



HELSIE

HEALTH EFFECTS OF LEBANESE SCHOOLS INDOORS ENVIRONMENT

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Pilot Study

Outline

- ▶ Introduction
- ▶ Methods
- ▶ Results
- ▶ Conclusion

Introduction

Outline

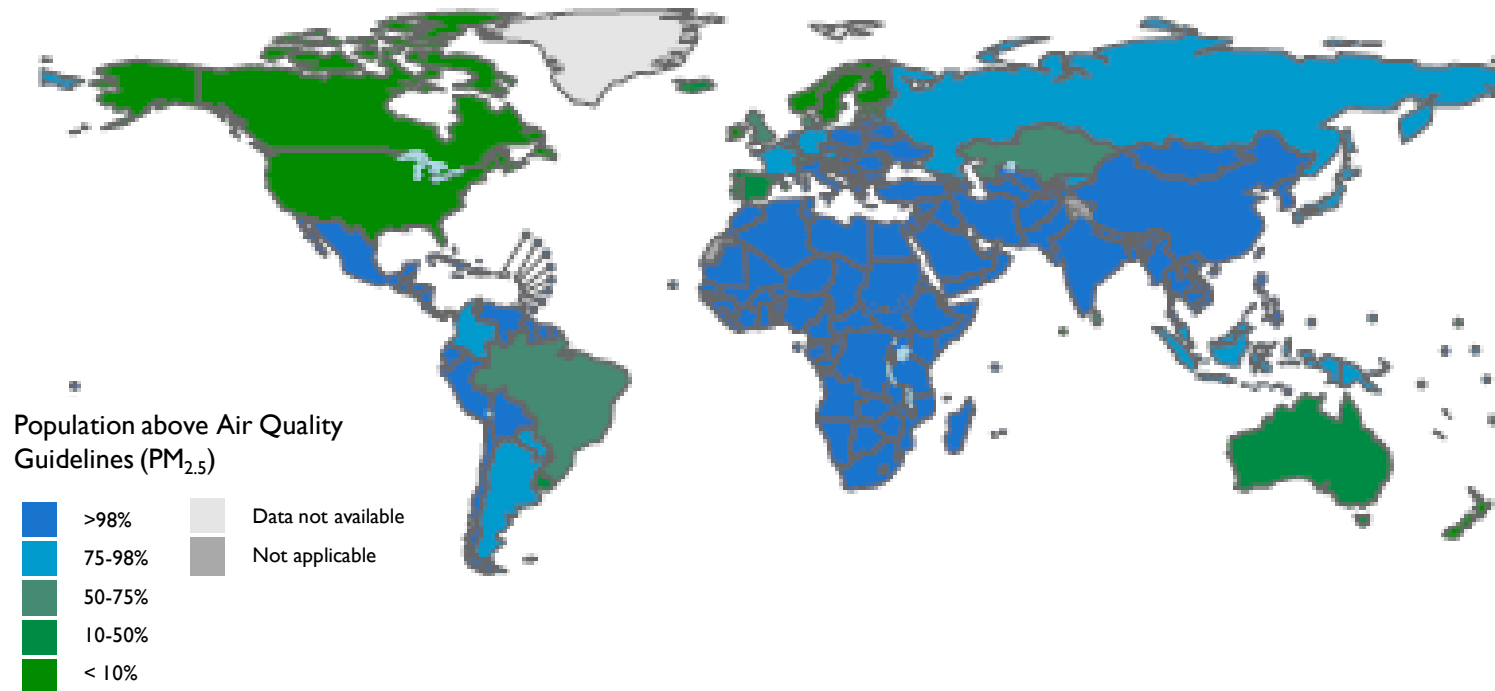
- ▶ **Introduction**
 - ▶ Air Quality and Health
 - ▶ Outdoor Air Quality and Health
 - ▶ Indoor Air Quality and Health
 - ▶ Schools' Air Quality
 - ▶ Health Effects of Air Pollution
 - ▶ HELSIE Objectives
- ▶ **Methods**
- ▶ **Results**
- ▶ **Conclusion**

Air Quality and Health

- ▶ WHO 2018 report on Air Pollution and Child Health:
Prescribing Clean Air
- ▶ More than 1 in every 4 deaths of children under 5 years of age is directly or indirectly related to environmental causes
- ▶ In 2016, 543,000 deaths in children under 5 years were caused by Respiratory Infections contributed by Outdoor and Indoor Air
- ▶ > 90% of children breathe air with pollution levels above the WHO guidelines

