



Strategy of HypnosAIR - Understanding the impact of air quality on sleep quality considering an integrated human exposure approach

PhD Program in Environmental Engineering

SERGIO MÉNDEZ HOYOS (sergiomendez@ctn.tecnico.ulisboa.pt)

Goal

HypnosAIR aims, based on the latest technologies, to understand which environmental factors may influence sleep quality and to assess the real contribution of the sleeping environment to the daily integrated human exposure to air pollutants.

Ultimately, HypnosAIR intends to define how it is possible to improve the quality of sleep by improving the quality of the air that people breathe during all day.

Keywords: human exposure, air quality, sleep, low- cost sensors, aerosols

Background

Air quality is considered to be one of the main factors that influence **human health** and the **well-being of citizens**. This awareness results from the research developed in the last decades, initially focused on the levels of **human exposure to air pollutants in outdoor environments** and, later, in **indoor environments**.

Therefore, to assess the **real human exposure to air pollutants**, it is crucial to consider an integrated approach of **all micro-environments** in which **people are during 24 hours**.

Since **people spend a 1/3 of their lives sleeping** and that **sleep is essential to the well-being, performance and health** of individuals, **sleeping environments** have started to gather the attention of the scientific community in recent years **to assess exposure levels** and **how they can affect the quality of sleep**.

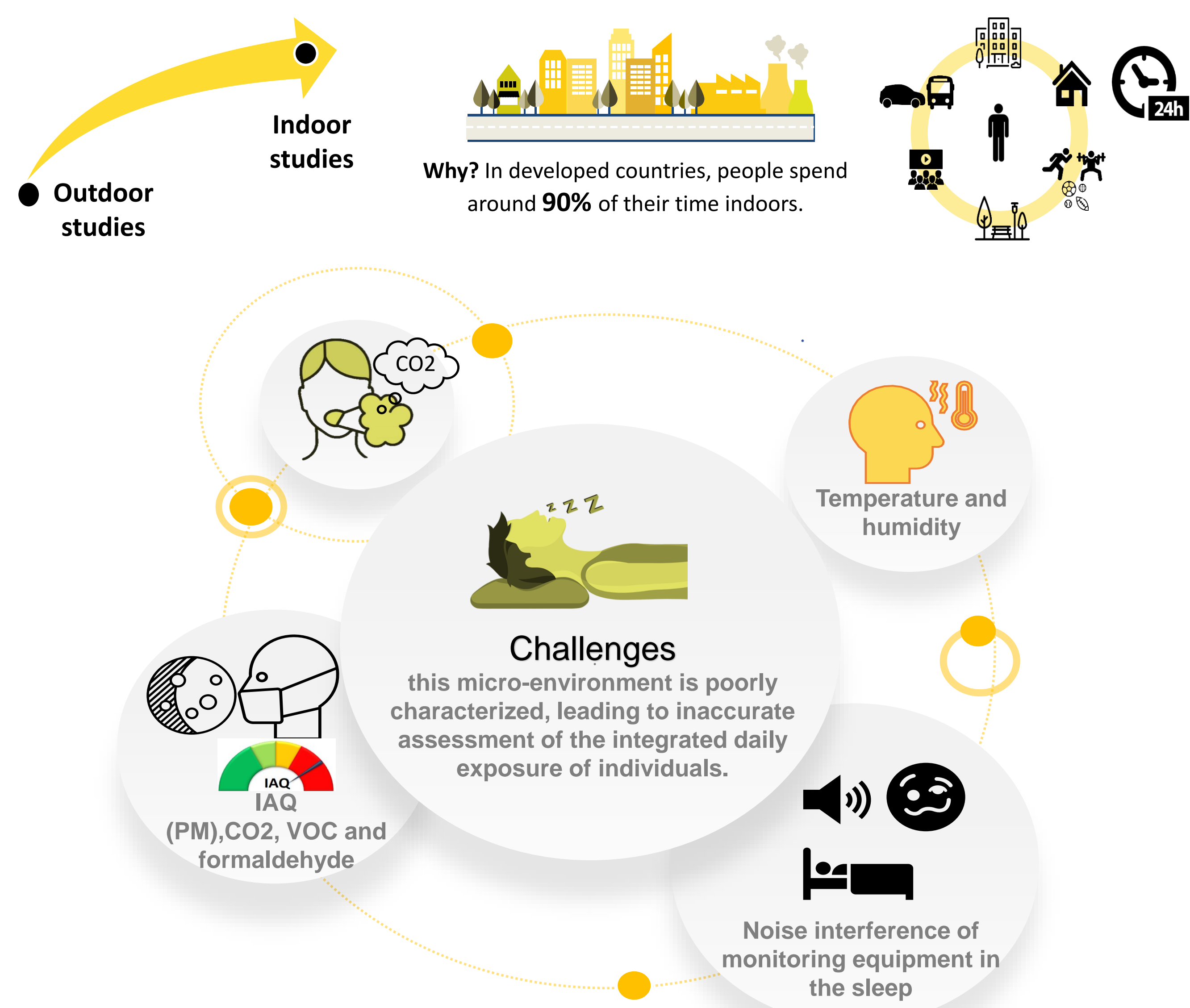


FIGURE 1: Integrated approach of all micro-environments in which people are during 24 hours.

Scientific Questions

The scientific questions that HypnosAIR aims to answer are:

- Which is the contribution of the exposure to pollutants while sleeping to the daily exposure of an individual?
- Which air pollutants have a negative impact on sleep quality and to what extent?
- How different is particulate matter during sleep and in other indoor and outdoor environments, in terms of composition and toxicity?
- Which are the main sleep characteristics of the Portuguese population, including in the several age groups?
- Which are the best strategies to improve sleep quality of citizens taking into account the exposure in sleeping environments and other environments where people are during the day?

Strategies

Development of PEMUAQ* monitoring unit for air quality assessment

1. Review of state-of-art of low-cost sensors.
2. Development of the PEMUAQ monitoring unit.
3. Validation of PEMUAQ using reference methods: accuracy and quality control.

* PEMUAQ – PErsonal Monitoring Unit of Air Quality

Assessment of IAQ in bedrooms using reference methods

1. IAQ characterization during sleep in Portuguese dwellings by reference methods.
2. Assessment of ventilation conditions during the sleeping period.
3. Identification of determinants of IAQ during sleep.

Some tools

Dust Track Particle counter	MicroAeth Aethalometer AE51	Graywolf IQ-610 probe	Formaldemeter	SILENT Sequential Air Sampler
-----------------------------	-----------------------------	-----------------------	---------------	-------------------------------

Identification of fine aerosols (PM2.5) levels during sleep, their sources and associated health impact

1. Sampling and characterization of PM2.5 during sleep and its outdoor.
2. Assessment of health impact of PM2.5 samples by Oxidative potential (OP).
3. Identification of pollution sources by source apportionment techniques.

Yearly survey of exposure to air pollutants and sleep quality

1. Seasonal monitoring of air pollutants (PEMUAQ) and sleep survey (by actigraphy) in dwellings and university dorms.
2. Assessment of ventilation conditions and Identification of determinants in the sleep

Some tools to assess sleep quality

Actigraphy	Polysomnography
------------	-----------------

Environmental factors affecting sleep quality

1. Understand the contributions of the different micro-environments to the daily integrated human exposure to air pollutants.
2. Assessment of environmental factors affecting sleep quality.
3. Guidelines to improve sleep quality by minimizing exposure to air pollutants.

FIGURE 2: Questions and description strategies to solve in the project.