LIFE INDEX AIR

NEWSLETTER 04

THIS PROJECT IS FUNDED BY THE LIFE PROGRAMME FROM THE EUROPEAN UNION

TÉCNICO LISBOA · universidade de aveiro · Technical University of crete · DEMOKRITOS NATIONAL CENTRE FOR SCIENTIFIC RESEARCH · NATIONAL INSTITUTE FOR HEALTH AND WELFARE

LIFE INDEX-AIR – REACHING OUR GOALS

Welcome to the fourth newsletter of our project – LIFE Index-Air!

LIFE Index-Air team continues to work to achieve all the goals established for our project!

In this new newsletter, we will bring you news about what we have achieved meanwhile!

Some highligths are regarding the recent studies developed within the framework of our project, RICTA2019, recently published papers and the profiles of more team members!

Always remember... **The air belongs to everyone!**

TO KNOW MORE ABOUT OUR PROJECT

We invite you to follow us through our website and facebook!

www.lifeindexair.net
www.facebook.com/LIFEIndexAir

If you have any questions or comments about our work or our future plans, don't hesitate to get in touch.

HOW IS THE CHILDREN'S EXPOSURE AND DOSE TO PARTICULATE MATTER IN LISBON?

Exposure to Particulate Matter (PM) has been associated with adverse health effects. Within LIFE Index-Air project, the quantification of children's exposure to PM and the respective inhaled dose in Lisbon was assessed.

PM was sampled inside 5 schools, 40 homes and 4 transport modes and in the outdoor environments. Time-activity pattern records showed that children spent 86% of their time indoors, especially at home and in the classroom.

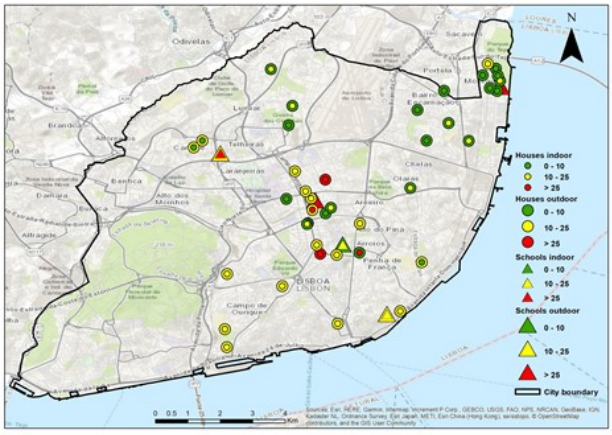
The PM2.5 and PM10 concentrations in classrooms (35.3 µg/m^3 and 65.4 µg/m^3, respectively) were more than double than in homes (14.5 µg/m^3 and 18.2 µg/m^3, respectively) and highly exceeded the limit values established by the Portuguese legislation.

PM daily patterns for classrooms showed the importance of occupancy, resuspension of dust and cleaning activities for the elevated levels of particles. The spatial distribution of the PM concentrations measured inside and outside the studied homes indicated that traffic is one of the major sources affecting the indoor air quality in this microenvironment. Other sources were also identified for homes such as smoking, cooking and cleaning activities.

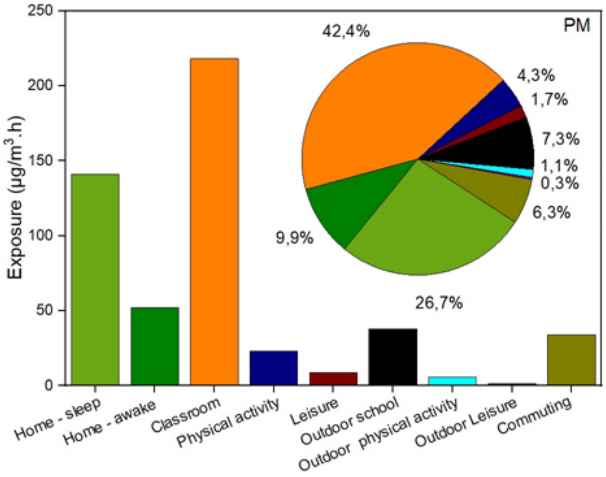
The average daily children exposure was 20.6 µg/m^3 for PM2.5 and 31.5 µg/m^3 for PM10. During weekdays, the classrooms contributed with 42% and 50% to the PM2.5 and PM10 daily exposure, respectively.

The microenvironment that more contributed to the daily PM2.5 and PM10 inhaled dose was also the classroom, with 36% and 41%, respectively.