Outdoor Air Quality and Health

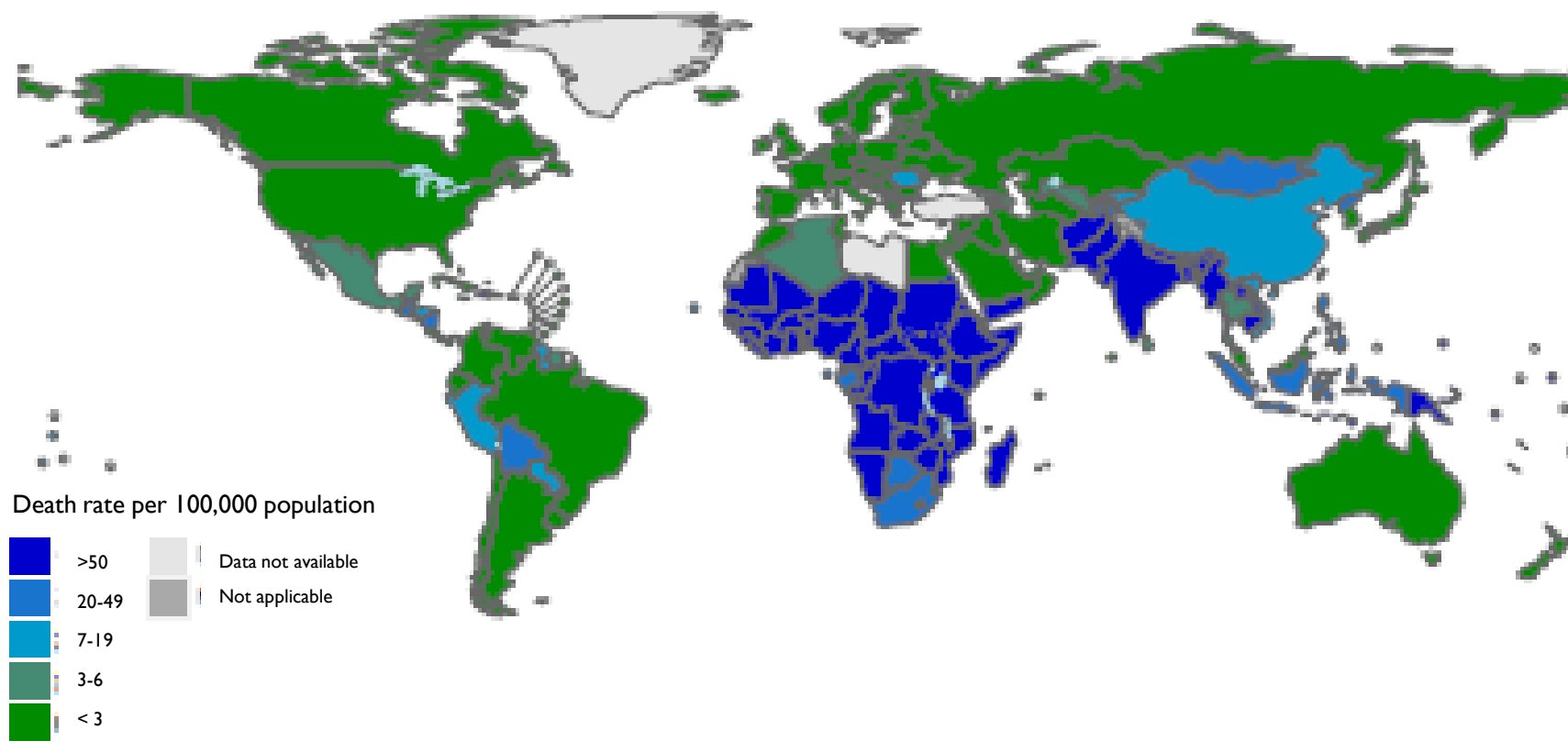
Proportions of Children under 5 years living in areas in which the WHO air quality guidelines ($PM_{2.5}$) are exceeded, by country, 2016



BUT

Personal Exposure is based on Outdoor and Mainly Indoor Air Quality
People spend 90% of their day indoor

Indoor Air Quality and Health



Death rate per 100,000 population from Acute Lower Respiratory Tract Infections due to Indoor Air Pollution in children under 5 years, 2016

Schools' Air Quality

- ▶ Children spend 1/3 of their day at school, breathe larger volume and have less developed immunity
- ▶ Most Common Indoor Air Pollutants
 - ▶ Particulate Matter: PM_{10} and $PM_{2.5}$
 - ▶ Volatile Organic Compounds
 - ▶ Formaldehyde
 - ▶ Nitrous Gases, CO, SO_2
 - ▶ CO_2
 - ▶ O_3

Health Effects of Air Pollution

▶ Health Effects on Students:

- ▶ Adverse Birth Outcomes
- ▶ Infant Mortality
- ▶ Neurodevelopment
- ▶ Childhood Obesity
- ▶ Lung Function
- ▶ Allergies and Respiratory Tract Infections
- ▶ Asthma
- ▶ Otitis Media
- ▶ Childhood Cancers

HELSIE Objectives

- ▶ To measure and assess the physical, chemical and biological parameters of pollutants found in Lebanese schools.
- ▶ To evaluate the impact of the outdoor air pollution on the indoor school environment
- ▶ To obtain data on exposed students' health status: respiratory health, school performance and variation of nasal microbial flora
- ▶ To study the association between Outdoor Air Quality, Indoor Air Quality and the health (respiratory, school performance and nasal microbial flora) of the exposed students

