

# Preliminary results concerning school staff personal exposure to microbial load – Worry to be considered?

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InChildHealth



# InChildHealth

This study is a spin-off of a European research project “Identifying determinants for indoor air quality and their health impact in environments for children: measures to improve indoor air quality and reduce disease burdens”.



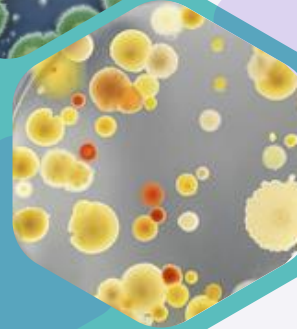
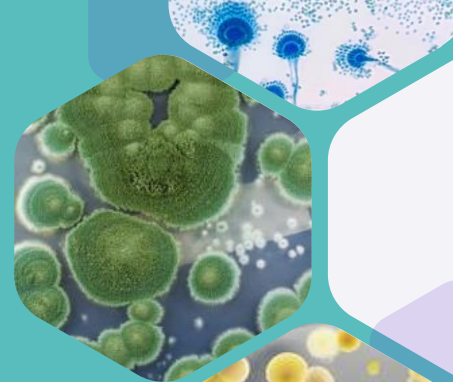
Improving **indoor air quality**  
to bring about a **healthier future**  
for our children





# Why is it important to assess Indoor Air Quality in schools?

- Indoor Air Quality (IAQ) is an important determinant of human health<sup>1</sup>
- School occupants can be exposed to bioaerosols such as fungi and bacteria can be pathogenic and toxigenic<sup>2,3,4</sup>
- Health effects: Infectious diseases, respiratory health problems, and chronic lung conditions<sup>5,6</sup>





# Is Portugal addressing educators' health risks?

## Safety Deficiency

Primary schools lack mandatory occupational health and safety services



## Health Risks

No hierarchy of responsibilities, risking educators' health



## Growing Risks

Increasing workplace accidents and occupational diseases<sup>7,8</sup>





# Do the current guidelines cover school workers too?



Scientific literature recommends<sup>9</sup>:

- Total bacteria in non-industrial workplaces:  $1.0 \times 10^3$  to  $7.0 \times 10^3$  CFU.m<sup>-3</sup>.
- Fungi:  $1.0 \times 10^1$  to  $1.0 \times 10^4$  CFU.m<sup>-3</sup>

Limits overlook pathogen risk (0 CFU.m<sup>-3</sup>) but lack specificity for schools or personal exposure in the same environment<sup>10</sup>.

Studies on school air quality focus on children; none address teachers' exposure or school workers<sup>11,12,13</sup>.



# Aim

This study aims to provide a first insight into the personal exposure of teachers and school staff to bacteria and fungi in primary schools in Portugal.





# Addressing personal microbial exposure

## Sampling campaign



- 10 schools in Lisbon Metropolitan Area
- Warm and cold season
- Record of teachers and staff activities teachers and staff activities

Professional	Activity	School site
<b>Teacher</b>	Teaching Managing children's activities Preparing classes	Classroom Classroom/outdoor Teachers room
<b>Staff member</b>	Cleaning Children activities management Breaks vigilance Lunch breaks vigilance	Indoor Indoor/Outdoor Outdoor Canteen



# Addressing personal microbial exposure

## Sampling campaign



- SKC Button Aerosol Sampler with sterilized Polycarbonate filters
- Sampling for 2h at 4L/min
- 1 teacher and 1 school staff member of each school in each season

40  
samples

Filters extracted with NaCl 0.9% + Tween 80 0.05%  
Inoculated onto:

