

# Long-term effect of air pollution on re-hospitalization in children discharged from Pediatric Intensive Care Units

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## Introduction

Exposure to air pollution is a known risk factor for respiratory morbidity in children both in terms of emergency room visits and hospitalizations<sup>1</sup>. In particular, air pollution was associated with higher number of hospital admissions, longer length of stay and higher economic cost of hospitalization in children with respiratory diseases, with a maximum effect observed on the day before hospitalization<sup>2</sup>. Furthermore, studies on the chronic and long-term exposure to air pollution showed that children living closer to the main roads have an increased risk of developing respiratory infections<sup>3,4</sup>. However, no studies investigated the relation between air pollution levels and re-hospitalization rates in *fragile* children (with a previous admission in Pediatric Intensive Care Unit (PICU)).

## Data collection

Children hospitalized in the PICU of Padova hospital (Italy) between 2013 and 2019 were selected from hospital discharged records (index hospitalization). All subsequent hospitalizations for cardiovascular, respiratory or neurological diagnosis have been tracked until 2020. Daily data on PM<sub>10</sub>, PM<sub>2,5</sub>, NO<sub>2</sub>, temperature, atmospheric pressure and relative humidity were obtained from the monitoring stations of the Regional Agency for Environmental Prevention and Protection (ARPA).

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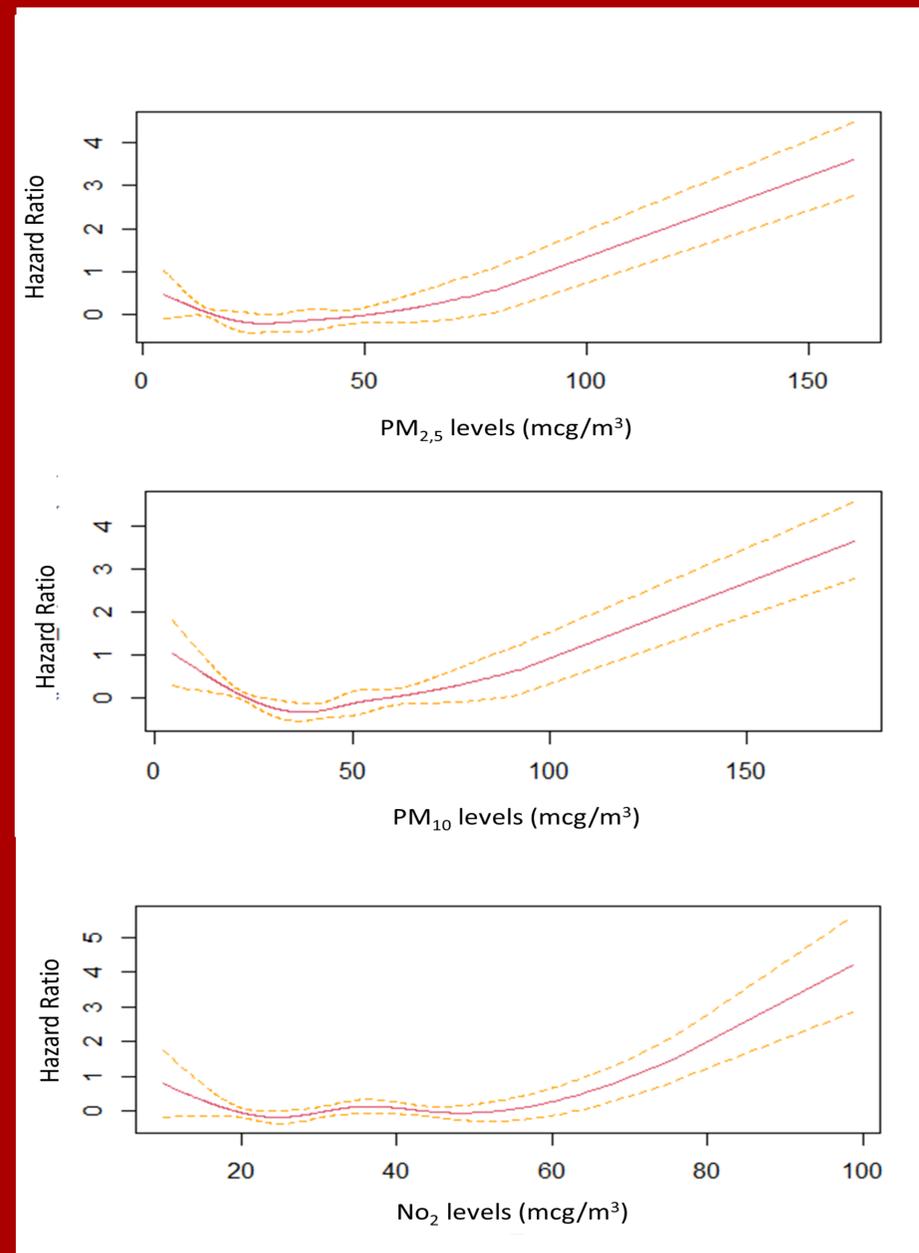