Methods

Outline

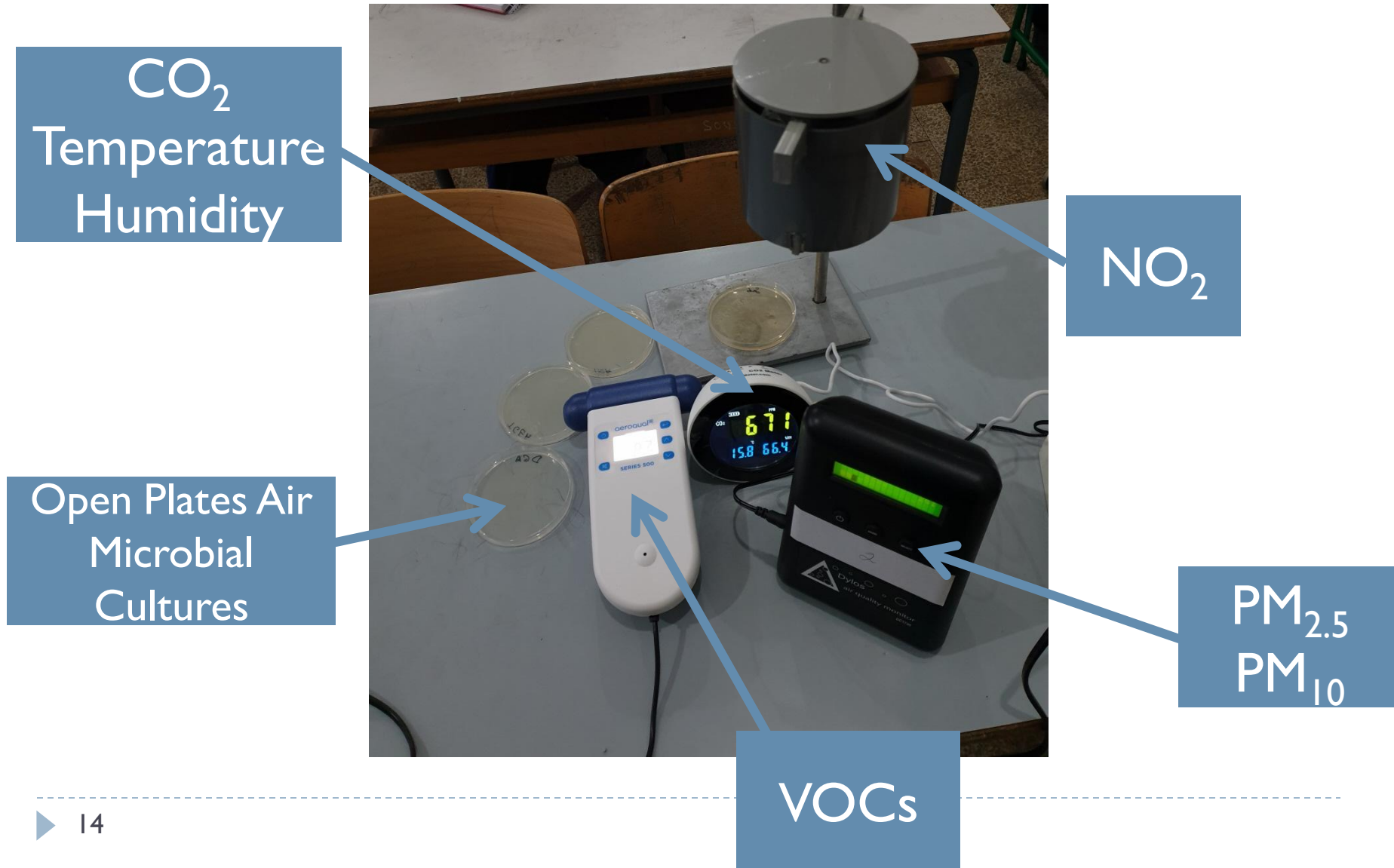
- ▶ Introduction
- ▶ Methods
 - ▶ Study Design and Population
 - ▶ Assessment of Air Quality Indoor / Outdoor
 - ▶ Physical Pollutants
 - ▶ Chemical Pollutants
 - ▶ Biological Pollutants
 - ▶ Assessment of Respiratory Health
 - ▶ Clinical Tests
 - ▶ Questionnaires
 - ▶ Assessment of School Performance
- ▶ Results
- ▶ Conclusion

