

Sources of cadmium exposure in an Italian population: A cross-sectional study

Filippini Tommaso¹, Cherubini Andrea², Greco Salvatore², Maffei Giuseppe², Malagoli Carlotta¹, Bottecchi Ilaria¹, Malavolti Marcella¹, Sieri Sabina³, Krogh Vittorio³, Vescovi Luciano⁴, Modenesi Marina⁴, Castiglia Paolo⁵, Michalke Bernard⁶, Vinceti Marco¹

¹Environmental, Genetic and Nutritional Epidemiology Research Center (CREAGEN), Department of Diagnostic, Clinical and Public Health Medicine, University of Modena and Reggio Emilia, Reggio Emilia, Italy;

²Italy Terra srl, Milan, Italy;

³Epidemiology and Prevention Unit, Fondazione IRCCS Istituto Nazionale dei Tumori Milan, Italy;

⁴IREN, Reggio Emilia and Piacenza, Italy;

⁵Department of Biomedical Sciences, Hygiene and Preventive Medicine Unit, University of Sassari – AOU Sassari, Sassari, Italy;

⁶Research Unit Analytical BioGeoChemistry, Helmholtz Zentrum München – German Research Center for Environmental Health GmbH, Munich, Germany.

Background and Aims

Main sources of Cadmium (Cd) exposure in the human are food and cigarette smoking as, but also outdoor and indoor air pollution can be important, mainly from industrial emissions, fossil fuel combustion and solid waste incineration.

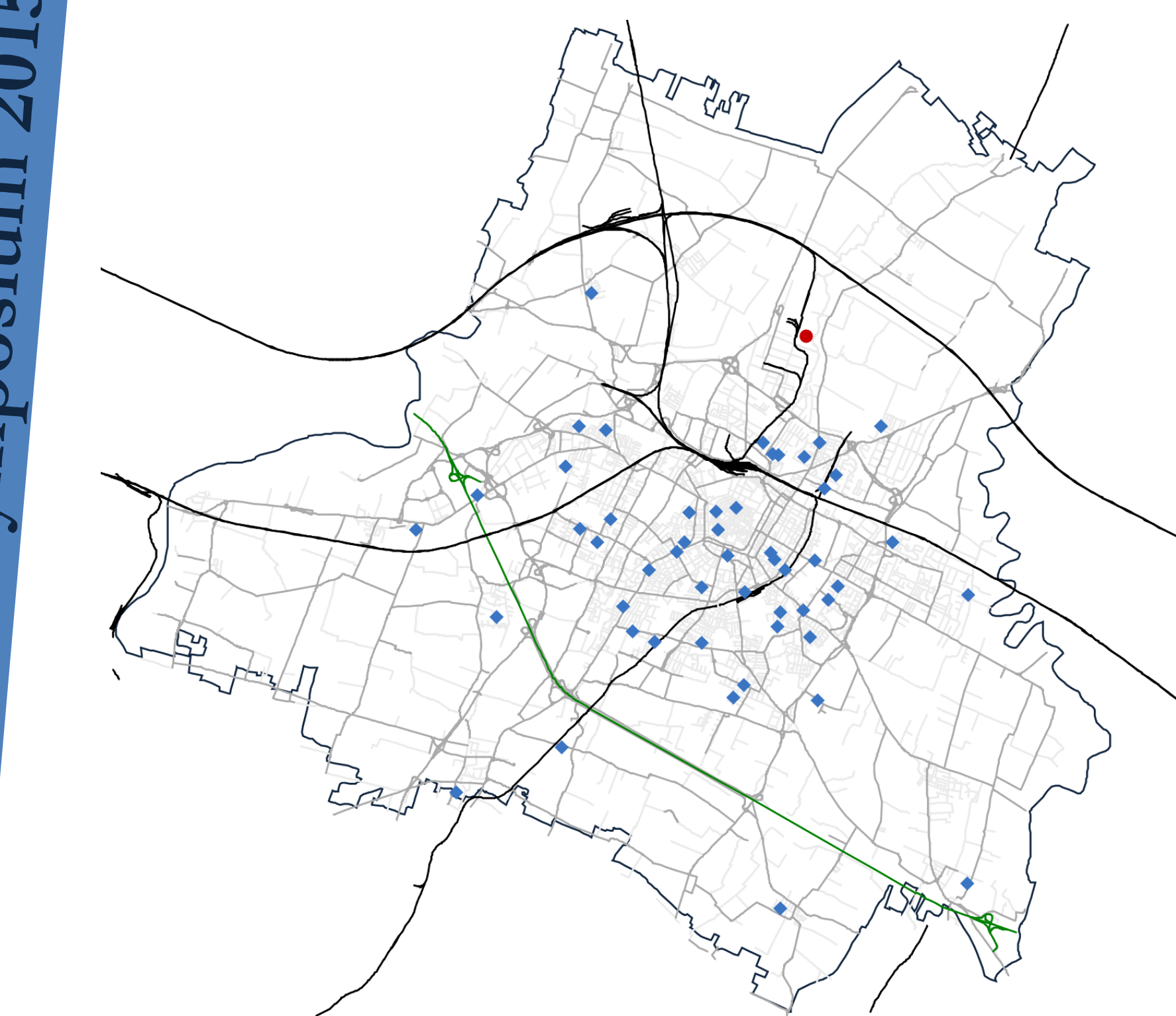
The aim of this study was to assess the influence of outdoor air pollution on serum Cd levels in fifty residents randomly selected from the municipal population of Modena, Northern Italy.

