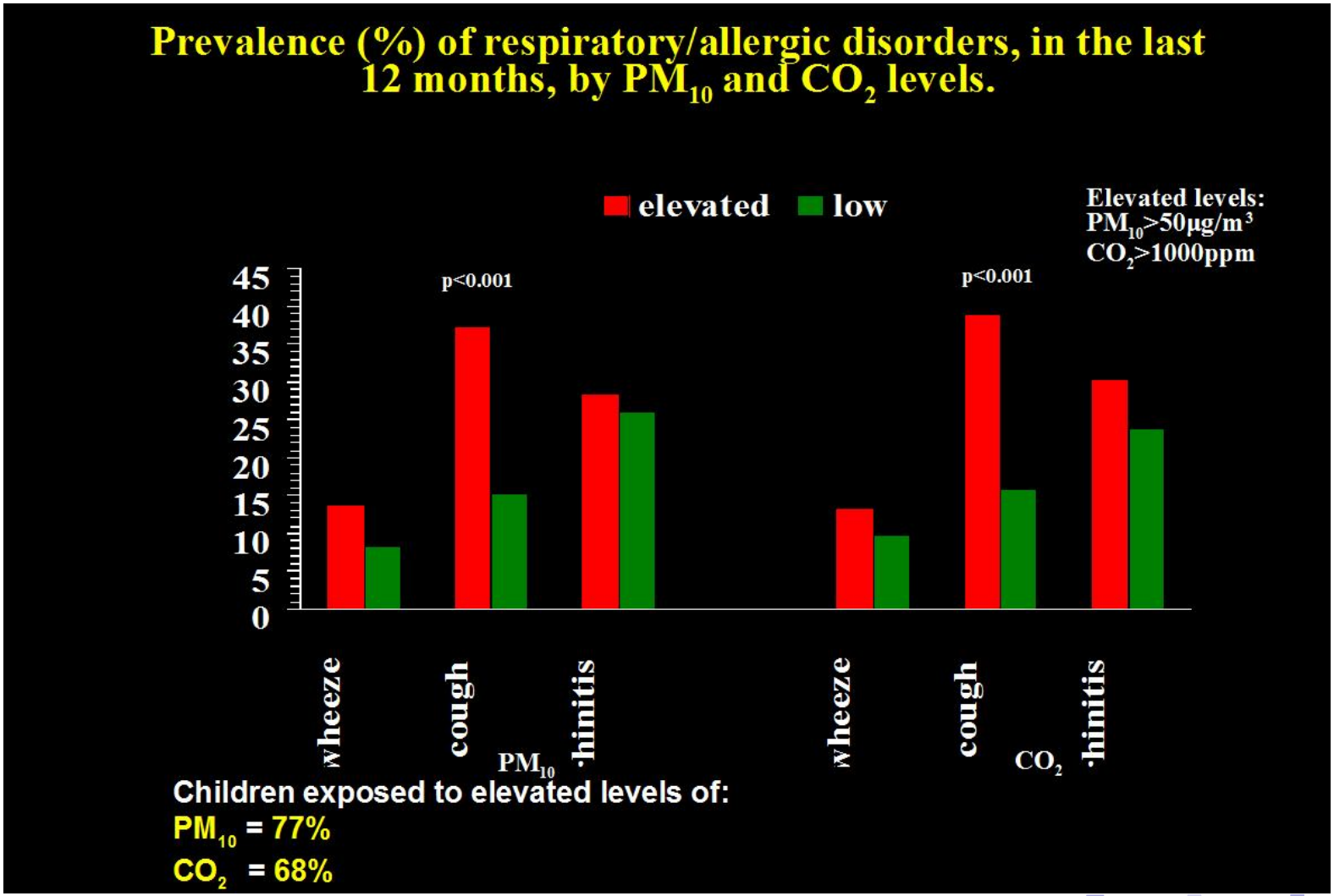



Levels > 1000ppm (Standard by ASHRAE for good IAQ) in 66% of classrooms

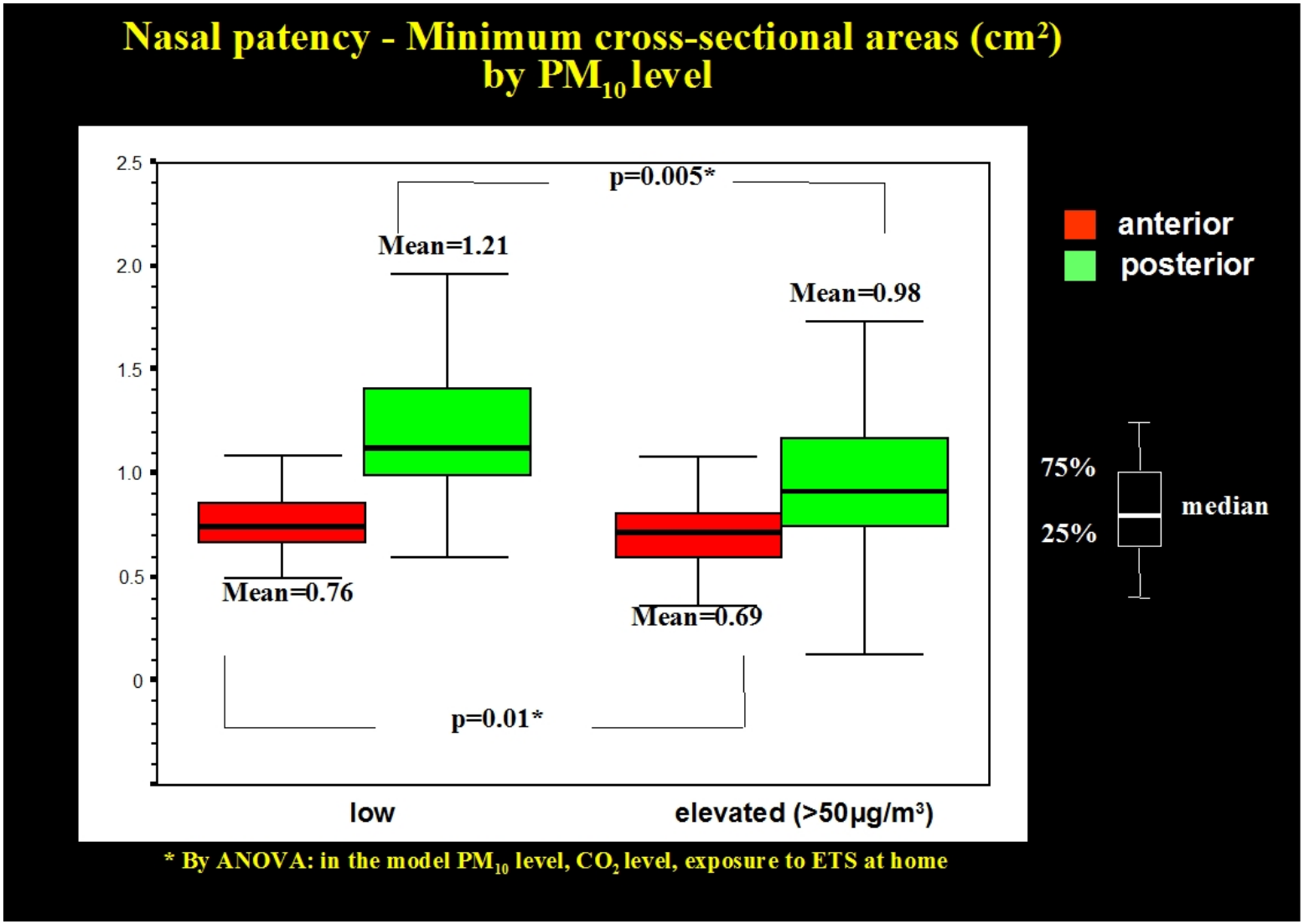
# Mechanical Ventilation

| | *Mechanical* | | *Natural* | | |
|---|---|---|---|---|---|
| **CO2** | 669 | (596-750) | 1733 | (1492-2014) | * |
| **Ventilation** | 16 | (11-22) | 2 | (1-4) | * |
| **Relative humidity** | 20 | (16-24) | 45 | (42-48) | * |
| **Mean PM10** | 29 | (22-39) | 134 | (118-152) | * |
| **Air allergens** | 125 | (62-249) | 1192 | (792-1793) | * |
| **Dust allergens** | 1864 | (1329-2615) | 1950 | (866-4390) | |
| **Tot moulds** | 8709 | (6166-12302) | 36064 | (23807-54630) | * |
| **Viable moulds** | 73 | (54-99) | 300 | (189-476) | * |
| **Tot bacteria** | 22115 | (11211-43625) | 35385 | (18180-68874) | |
| **Viable bacteria** | 222 | (119-415) | 484 | (278-845) | |
| **Outdoor humidity** | 44 | (31-62) | 42 | (35-50) | |
| **Outdoor PM10** | 21 | (14-33) | 53 | (30-94) | |