Study Design and Population

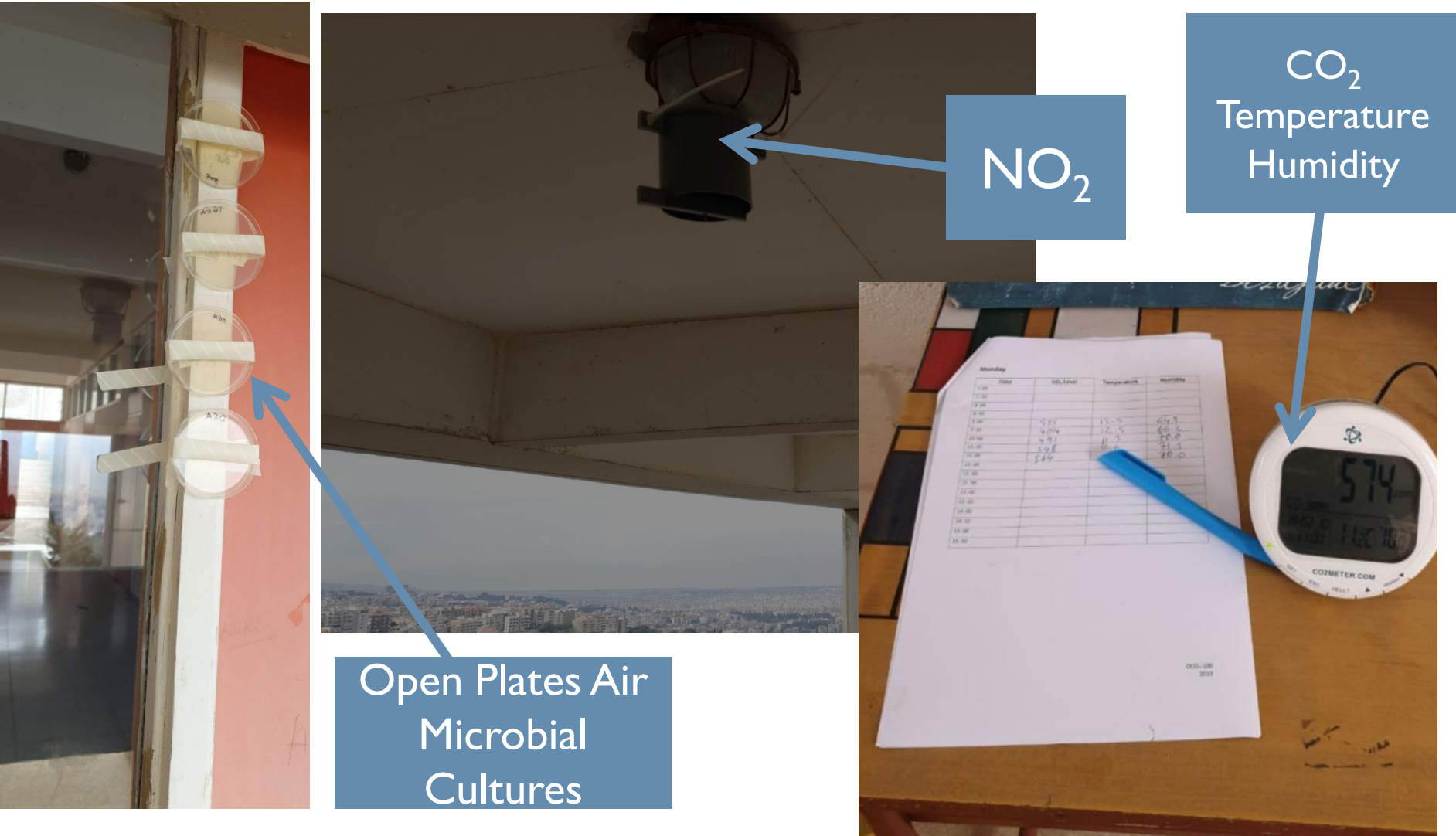
- ▶ Cross-sectional study
- ▶ Green area school
- ▶ Grade 6 classroom
- ▶ One week
- ▶ Heating season
- ▶ 77.42% of the parents allowed their children participate in the study



Measurements Setup Indoor



Measurements Setup Outdoor



Questionnaires & Attention Test

▶ Questionnaires

- ▶ Questionnaires on respiratory health and allergies were filled by:

- ▶ Parents
- ▶ Students
- ▶ Teachers
- ▶ School administrators
- ▶ Teacher in charge of the classroom
- ▶ Investigation checklist for the school's building



▶ Concentration Tests

- ▶ Done twice (morning, afternoon)