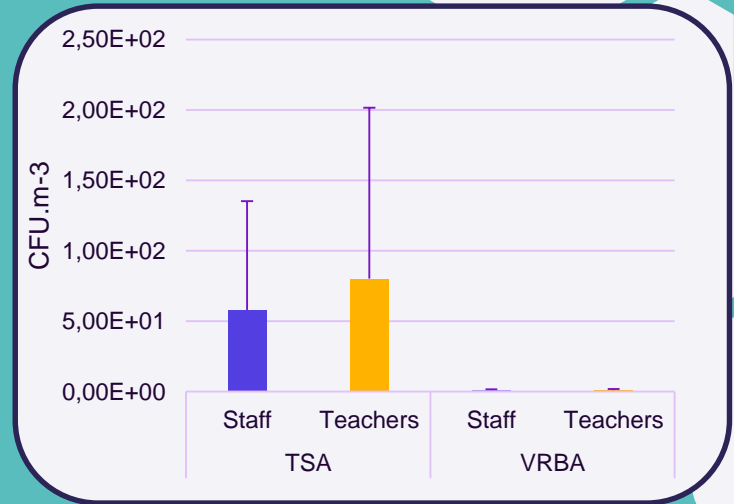
- TSA and VRBA for Total bacteria and Gram-negative quantification (incubated for 7 days at 30°C and 37°C, respectively)
- MEA and DG18 for Fungal quantification (incubated for 5-7 days at 27°C)





# Bacterial contamination

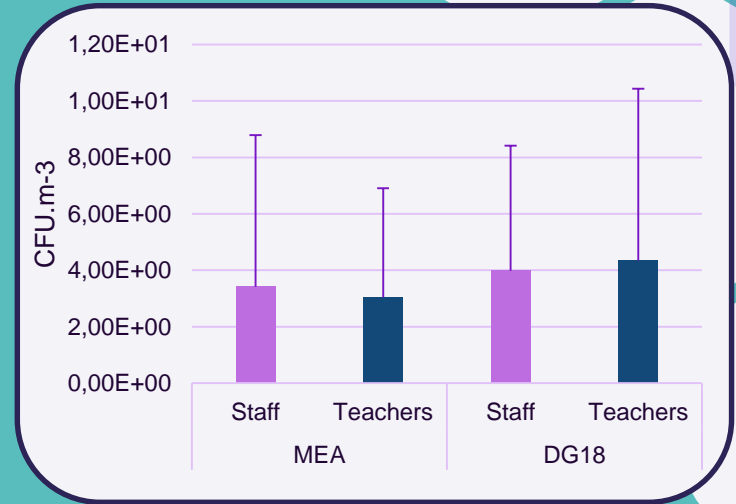
- Teacher presented higher average contamination on TSA ( $8.03 \times 10^1$  CFU.m<sup>-3</sup>).
- Teachers and staff presented less than  $0.5 \times 10^0$  CFU.m<sup>-3</sup> on VRBA.  
(Teachers:  $6.25 \times 10^{-1}$  CFU.m<sup>-3</sup>; Staff:  $2.08 \times 10^{-1}$  CFU.m<sup>-3</sup>).





# Fungal contamination

- Staff presented higher contamination on MEA ( $3.42 \times 10^0$  CFU.m<sup>-3</sup>).
- Teachers presented higher counts on DG18 ( $4.35 \times 10^0$  CFU.m<sup>-3</sup>).





# Filling the gap

## School bioaerosol exposure

Portugal's NHS urges health promotion in schools despite no specific microbial regulations<sup>14</sup>.  
Bioaerosol exposure depends on activities and building conditions assessment<sup>15</sup>.  
Ventilation in classrooms is often poor, relying on open windows.

Teachers spend most time in classrooms or offices, standing near students.  
Staff handle cleaning and managing children, exposing themselves to bioaerosols<sup>16</sup>.





# Filling the gap

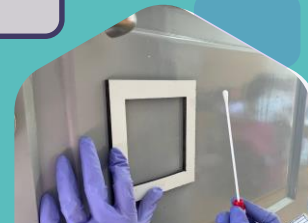
## Bioaerosol sampling

Active samplers like MAS-100 and passive samplers like EDC effective on contamination assessment<sup>17</sup>.

Personal samplers are efficient in assessing personal bioaerosol exposure<sup>18,19</sup>.

Button samplers excel at monitoring workplace breathable contamination collecting particles near the breathing zone.

Suitable for assessing exposure during different workstations and activities<sup>19,20</sup>.  
Low-volume samplers require representative sampling time of all activities.