Methods

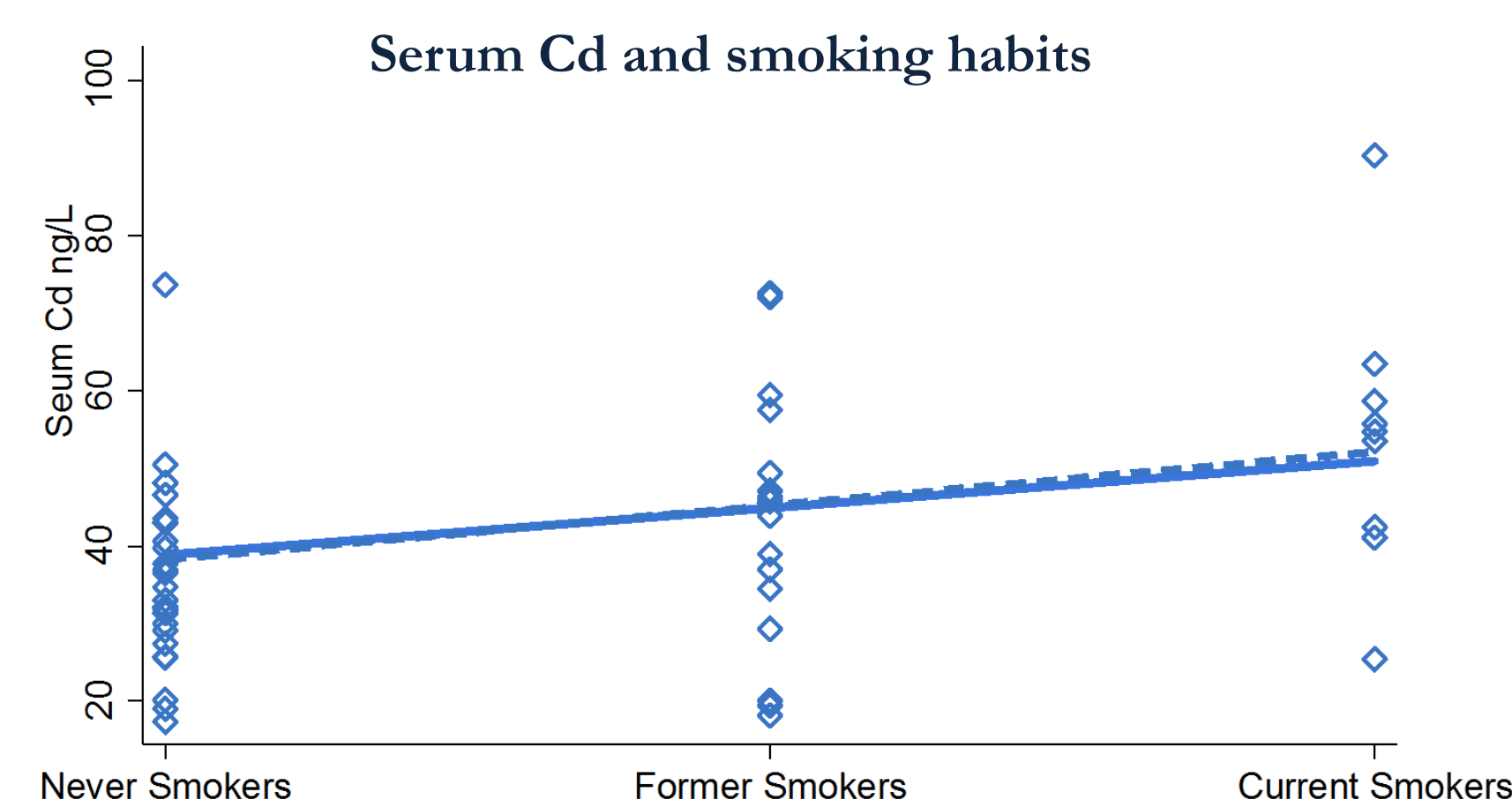
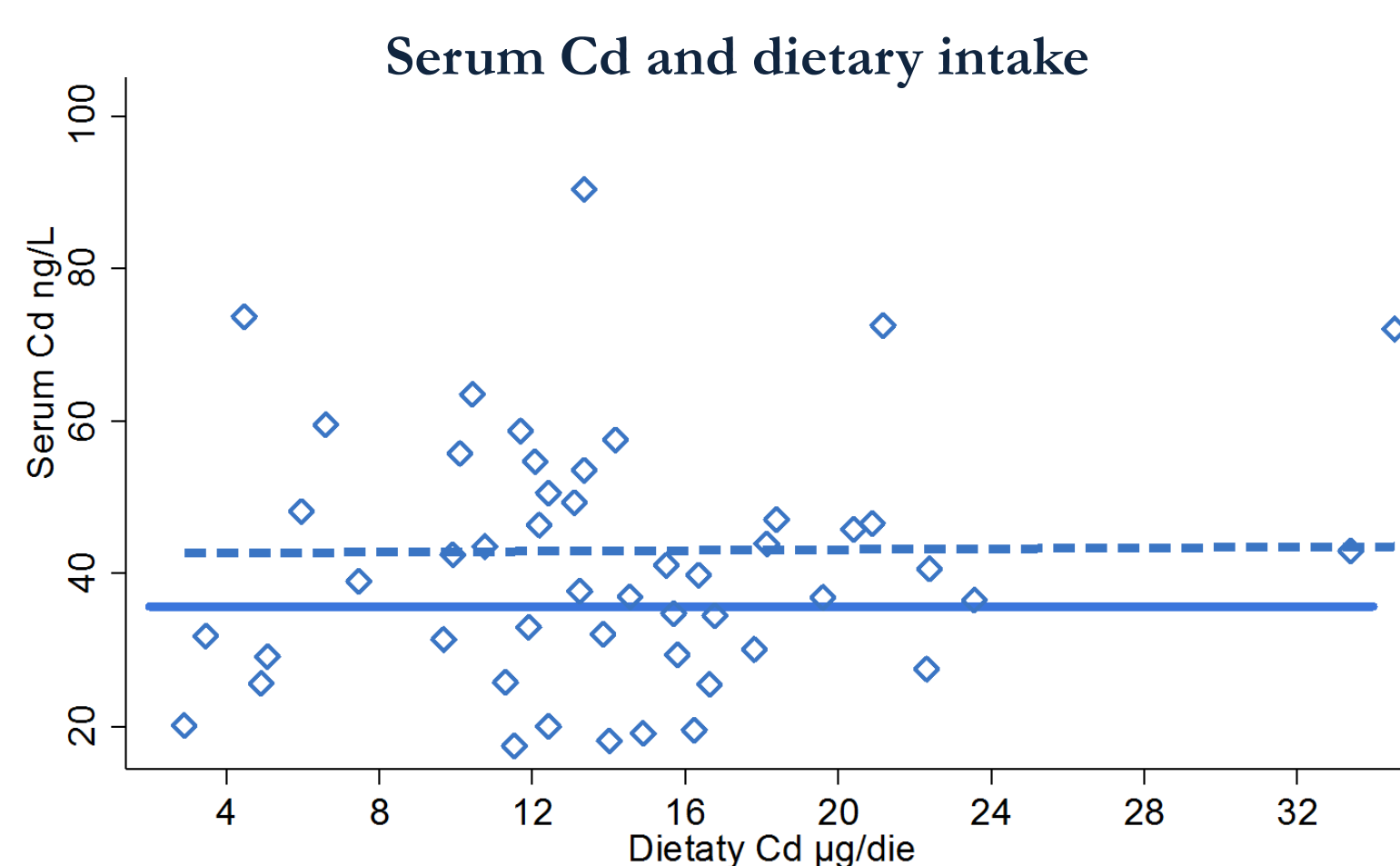
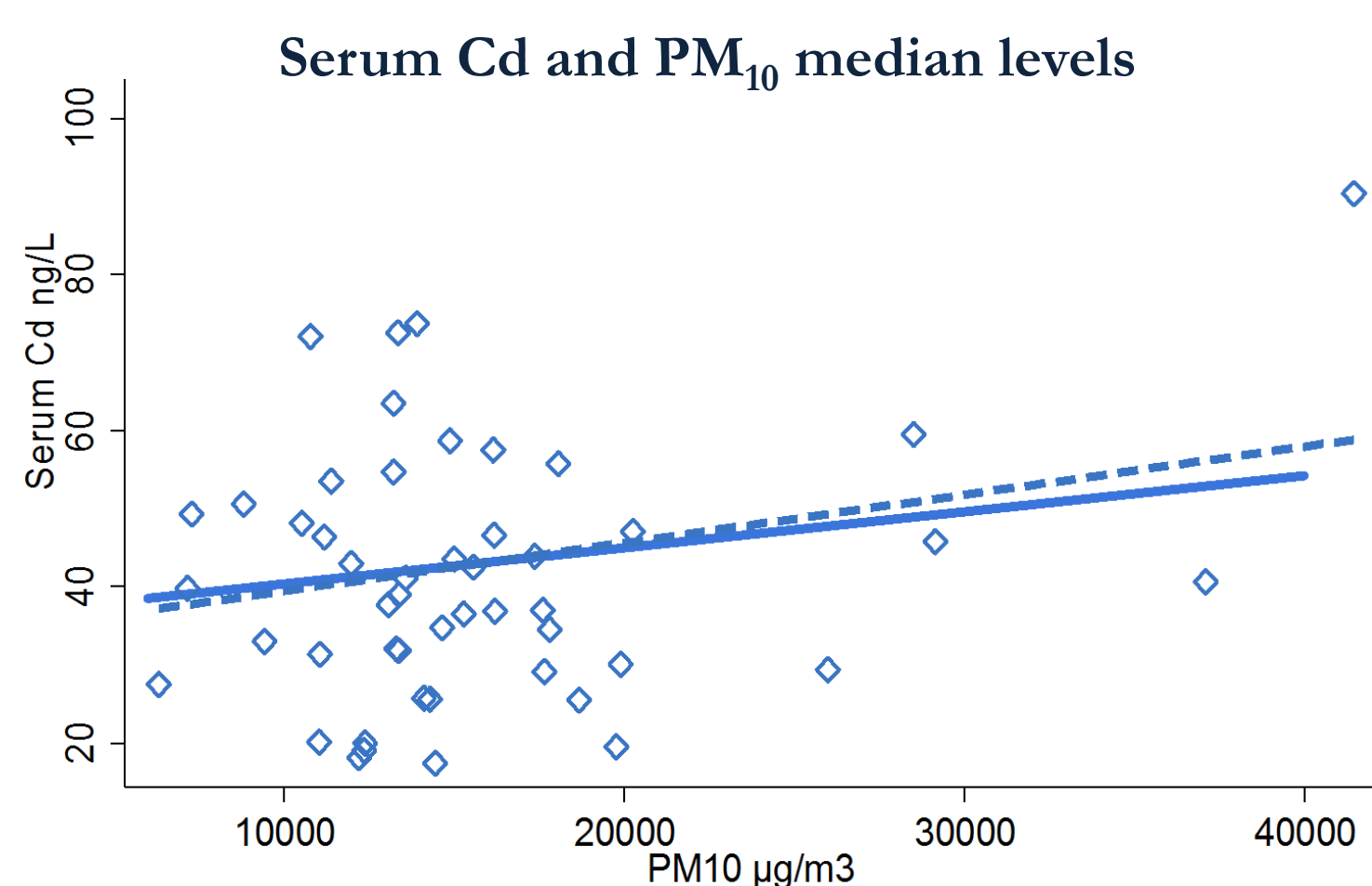
We geocoded the current residence of these subjects and modeled their outdoor ambient air concentration of particulate matter $\leq 10\mu\text{m}$ (PM_{10}), with the California LINE Source Dispersion Model version 4 (CALINE-4), as a proxy of environmental air Cd. Information on smoking habits and Cd dietary intake were also collected, to assess these two additional sources of exposure. We used both crude and multivariate linear regression models to determine the influence of outdoor PM_{10} levels, smoking and dietary Cd intake on serum Cd.