Microenvironment concentrations



Exposure to PM2.5



For more information: Faria T., Martins V., Correia C., Canha N., Diapouli E., Manousakas M., Eleftheriadis K., Almeida S.M. (2020) Children's exposure and dose assessment to particulate matter in Lisbon. Building and Environment 171, 106666. DOI: 10.1016/j.buildenv.2020.106666

Particle exposure and inhaled dose while commuting in Lisbon

While commuting the citizens are usually exposed to high concentrations of urban air pollutants, namely particulate matter.
Commuters exposure to PM2.5, PM10, PN0.01-1 and black carbon (BC) was assessed in a selected route (total distance of 6.7 km) that was representative of the daily commutes of the Lisbon citizens. The field measurements were conducted in the four modes of transport most frequently used in the city, namely, car, bicycle, metro and bus.

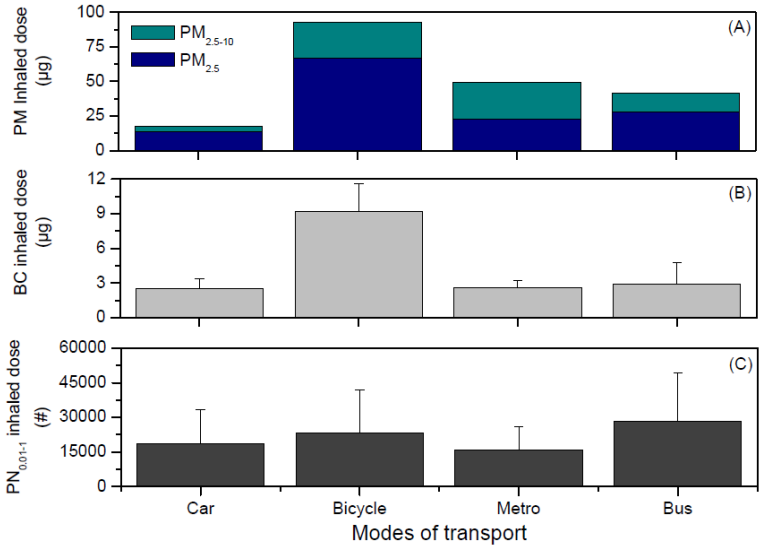
Results showed that exposure while commuting depends on the mode of transport used.

PM2.5 and PM10 concentrations were significantly higher while commuting in the metro than in the other modes of transport, which is attributed to the main sources of PM in this environment (abrasion of rails, wheels and brakes and also the resuspension of particles due to turbulence).
On the other hand, BC concentrations where the highest inside cars and the lowest inside the bus. In fact, buses run on dedicated lines being less impacted by traffic. BC concentrations were smaller when travelling by bicycle than by car which can be explained by the fact that, in parts of the route, the bicycle paths are separated from the roadway and thus, from the main source of BC in this microenvironment (traffic).

Inside cars, the type of ventilation used influenced concentrations.
Common air filters are efficient in the removal of bigger particles (PM2.5 and PM10) but usually fail to remove the smaller particles to each BC is associated. On the contrary, high efficient activated carbon filters, installed in some cars, are also efficient in the removal of the smaller PM from the outside air, resulting in a smaller exposure of the passengers.

The average inhaled doses are influenced, more than by the concentrations, by the time spent and the physical effort associated.

In this way, the inhaled doses were usually higher when travelling by bicycle.



Inhaled doses of PM2.5 and PM2.5-10 (A), BC (B), PN0.01-1 (C)

For more information: Correia C., Martins V., Cunha-Lopes I., Faria T., Diapouli E., Eleftheriadis K., Almeida S.M. (2020) Particle exposure and inhaled dose while commuting in Lisbon. Environmental Pollution 257, 113547. DOI: 10.1016/j.envpol.2019.113547

MEET THE TEAM

Each newsletter features profiles of collaborators from our five partner organizations.

HELI LEHTOMÄKI

Researcher at the Finnish Institute for Health and Welfare and PhD student in Health Sciences at University of Eastern Finland
Kuopio, Finland

Lehtomäki is a researcher working on public health impacts of environmental risks. In her work she applies burden of disease methods to quantify health risks and to provide necessary information for prioritization and comparative risk analyses. Lehtomäki is doing a PhD related to use of burden of disease methods in estimating the health impacts of air pollution. She has worked as a Temporary Advisor for WHO related to development of AirQ+ software tool for health risk assessment of air pollution. She is a Management Committee member of the European Burden of Disease Network. She is also actively involved in other international collaborations including Nordforsk – funded NordicWelfAir, and The Arctic Monitoring and Assessment Programme (AMAP).