Figure 1. Hazard ratios and related 95% confidence interval of the association between air pollution levels of PM<sub>2,5</sub>, PM<sub>10</sub> and NO<sub>2</sub> and re-hospitalization rates for patients with a previous admission in PICU.

## Statistical analysis

To account for time-varying air pollution levels, a Cox model with the Andersen-Gill counting process was applied. Models have been adjusted for subject-related confounders (age and sex) and exposure characteristics (temperature and humidity). The single pollutant has been modelled with 3-nodes natural cubic splines.

**Outcome.** The association was evaluated considering re-hospitalizations that occurred in the first year after PCU discharge.

## Key findings

- Overall, 1204 children were admitted to the PICU and 461 of them experienced a subsequent hospitalization for cardiovascular, respiratory or neurological issues. The 73% was re-hospitalized during the first year after the PICU discharge.
- A positive effect of PM<sub>2,5</sub> and NO<sub>2</sub> levels on hospital re-admission risk can be observed for levels higher than 50 ug/m<sup>3</sup>.
- The association with PM<sub>10</sub> is less strong, with an increase in the re-hospitalization hazard only for exposure to very high levels of pollutant.
- This could be due to the smaller diameter of PM<sub>2,5</sub> as respect to PM<sub>10</sub> that let it easily penetrate deep into the pulmonary alveoli and therefore in the blood flow, causing more severe clinical pictures.
- NO<sub>2</sub> shows a similar trend with a flat slope at low levels of the pollutant and an increased hazard at concentrations over 50 ug/m<sup>3</sup>.
- The small number of the sample considered may have influenced the results obtained.

## References

- 1 Farhat SCL, Paulo RLP, Shimoda TM, Conceição GMS, Lin CA, Braga ALF, et al. Effect of air pollution on pediatric respiratory emergency room visits and hospital admissions. *Braz J Med Biol Res.* febbraio 2005;38(2):227–35.
- 2 Zhou H, Wang T, Zhou F, Liu Y, Zhao W, Wang X, et al. Ambient Air Pollution and Daily Hospital Admissions for Respiratory Disease in Children in Guiyang, China. *Front Pediatr.* 4 ottobre 2019;7:400
- 3 Girguis MS, Strickland MJ, Hu X, Liu Y, Chang HH, Belanoff C, et al. Chronic PM2.5 Exposure and Risk of Infant Bronchiolitis and Otitis Media Clinical Encounters. *Int J Hyg Environ Health.* agosto 2017;220(6):1055–63
- 4 Karr CJ, Rudra CB, Miller KA, Gould TR, Larson T, Sathyanarayana S, et al. Infant exposure to fine particulate matter and traffic and risk of hospitalization for RSV bronchiolitis in a region with lower ambient air pollution. *Environ Res.* aprile 2009;109(3):321–7.