"Metal levels in urine samples and in air particulate matter in Turin metropolitan area (Italy): a comparison study "

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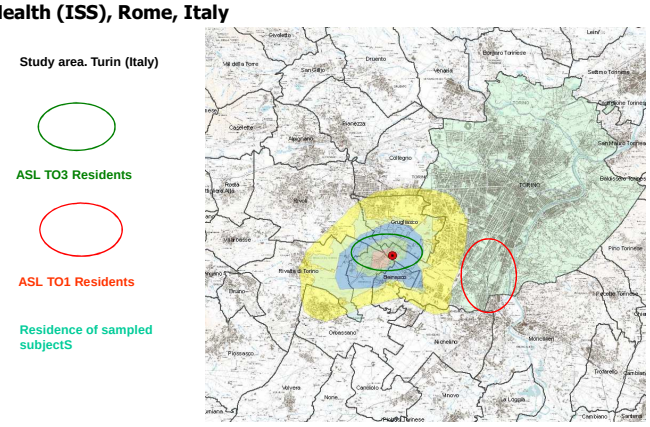


Figure I. Fall-out maps. Red dot is the location of the WTE plant, green area is the municipality of Turin. Blue and yellow areas correspond to two different levels of fall-out maps

Background and Aims

Current scientific knowledge gives high relevance to oral assumption through diet in determining metal levels in human body while other pathways, like inhalation, seem to be less important.

Objective of this study, performed within the SPoTT health surveillance program, was to evaluate the correlation between metal concentration present in particular matter and metals content in urines of a sample of population of the Turin metropolitan area resident around the new Turin's waste incinerator (WTE).

Methods

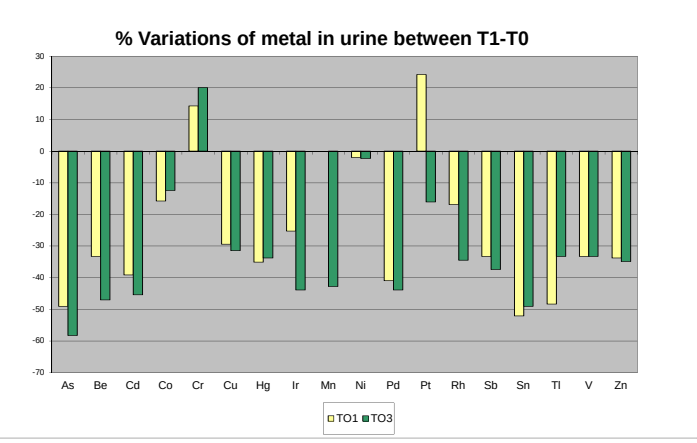
394 subjects (35-69 years) were randomly selected from the municipal registers, equally distributed by gender, age group, and residential area, whose urine samples were collected in two periods, T_0, (June-July 2013), and after one year T_1 (July 2014). In the same period monthly concentrations of selected metals were computed on particulate matter (PM) sampled from 2 monitoring stations near resident addresses, each representative of the two areas considered.

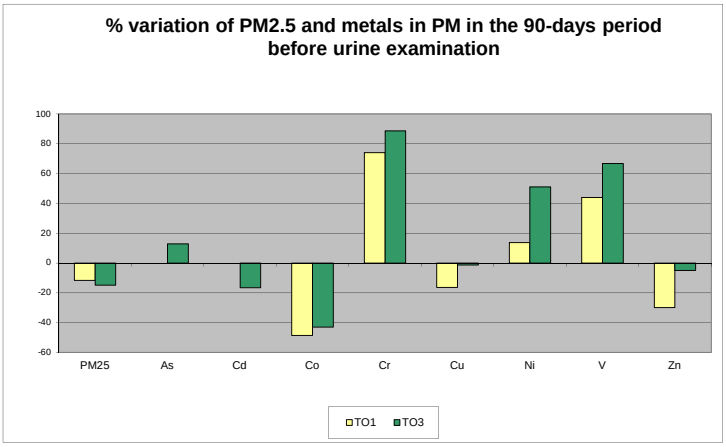
Mean and median levels of urine metals were computed at T0 and T1; a 90-days moving average of metal levels in PM was also computed for each subject, considering the date of examination of each of them. The metals analysed both in urine and in samples of Particulate Matter were: As, Cd, Co, Cr, Cu, Ni, V, and Zn.

Results

96% of the original sample at T0 completed the examination also at T1 phase. **On average, a decrease of ca. -30% (ranging from -2% for Ni to -57% of As) of metals content in urine (except Cr, that showed an increase of about +18%) was found.**

Apart for Arsenic, whose reduction was due to a dietary advice, the only explanation found was an analogous overall PM2.5 percentage reduction (-25% as annual mean and -14% in the previous 90 days) registered in the same period. The levels of metals among PM samples in the same period (2013 vs 2014) showed a good correlation with urine levels (R2=.77), in particular showing a similar rise in Cr increase. A detailed analysis considering the 90 days average of metal concentrations in PM inhaled by each subject confirmed the association between metals in urine and metals in PM.





Conclusions

The current knowledge about concentration of metals in human body reports that it is mainly due to oral assumption through diet. Other exposure routes are considered less important. Our data show that inhalation of PM could be a non negligible pathway of assumption for some metals, responsible for significant differences of concentration over time in human bodies, of course only if the metallic dietary composition and its oral assumption does not vary along time.