'Improving public health is what motivates me in my work. Air pollution is the biggest environmental factor threatening the health of people. Children are especially vulnerable in regards to exposure to air pollution and in LIFE Index-Air project the special focus is on the health of children.
I am happy to be part of the research aiming to better evaluate the public health losses caused by air pollution exposure and to communicate the problem for the decision makers as well as to the public. When people are aware of the problem it is possible to look for solutions and get decision makers motivated to further improve the air quality."

TIAGO FARIA

PhD student in Environmental Engineering at Instituto Superior Técnico, University of Lisbon,
Lisbon, Portugal

Tiago Faria is a PhD student in Environmental Engineering at C2TN, Instituto Superior Técnico of University of Lisbon. His PhD work is part of the LIFE Index-Air project with the PhD thesis entitled "Children exposure to inorganic and organic chemical compounds in particulate matter: characterization and source identification".

"Air quality field has always been my interest and motivation for my professional journey. Air pollution is a current concern due to the adverse effects it causes on human health. To develop my PhD thesis within LIFE Index-Air project was a great opportunity to continue my research career in this field. This project also gave me the chance to be involved actively with awareness campaigns for children from the participant schools.
Moreover, people spend more than 85% of their time indoors, so an integrated personal exposure is essential, as it takes into account the several environments in which people spend their daily time.
To determine the particulate matter concentrations and to identify its chemical compounds to which people are exposure will allow the identification of sources and, consequently, of measures to reduce the human exposure to air pollution.

A more informed population about air pollution and a user-friendly tool for police makers and stakeholders are essential, since the air quality depend on us."

7TH IBERIAN MEETING ON AEROSOL SCIENCE AND TECHNOLOGY

Three days of latest findings and discussion about aerosol science and technology happen last July 2019 at RICTA, held at Lisbon (Portugal) and co-organized by LIFE Index-Air.

A total of 86 researchers from 8 different countries (Brazil, China, Finland, Greece, Poland, Portugal, Spain and The Netherlands) participated in RICTA2019, with 4 plenary talks, 41 oral and 62 posters presentations.

More informations at the conference website: **www.lifeindexair.net/ricta19/**

NEW SCIENTIFIC ARTICLES WITHIN THE FRAMEWORK OF LIFE INDEX-AIR

Characterization of Human Health Risks from Particulate Air Pollution in Selected European Cities

Authors: E. Chalvatzaki, S.E. Chatoutsidou, H. Lehtomäki, S.M. Almeida, K. Eleftheriadis, O. Hänninen, M. Lazaridis

Abstract: The objective of the current study was to estimate health risk indexes caused by the inhalation of particulate matter (PM) by adult males and children using data sampled in three European cities (Athens, Kuopio, Lisbon).
Accordingly, the cancer risk (CR) and the hazard quotient (HQ) were estimated from particle-bound metal concentrations whilst the epidemiology-based excess risk (ER), the attributable fraction (AF), and the mortality cases were obtained due to exposure to PM_{10} and $PM_{2.5}$. CR and HQ were estimated using two methodologies: the first methodology incorporated the particle-bound metal concentrations (As, Cd, Co, Cr, Mn, Ni, Pb) whereas the second methodology used the deposited dose rate of particle-bound metals in the respiratory tract.
The indoor concentration accounts for 70% infiltration from outdoor air for the time activity periods allocated to indoor environments. HQ was lower than 1 and the cumulative CR was lower than the acceptable level (10^{-4}), although individual CR for some metals exceeded the acceptable limit (10^{-6}).
In a lifetime the estimated number of attributable cancer cases was 74, 0.107, and 217 in Athens, Kuopio, and Lisbon, respectively. Excess risk-based mortality estimates (due to outdoor pollution) for fine particles were 3930, 44.1, and 2820 attributable deaths in Athens, Kuopio, and Lisbon, respectively.