Results

Median values (25th–75th) for serum and dietary Cd were 40.85 ng/l (30.05 – 53.50) and 13.36 $\mu\text{g}/\text{die}$ (10.45 – 16.63). Crude β -coefficients were 0.617 (95% CI -0.194 – 1.428, $P=0.133$), 0.026 (-0.827 – 0.829, $P=0.952$) and 6.962 (-0.022 – 13.945, $P=0.051$) for PM_{10} , diet and smoking, respectively. Corresponding adjusted values were 0.463 (-0.365 – 1.292, $P=0.266$), -0.036 (-0.866 – 0.793, $P=0.930$) and 6.057 (-1.175 – 13.289, $P=0.099$), respectively.



Modena Municipality Map with layers of interest for outdoor PM_{10} exposure assessment: railway lines (black), highway (green), highroads (dark gray), urban roads (light gray), waste incinerator (red point) and study subjects (blue diamonds).



Figures and Table: linear regression analysis between serum cadmium (ng/L) and PM_{10} ($\mu\text{g}/\text{m}^3$), dietary intake ($\mu\text{g}/\text{die}$) and smoking habits (smoking categorized as 0=never smokers, 1=former smokers, 2=current smokers). Multivariate model included as adjusting variable each factor alternatively.

Sources of Cd	Crude			Adjusted		
	β	95% CI	P	β	95% CI	P
Outdoor PM_{10} levels	0.632	(-0.275 – 1.539)	0.168	0.473	(-0.451 – 1.399)	0.308
Dietary intake	0.026	(-0.827 – 0.879)	0.952	-0.050	(-0.884 – 0.785)	0.905
Smoking habits	6.962	(-0.022 – 13.945)	0.051	6.199	(-1.020 – 13.419)	0.091

Conclusions

In our population, the most important factor influencing Cd serum content thus appears to be cigarette smoking, followed by outdoor air pollution and lastly by diet.



UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

Bibliography

- Vahter M, Berglund M, Nermell B, Akesson A. Bioavailability of cadmium from shellfish and mixed diet in women. *Toxicol Appl Pharmacol*. 1996;136:332-341.
- Nordberg M. Environmental exposure and preventive measures in Sweden and EU. *Biomaterials*. 2004;17:589-592.
- Drufuca A, Battaio S, Bengo I, Rossi D, Torriani L. Variante Generale al Piano Territoriale di Coordinamento Provinciale. Procedura di simulazione della mobilità delle persone. Milano: Provincia di Modena-Polinomia; 2007.
- Jarup L, Akesson A. Current status of cadmium as an environmental health problem. *Toxicol Appl Pharmacol*. 2009;238:201-208.

Mail to Prof. Marco Vinceti
at CREAGEN – Environmental, Genetic
and Nutritional Epidemiology Research
Center, University of Modena and Reggio
Emilia, Via Campi 287 – 41125 Modena.
marco.vinceti@unimore.it

Creagen
Environmental, Genetic and Nutritional
Epidemiology Research Center