Clinical Tests

- ▶ Level of exhaled CO (% of saturation of Hb with CO)
- ▶ Nasal Swab

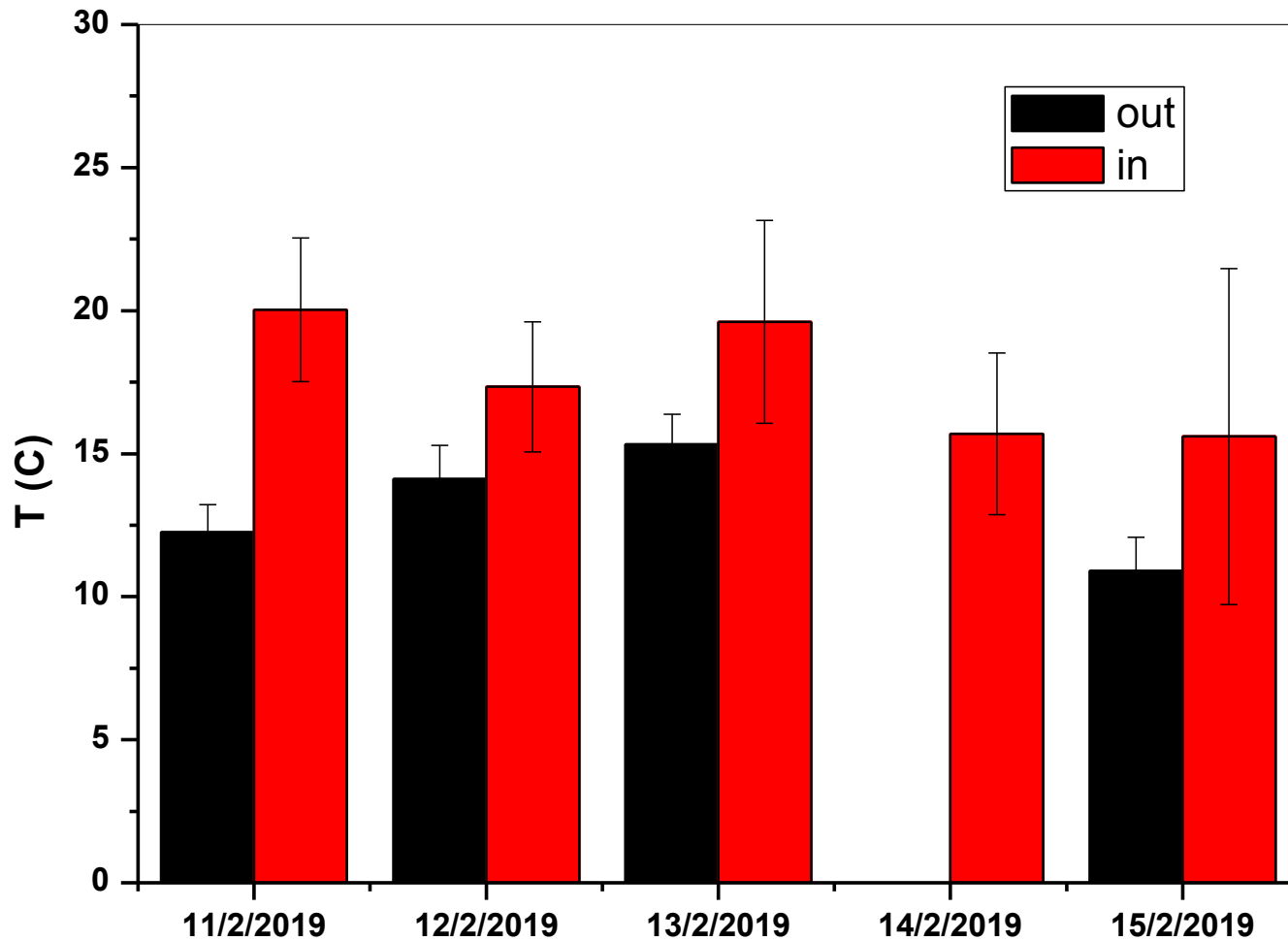


Results

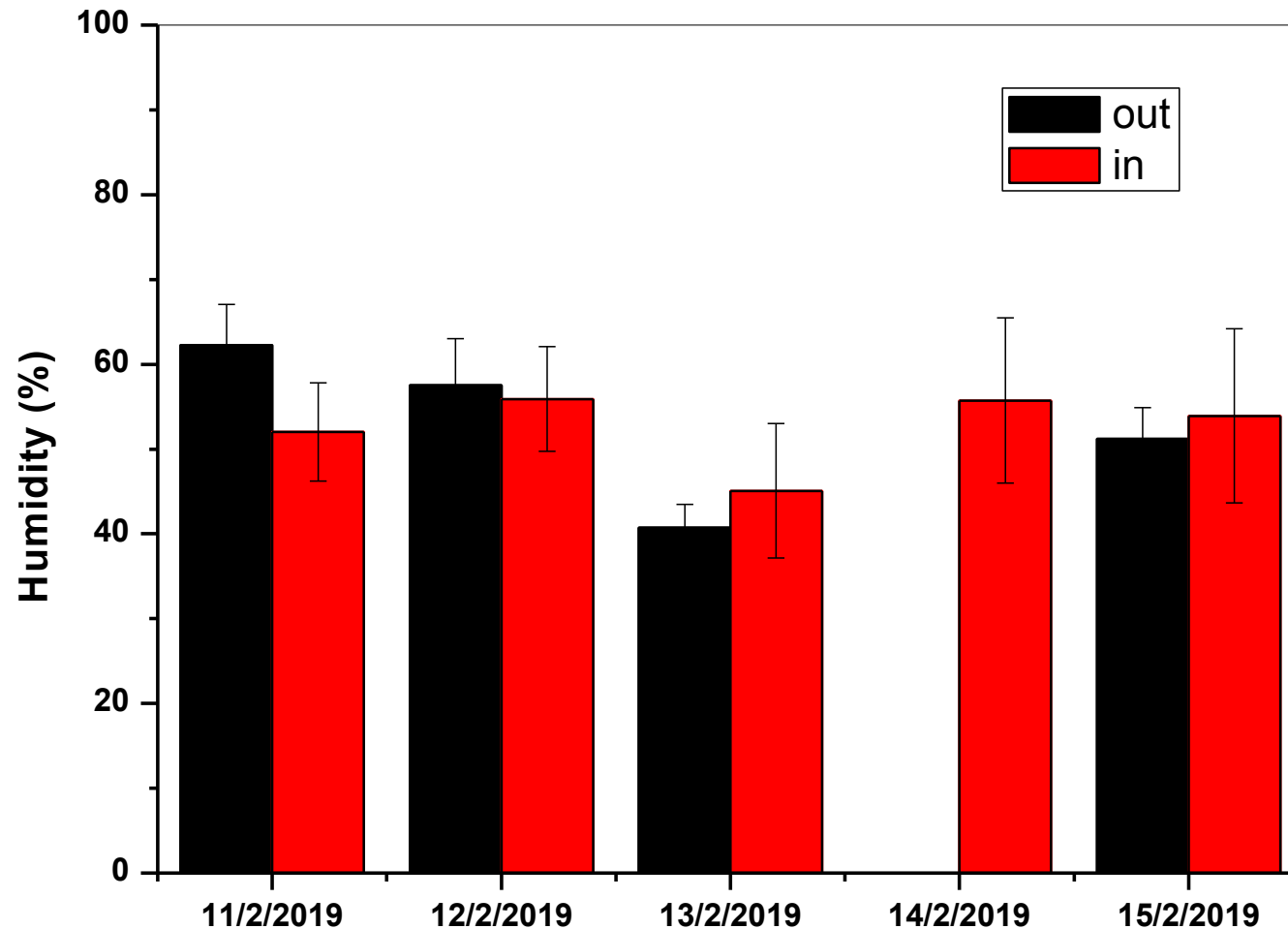
Outline

- ▶ Introduction
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 - ▶ Comparison of Indoor School's Environment and Outdoor School's Environment
- ▶ Conclusion