Type of publication: Scientific article published at Atmosphere (Open Acess)

How to cite: E. Chalvatzaki, S.E. Chatoutsidou, H. Lehtomäki, S.M. Almeida, K. Eleftheriadis, O. Hänninen, M. Lazaridis (2019) Characterization of Human Health Risks from Particulate Air Pollution in Selected European Cities. Atmosphere 10(2), 248-256. DOI: 10.3390/atmos10020096

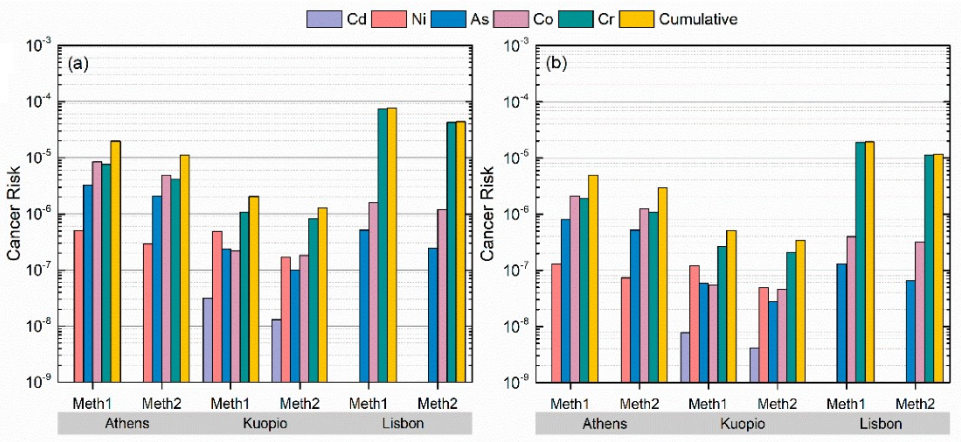


Figure. **Cancer risk for (a) adult males and (b) children estimated from both methodologies for each metal and city.**

Children's exposure to sized-fractioned particulate matter and black carbon in an urban environment

Authors: I. Cunha-Lopes, V. Martins, T. Faria, C. Correia, S.M. Almeida

Abstract: Fine air particulate matter (PM2.5) is currently one of the major environmental issues influencing people's health. The first step for assessing the health effects of inhaled PM2.5 is based on the evaluation of the human exposure levels. The main objective of this study is to quantify children's daily exposure to sized-fractioned PM2.5 and Black Carbon (BC) in an urban environment.

Children from Lisbon metropolitan area carried portable monitoring equipment during three days and recorded the time spent in their activities and respective microenvironments (MEs). The average exposure to PM2.5 (19 μg/m^3) was higher than that registered by the nearest fixed urban background station (11 μg/m^3), evidencing the importance of assessing the personal daily exposure. The average exposure to PM1, PM0.5 and PM0.25 was 14 μg/m^3, 11 μg/m^3, and 7.7 μg/m^3, respectively. Time-activity pattern records showed that children spent more than 80% of their time indoors, especially at home (55%) and in the classroom (22%), where they received 44% of the daily BC dose.

Although commuting only accounted for 5.0% of the daily time, children inhaled 23% of their daily BC dose when travelling in rush hours to school. Time_series analysis of the BC concentrations showed an average of 1.3 μg/m^3, with high peak levels in underground parking lots (63 μg/m^3), during charcoal grills (53 μg/m^3), and when candles were burning (6.6 μg/m^3). This work highlights the importance of urban planning to reduce children's exposure to traffic emissions, combined with awareness-raising actions for citizens concerning the impact of indoor sources.

Type of publication: Scientific article published at Building and Environment

How to cite: I. Cunha-Lopes, V. Martins, T. Faria, C. Correia, S.M. Almeida (2019) Children's exposure to sized-fractioned particulate matter and black carbon in an urban environment. Building and Environment 155, 187-194. DOI: 10.1016/j.buildenv.2019.03.045

Figure. Trolley with the three portable monitoring devices.

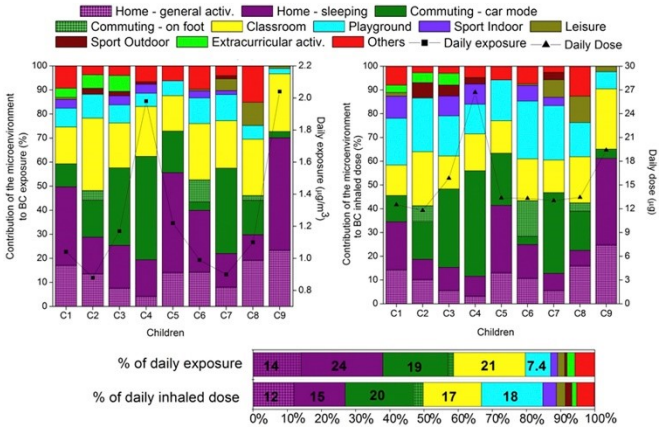


Figure. Contribution of the MEs to the BC exposure and dose and respective total daily exposure and dose of each child.

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KEEP IN TOUCH

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