# Filling the gap

## School workers' bioaerosol exposure

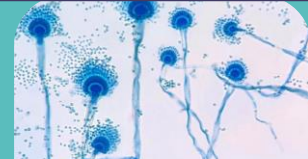
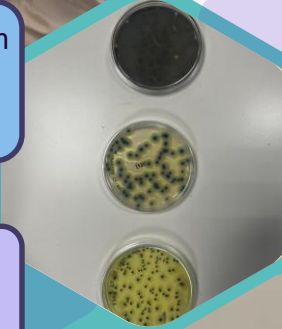


Teachers' samples showed higher bacterial counts, likely due to prolonged indoor exposure where contamination levels<sup>11,21,22</sup> tend to be higher compared to outdoors, despite counts remaining below OSHA's recommended thresholds ( $1.0 \times 10^3$  to  $7.0 \times 10^3$  CFU.m<sup>-3</sup>)<sup>9</sup>.

MEA's lower counts for teachers' samplers could be due to fast-growing fungi; using DG18 is crucial for diverse fungal growth<sup>23</sup>. Counts in both media were below OSHA thresholds ( $1.0 \times 10^1$  to  $1.0 \times 10^4$  CFU.m<sup>-3</sup>).

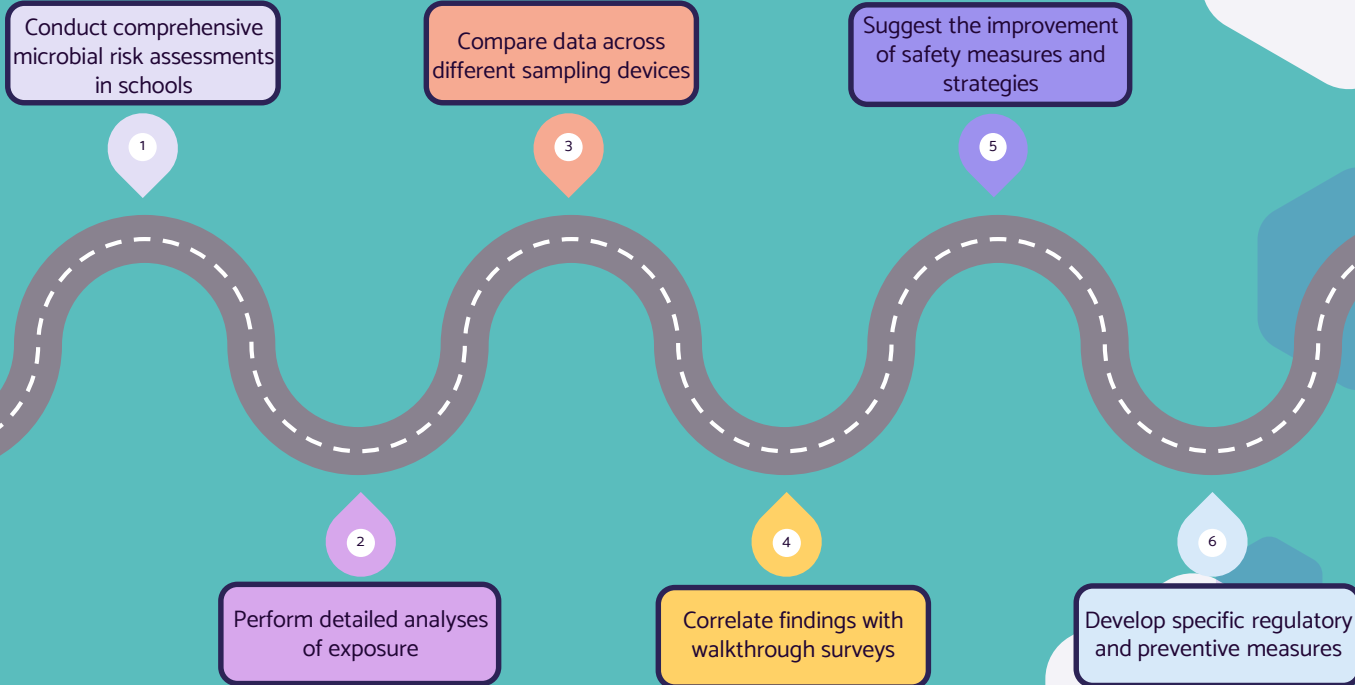
While quantitative thresholds for microbial contamination are met, assessing qualitative data remains crucial. These thresholds do not eliminate potentially harmful species like MRSA and *Aspergillus fumigatus*, which ideally should be absent (0 CFU.m<sup>-3</sup>)<sup>10</sup>.

Previous school studies met quantitative cut-offs but found pathogenic and toxigenic fungi<sup>24,25</sup>.





# Further steps





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