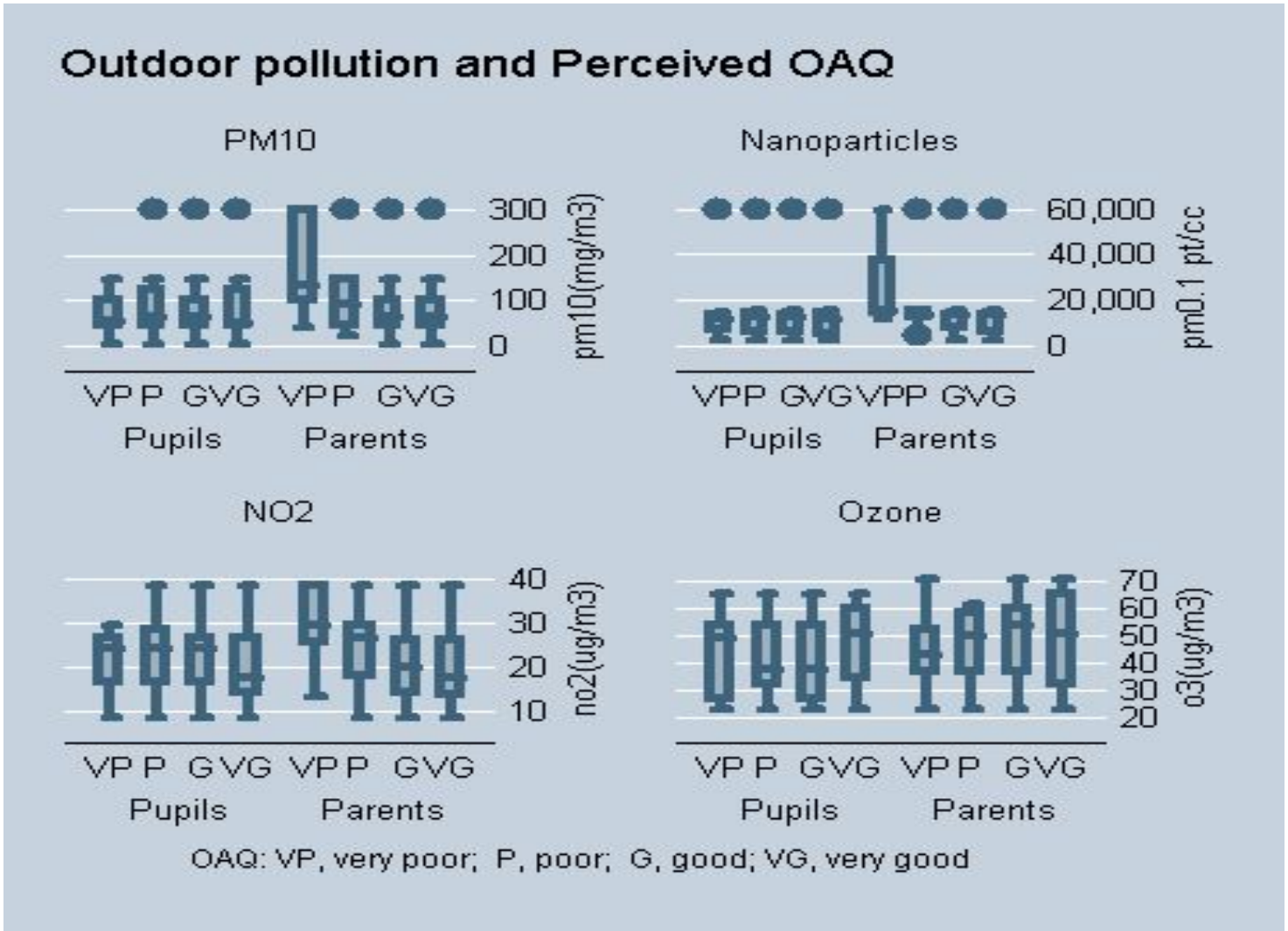
# Symtoms


Prevalence (%) of respiratory/allergic disorders, in the last 12 months, by $PM_{10}$ and $CO_2$ levels.
elevated
low
Elevated levels:
$PM_{10}$>50µg/m$^3$
$CO_2$>1000ppm
45
40
35
30
25
20
15
10
5
0
p<0.001
p<0.001
wheeze
cough
·hinitis
$PM_{10}$
wheeze
cough
·hinitis
$CO_2$
Children exposed to elevated levels of:
$PM_{10}$ = 77%
$CO_2$ = 68%