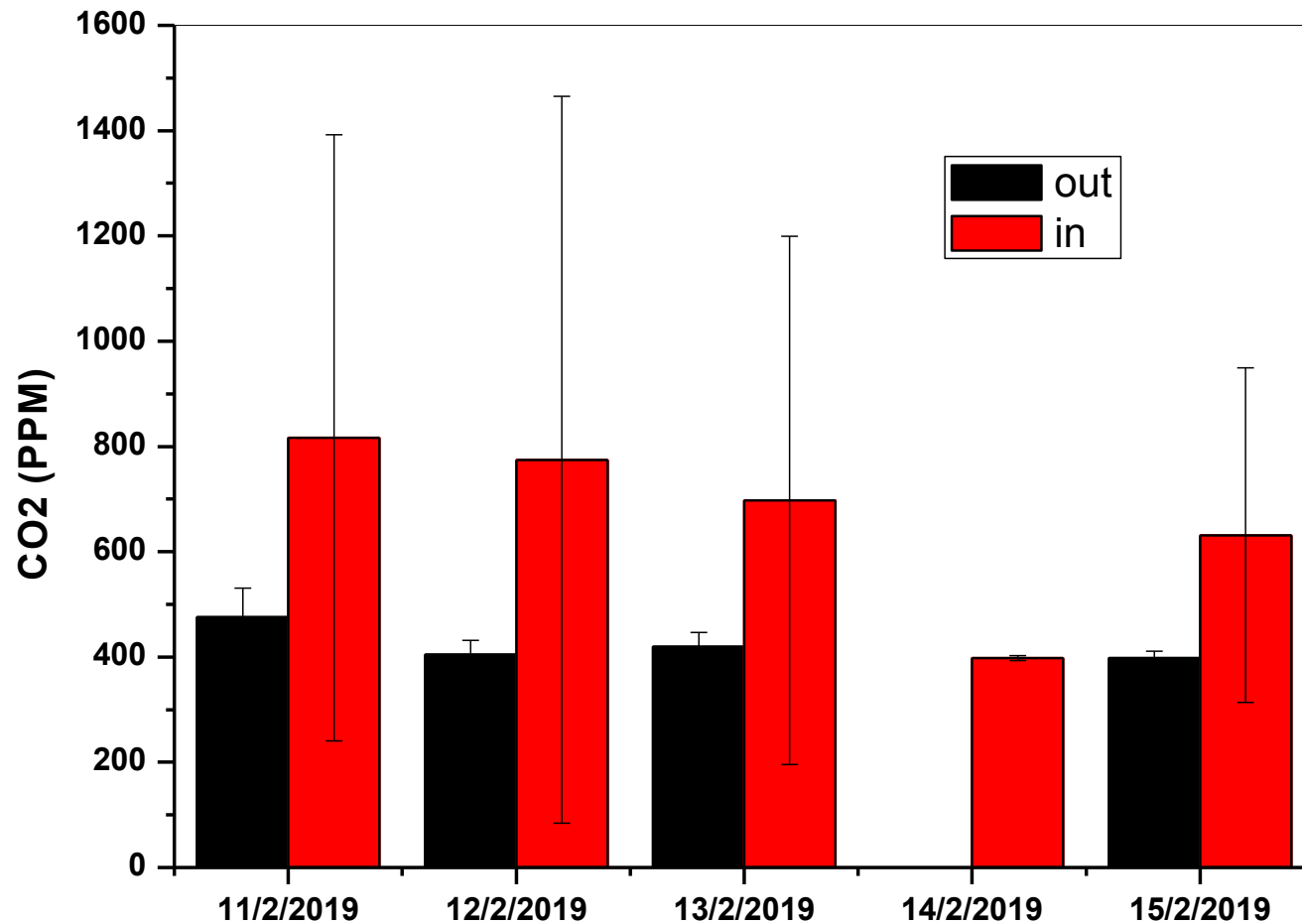
Indoor Temperature vs. Outdoor Temperature



