PASSIVE EXPOSURE TO AGRICULTURAL PESTICIDES AND RISK OF CHILDHOOD LEUKEMIA IN AN ITALIAN COMMUNITY

[1]Carlotta Malagoli, [1]Marcella Malavolti, [2]Sofia Costanzini, [2]Sergio Teggi, [3]Giovanni Palazzi, [1]Marco Vinceti

[1]CREAGEN – Environmental, Genetic and Nutritional Epidemiology Research Center, University of Modena and Reggio Emilia; [2]Department of Engineering 'Enzo Ferrari', University of Modena and Reggio Emilia; [3]Division of Pediatric Oncology-Hematology, Policlinico Hospital, Modena

Background

Exposure to pesticides used in agriculture has been suggested to be a risk factor of childhood leukemia, though definitive evidence on this relation and the exact identification of the specific pesticides involved are still lacking.

Methods

We carried out a population-based case-control study in the Modena and Reggio Emilia provinces of Emilia-Romagna region, Northern Italy. We included the 111 childhood leukemia cases newly-diagnosed from 1998 to 2011, and 444 controls matched by age and sex to the cases. Each children's house was georeferred and positioned on the provincial territorial cartography.

Study population

Cases: 111
All cases of leukemia (0-14 years) diagnosed in period 1998-2011 in Modena and Reggio Emilia provinces.

Associazione Italiana Ematologia ed Oncologia pediatrica (AIEOP)

Controls: 444
4 children for each case randomly extracted from the general population and matched for:
- Province of residence
- Year of birth
- Gender

Table 1. Main classes of pesticides frequently used in different crops in Modena and Reggio Emilia farms.

Crops	Classes of pesticides
Vineyards	Phosphorganics, Triazoles, Phenylalanines
Orchards	Phosphorganics, Triazoles, Phenylalanines, Neonicotinoids
Arable	2,4D, MCPA, Dicamba, Azatrine, Pyrethroids
Vegetable	Neonicotinoids, Pyrethroids, Phenylalanines

Exposure assessment

Through remote sensing mapping and Geographical Information System analysis, we assessed land use in the 100-meter radius around children's homes. In particular, we examined four types of crops (vineyards, orchards, vegetable and arable) characterized by the use of specific pesticides potentially involved in childhood leukemia etiology. Exposure to air pollutants from motorized traffic (benzene and PM_{10}) was assessed for each subject in study using detailed emission and dispersion modeling.

Figure 1: Geographical Information System: layers overlapping.
Layer C: Geo-positioning of cases and controls
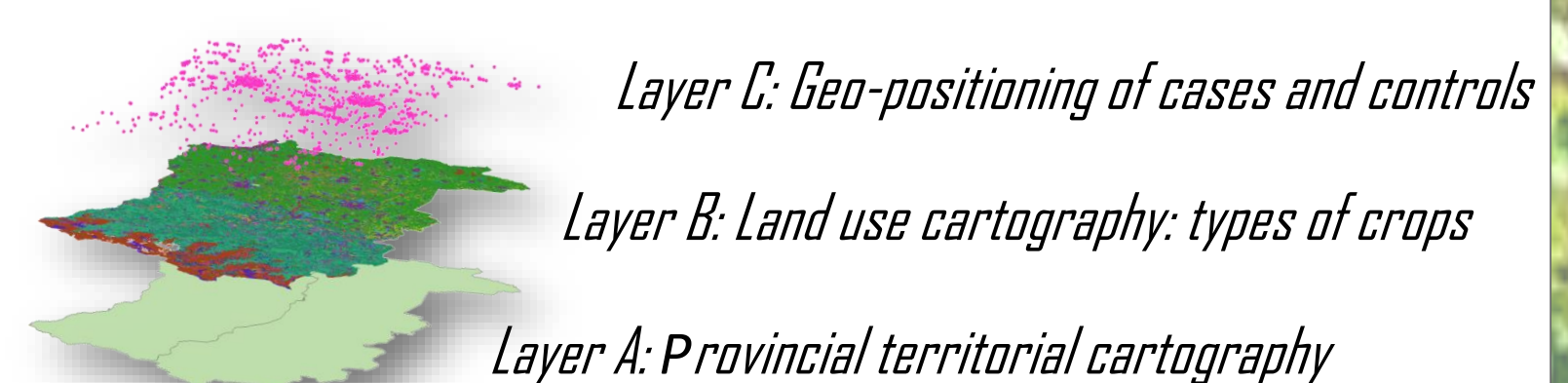*Layer B: Land use cartography: types of crops*
Layer A: Provincial territorial cartography