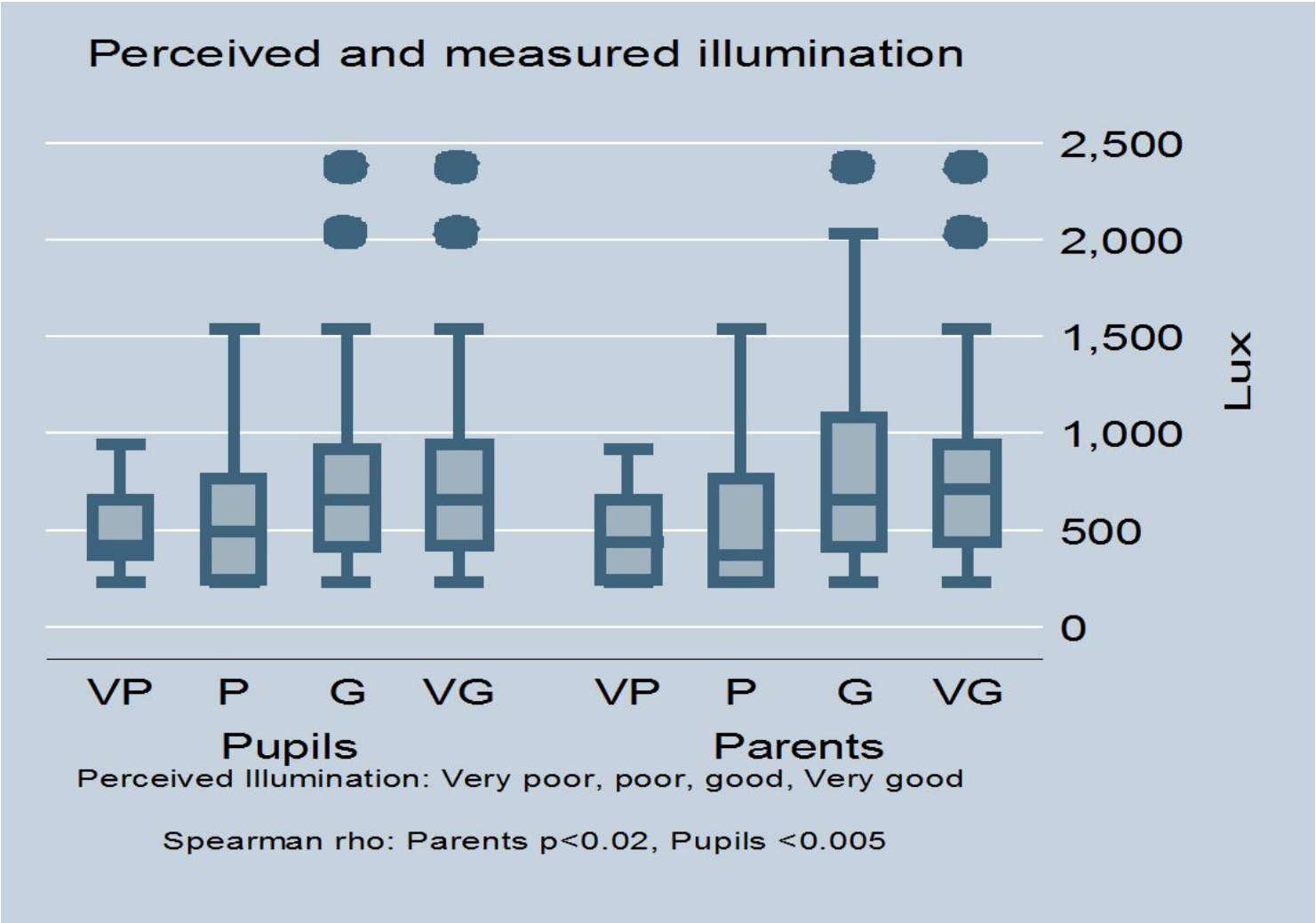
# Nasal Patency



# Perceived