



# Urban air pollution in Rome: children and elders exposure to PAHs in fine particulate matter (PM<sub>2.5</sub>)



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## INTRODUCTION

The evaluation of personal exposure to air pollution is a major concern especially for vulnerable population such as children and elderly[1, 2]. Among urban pollutants, Polycyclic Aromatic Hydrocarbons (PAHs) are of great interest from a toxicological point of view due to the presence of carcinogenic and mutagenic congeners[3].

## MATERIALS AND METHODS

In the frame of the EXPAH Project (EXposure population to PAHs) funded by European LIFE+ Program, measurements of personal exposure to PM<sub>2.5</sub>-bound polycyclic aromatic hydrocarbons (PAHs) for six children and four elderly were performed during spring and summer 2012 in the city of Rome, Italy. The in-field campaigns lasted for fifteen days and the measurements were based on daily sampling (24 hours).



Figure 1. Volunteers wore a SKC sampler (flow rate 10L/min) equipped with a PM<sub>2.5</sub> particulate selector

Personal time activity schedules designed to record information about both the personal data and the habits of the volunteers monitored were also collected.

Ora	TIPO DI ATTIVITA'									
	IN MOVIMENTO	NON IN MOVIMENTO	IN MOVIMENTO	NON IN MOVIMENTO	IN MOVIMENTO	NON IN MOVIMENTO	IN MOVIMENTO	NON IN MOVIMENTO	IN MOVIMENTO	NON IN MOVIMENTO
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07:00-08:00										

All volunteers live inside the ring, in areas with medium to high vehicular traffic. Their movements can be mainly recognized next to their residential area; the schools are also included in that area. Figure 2 shows a map of volunteers' residential location.



Figure 2. Residential location of the volunteers monitored

Eight high-molecular-weight (molecular weight  $\geq 228$ ) carcinogenic and mutagenic PAHs were analysed: benzo(a)anthracene (BaA), benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene (BbjkF), benzo(a)pyrene (BaP), indeno(1,2,3-cd)pyrene (IP), dibenzo(a,h)anthracene (DBaH) and benzo(g,h,i)perylene (BPE). The target compounds were extracted from the PTFE membrane using sonication with dichloromethane/acetone sequence, purified by means of neutral alumina elution, concentrated to low volume and finally analyzed by GC-MS.

## RESULTS

The personal exposure to benzo[a]pyrene resulted well below the reference value of 1 ng/m<sup>3</sup> (EU Air Quality)[4], ranging from 0.06 ng/m<sup>3</sup> to 0.16 ng/m<sup>3</sup>. The average ΣPAHs ranged between 0.45 ng/m<sup>3</sup> and 1.08 ng/m<sup>3</sup>. The ratios benzo[g,h,i]perylene/benzo[a]pyrene and indeno[1,2,3-cd]pyrene/(indeno[1,2,3-cd]pyrene+benzo[g,h,i]perylene) suggest that exposure to PAHs in indoor environments in spring and summer is primarily addressed to vehicular traffic emissions, particularly diesel engines[5].

From the analysis of the daily diaries is also possible to draw a profile of the daily activities of the volunteers who participated to the study (see Fig. 3).

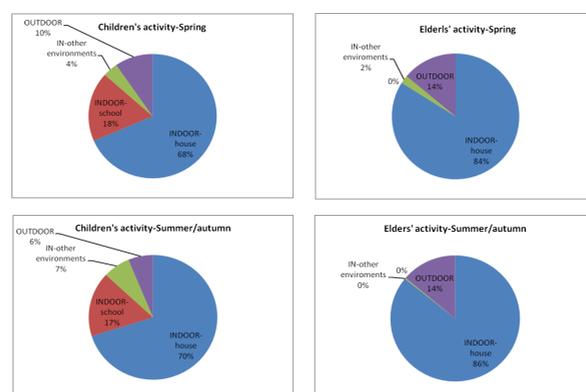


Figure 3. Volunteers time percentage from time activity diaries

These results are consistent with several studies which show that most people in Europe spend 80–90% of their time indoors, where exposure to major air pollutants is quite different from that outdoors

All personal measurements resulted in the same qualitative distribution of PAHs, which reflects the indoor mean distribution, as far as schools and homes are concerned.

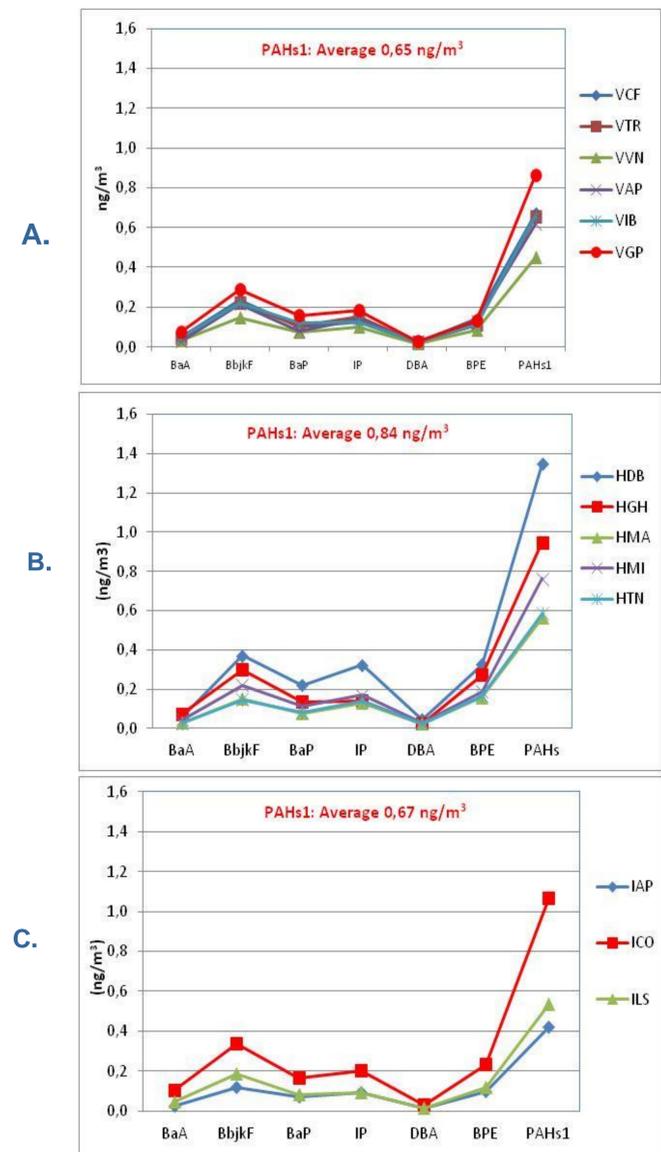


Figure 3. Mean concentration for single congeners monitored in spring. A. volunteers; B. homes indoor; C. schools indoor (Pahs 1 refers to ΣPAHs; red lines refer to volunteer VGP and his home and school, HGH and ICO respectively).

## CONCLUSIONS

Personal exposure levels of eight particle-bound PAHs have been measured for children and elderly people in the city of Rome, Italy, during spring and summer/autumn in-field campaigns. Mean levels were similar among the two groups; benzo[a]pyrene resulted well below the reference value of 1 ng/m<sup>3</sup>. Traffic emissions, especially from diesel vehicles, have a significant impact on exposures in Rome during non-heating seasons.

## REFERENCES

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