ON THE INFLUENCE OF DIFFERENT METHODOLOGIES IN THE ESTIMATE OF ULTRAFINE PARTICLE DOSE RECEIVED BY POPULATION IN ALL-DAY ACTIVITIES

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Background: In everyday life, people are exposed to different levels of airborne particle concentration depending on the microenvironment where they perform the different activities [1]. A measure of the exposure level can be evaluated by calculating the received particle surface area dose, which depends on the particle number concentration (PNC), time activity pattern (TAP) and inhalation rate (IR), as well as on the subject itself. While it is relatively easy to have a measure of the PNC which people are exposed to, it is not common to calculate the received dose referring to actual time activity patterns and, more important, to actual inhalation rates. In this paper, a full-direct method is proposed and evaluated for the calculation of the received ultrafine particle (UFP) dose, in which all the parameters are measured in real life conditions (PNC, TAP and IR).

Methods: 34 volunteers were continuously monitored for seven days and the data of particle number concentration, physical activity performed and heart rate (which was used for the evaluation of the inhalation rate [2]) were recorded for each of them. The received dose for the population sample was calculated with the proposed full-direct method and compared with those obtained from different combination of measured and statistical data of TAP and IR obtained from literature, as reported in Table 1.

Table 1. Combination of PNC, IR and TAP for different methodologies of UFP dose calculation (M): data obtained through experimental campaign measurements (Measured); data obtained through literature survey (Standard).

	M1	M2	M3	M4	M5
PNC	Measured	Measured	Measured	Measured	Standard
IR	Measured	Measured	Standard	Standard	Standard
TAP	Measured	Standard	Measured	Standard	Standard

Results: Figure 1 shows the distribution of the total daily doses received by the population sample. The numbers inside the box represent the median value of the total daily dose as calculated with the corresponding methodology.

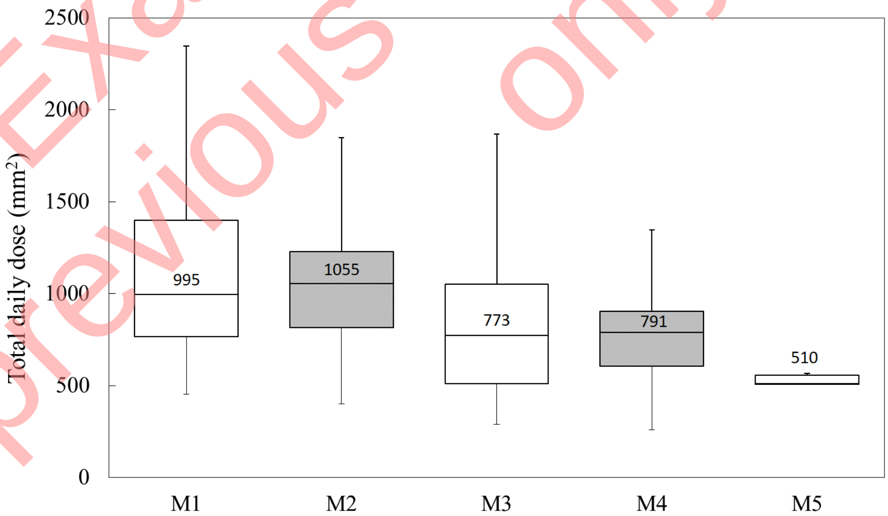

Figure 1: Total daily dose received by the population sample as calculated with the methodologies reported in Table 1

The results demonstrate that depending on the methodology used, the differences in the received total daily dose can be of the order of 49%, while looking at the single microenvironment/activity, these differences can be much higher, with a general underestimation of the standard methods with respect to a full-direct method.

References

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[2] Schuda, L., et al. (2009). "Metabolically derived human ventilation rates: a revised approach based upon oxygen consumption rates." EPA.