Outdoor Air Quality



# Perceived Illumination



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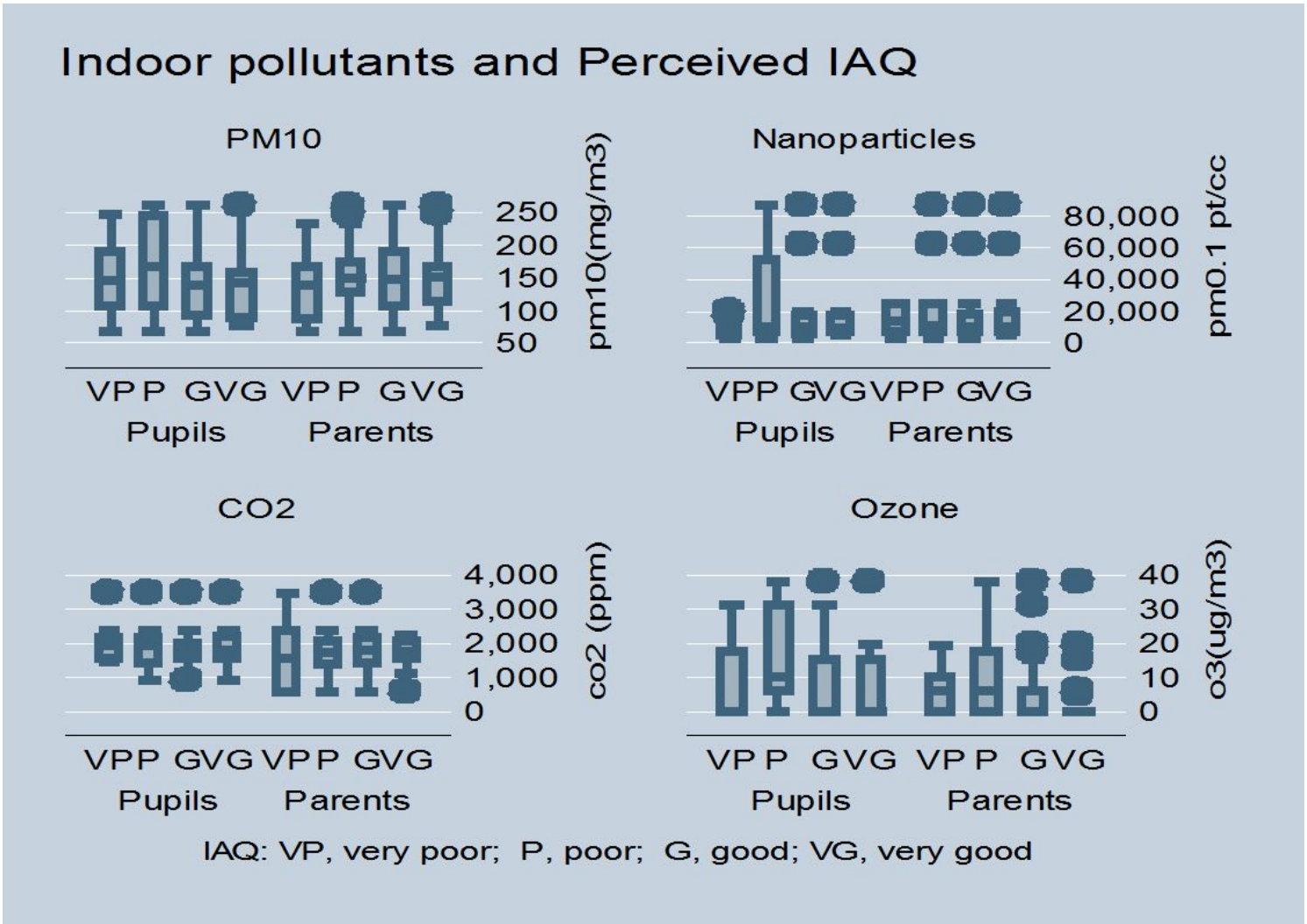
