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# Endocrine-Disrupting Chemicals in School Indoor Air and Childhood Health: Baseline evidence for climate-resilient and health-protective school environments

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## KEY MESSAGES

1. School indoor air contains endocrine-disrupting chemicals including PFAS and BFRs that may affect children's respiratory and skin health.
2. Associations were observed between exposure to BFRs and PFAS and increased risks of asthma, wheezing, and eczema in children.
3. Findings support the need for climate-resilient and health-protective school environments and ongoing monitoring of chemical exposures.

## ABSTRACT

**Introduction.** Endocrine-disrupting chemicals (EDCs) in school indoor air may affect children's respiratory and skin health. Schools are key indoor environments shaped by climate adaptation, where persistent pollutants such as PFAS and BFRs are present, potentially impacting children's health through multiple exposure pathways.

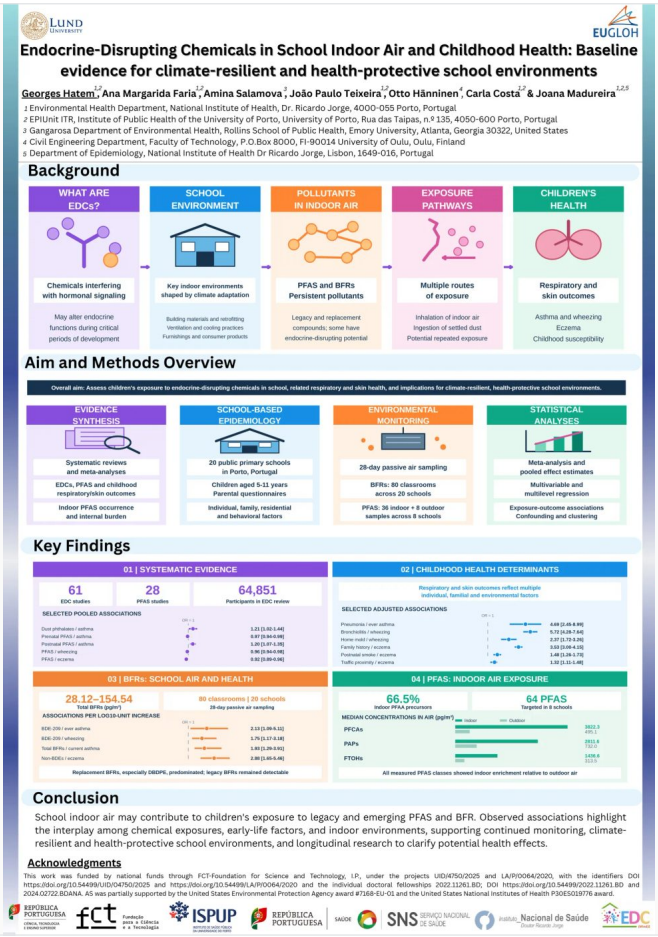
**Materials and methods.** This study assessed children's exposure to endocrine-disrupting chemicals in 20 public primary schools in Porto, Portugal, involving children aged 5-11 years. Methods included systematic reviews and meta-analyses of EDCs, PFAS, and childhood respiratory/skin outcomes, environmental monitoring with 28-day passive air sampling in 80 classrooms across 20 schools, and statistical analyses using meta-analysis, multivariable and multilevel regression to evaluate exposure-outcome associations.

**Results.** Systematic evidence included 61 EDC studies and 28 PFAS studies with 64,851 participants. Childhood health determinants showed multiple individual, familial, and environmental factors influencing respiratory and skin outcomes. Environmental monitoring detected total BFRs ranging from 28.12 to 154.54 pg/m$^3$ and 64 PFAS targeted in 8 schools, with 66.5% indoor PFAA precursors. Associations were found between BFRs and asthma/wheezing, and PFAS with wheezing and eczema. Replacement BFRs predominated, but legacy BFRs remained detectable.

**Conclusion.** School indoor air may contribute to children's exposure to legacy and emerging PFAS and BFR. Observed associations highlight the interplay among chemical exposures, early-life factors, and indoor environments, supporting continued monitoring, climate-resilient and health-protective school environments, and longitudinal research to clarify potential health effects.

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## POSTER




## REFERENCES

1. Hatem G, Faria AM, Costa C, Zhang Z, Dukes D, Hänninen O, Teixeira JP, Salamova A, Madureira J. Per-and polyfluoroalkyl substances (PFAS) in Portuguese primary schools: Occurrence in air and implications for children's inhalation exposure. Environmental Research. 2026 Aug 21:125533.

2. Hatem G, Faria AM, Kong M, Costa C, Slezakova K, do Carmo Pereira M, Hänninen O, Salamova A, Teixeira JP, Madureira J. Indoor air exposure to brominated flame retardants in public primary schools and associations with childhood respiratory and skin outcomes. Journal of Hazardous Materials. 2026 Aug 1;514:142814.

3. Hatem G, Faria AM, Pinto MB, Salamova A, Teixeira JP, Costa C, Madureira J. Exposure to per-and poly-fluoroalkyl substances and respiratory and skin effects in children and adolescents: A systematic review and meta-analysis. Journal of Hazardous Materials. 2025 Jul 5;491:137978.

4. Hatem G, Faria AM, Pinto MB, Teixeira JP, Salamova A, Costa C, Madureira J. Association between exposure to airborne endocrine disrupting chemicals and asthma in children or adolescents: A systematic review and meta-analysis. Environmental Pollution. 2025 Mar 15;369:125830.

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