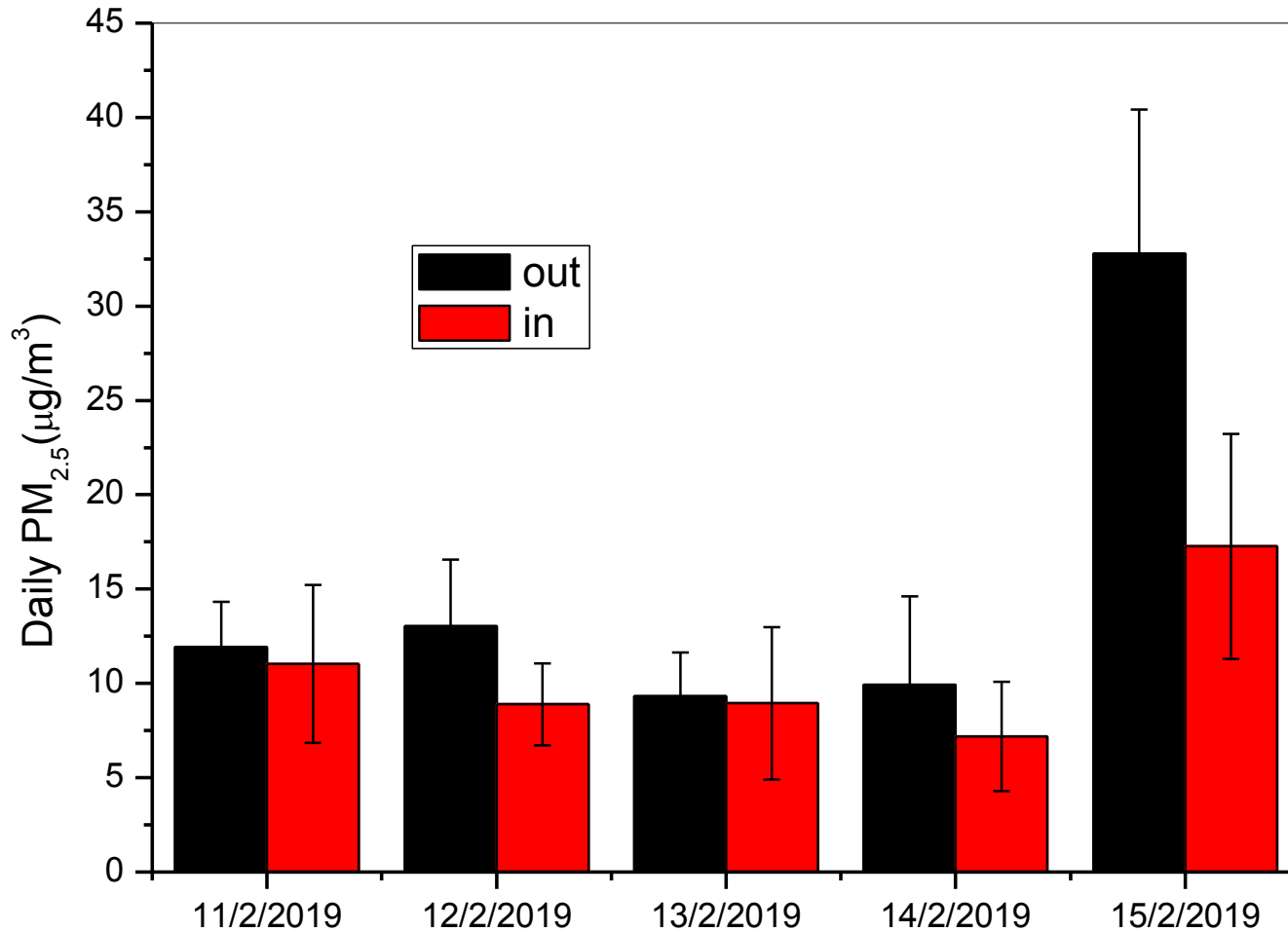
Indoor Humidity vs. Outdoor Humidity



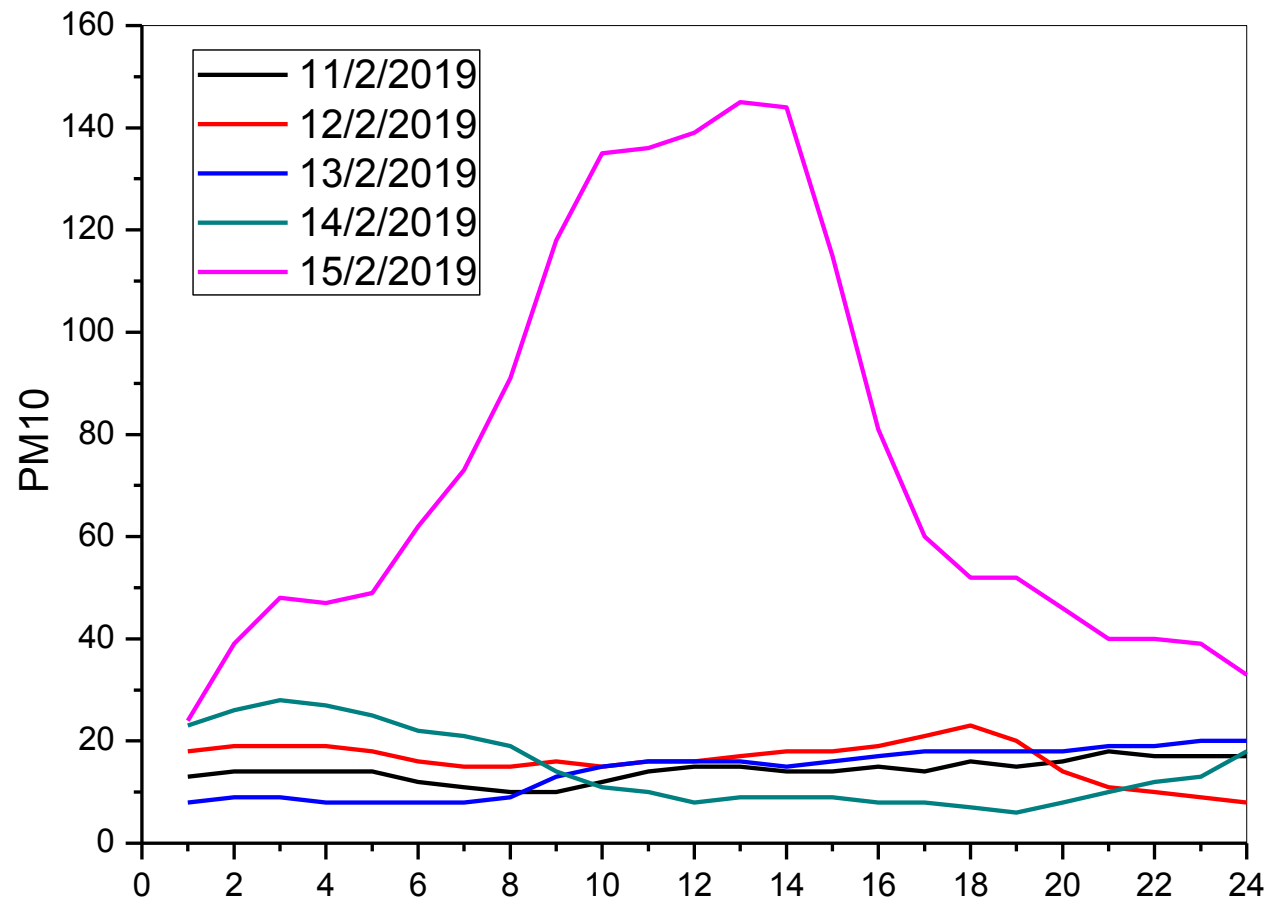
Indoor CO₂ vs. Outdoor CO₂



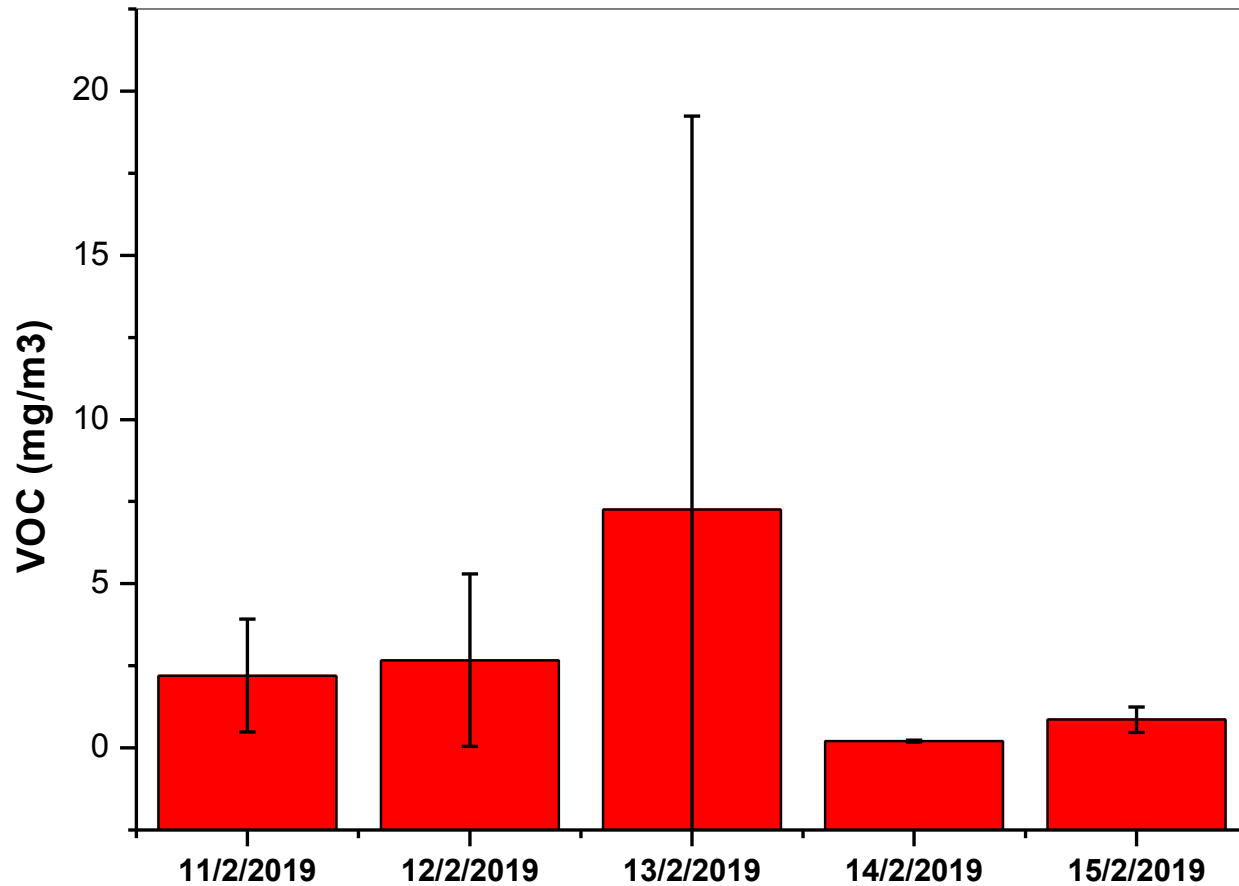
PM_{2.5} Indoor vs. PM_{2.5} Outdoor



PM₁₀ Outdoor



Volatile Organic Compounds Indoor



Recommendations & Conclusion

Conclusions

- ▶ CO₂ is much more fluctuating indoor more than outdoor
- ▶ Temperature is always higher indoor than outdoor during classes with similar fluctuating trends and the same goes for humidity
- ▶ VOCs showed similar daily trends of fluctuations, the highest being on Wednesday in which we have seen the highest peak. Wednesday being a day with longest time with board activities

Recommendations & Conclusion

- ▶ Frequent aeration of classrooms is a necessity even during the Heating Season
- ▶ The pilot study provides insight into the assessment of indoor and outdoor air pollution in Lebanese schools
- ▶ The findings will help in shaping the general study and estimating the health effects

THANK YOU