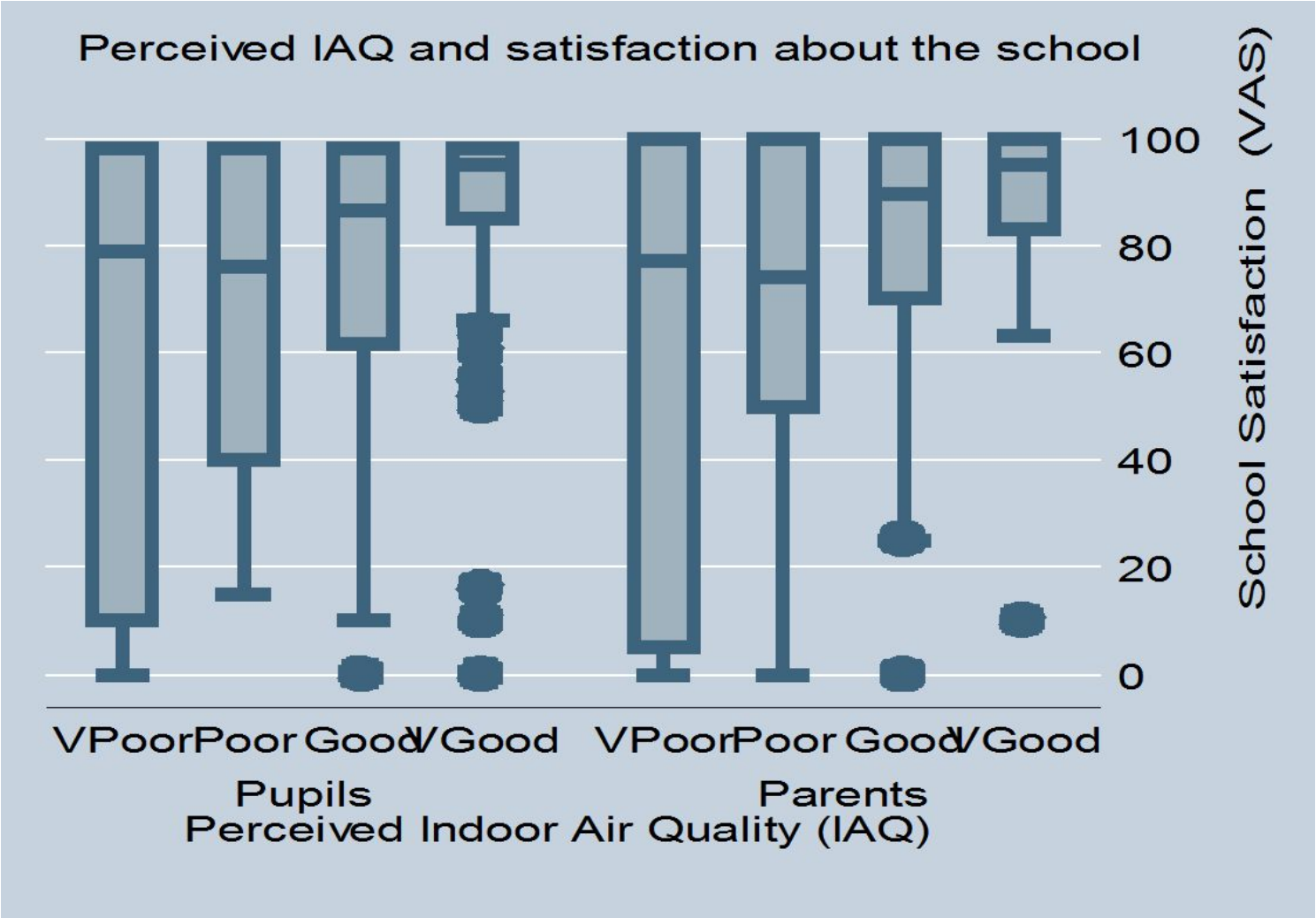
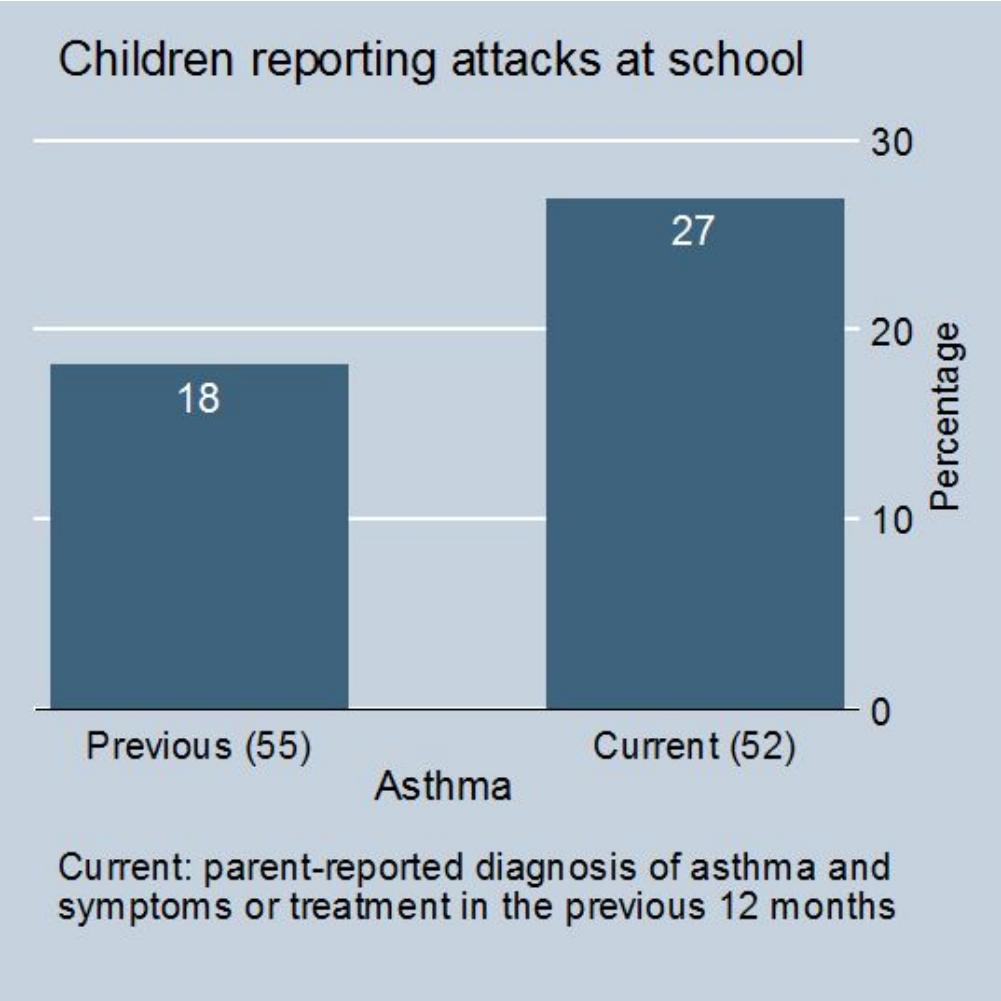


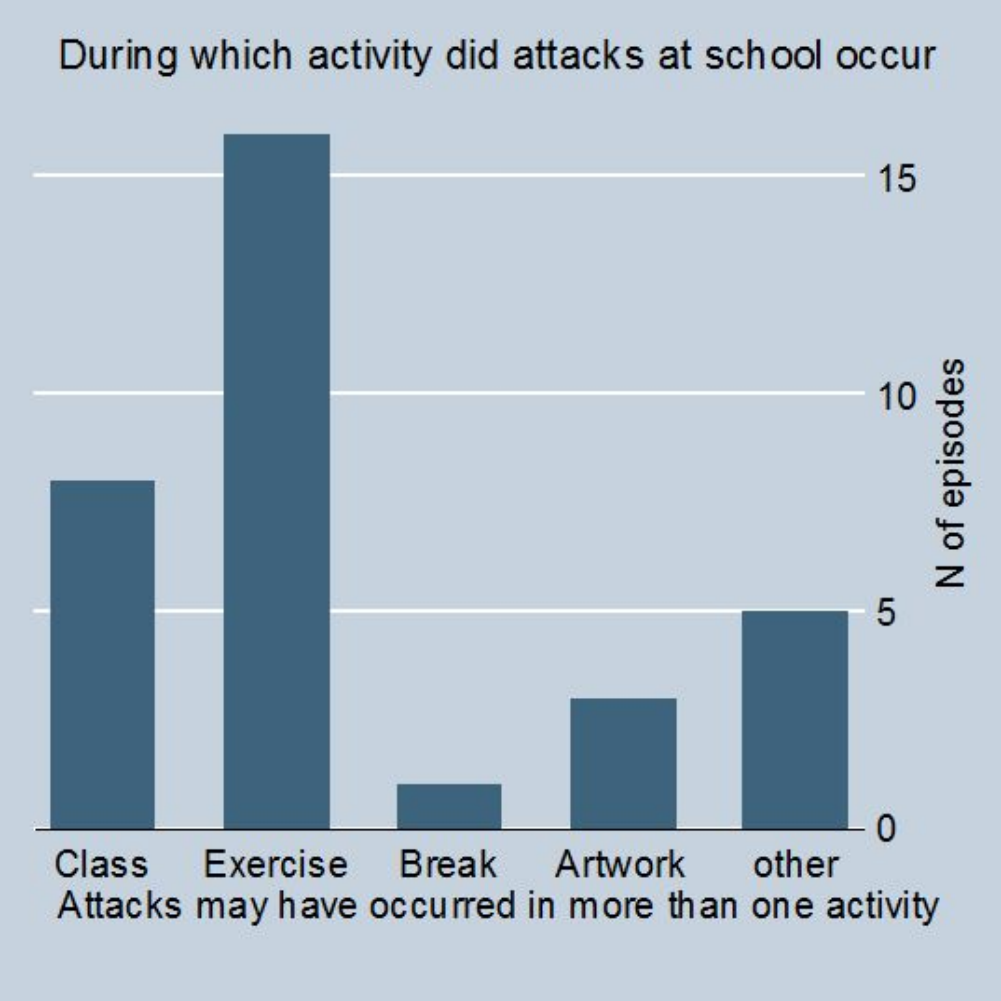
# Satisfaction



# Asthma Attacks at School



# Attack Location



# Management of Asthma Attacks

## How were they managed by the school?

- 1 case: bronchodilator administered by a school nurse
- 2 cases: bronchodilator self-administered upon suggestion by a school operator
- All the other cases: no intervention by the school operators

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# How asthma friendly are the schools?

- Scool nurse: 1 school full time, 7 sometimes, all the others never
- Written policy about IAQ:1 school
- Written policy about carryng asthma medications:1 school
- Written policy about asthma attacks:1 school
- Information on asthma to school operator and pupils:none
- Children known to have asthma: 11 (while 55 reported current asthma)

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- Poor ventilation is common in European schools
- Poor ventilation is associated with relevant clinical outcomes
- Air quality is better with schools with mechanical ventilation
- Schools are unprepared and unfriendly to asthmatic children

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