Figure 2: Geo-positioning on the provincial territorial cartography of children's homes.
REGGIO E.
MODENA

Figure 3: Soil analysis.
Types of crops:
- Arable
- Orchards
- Vineyard
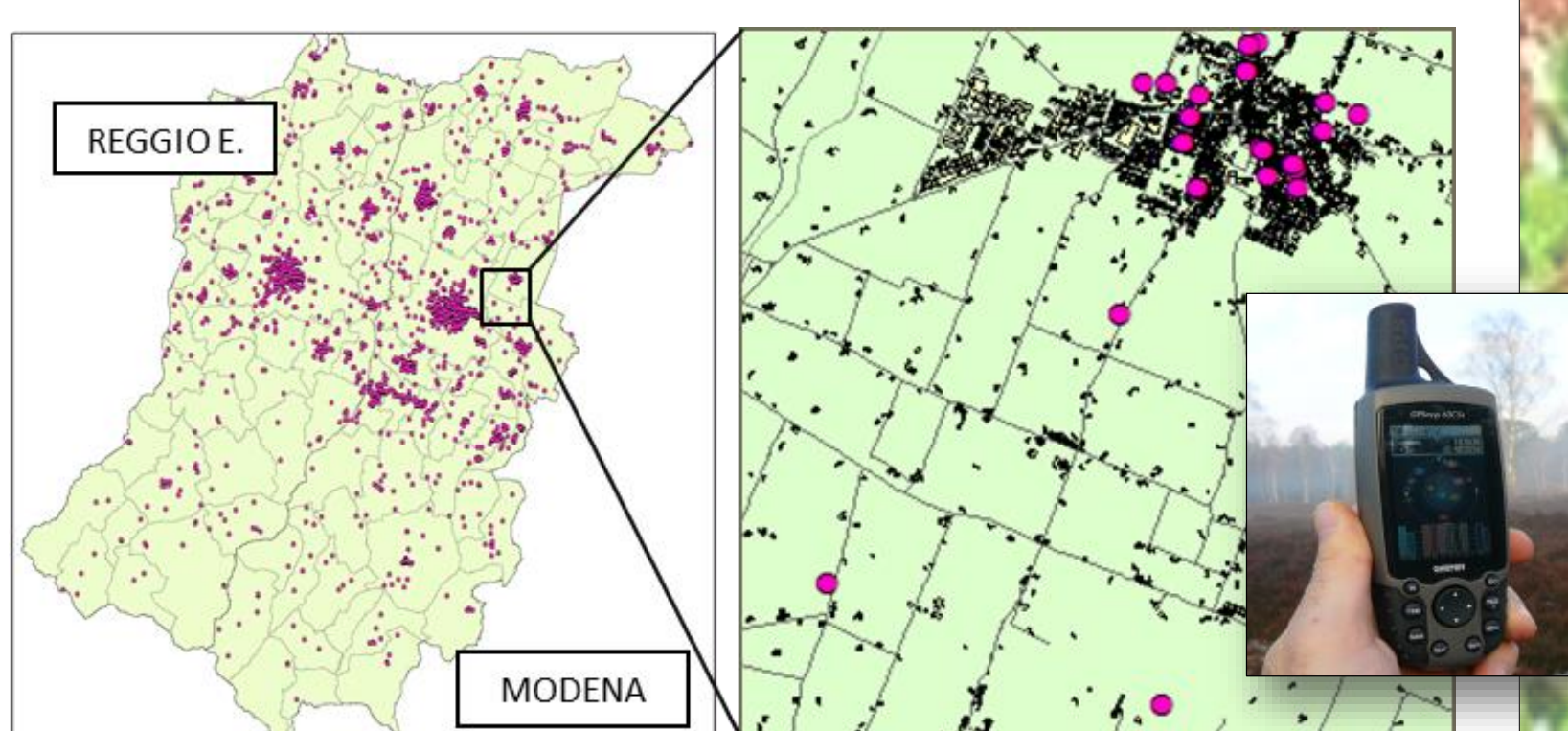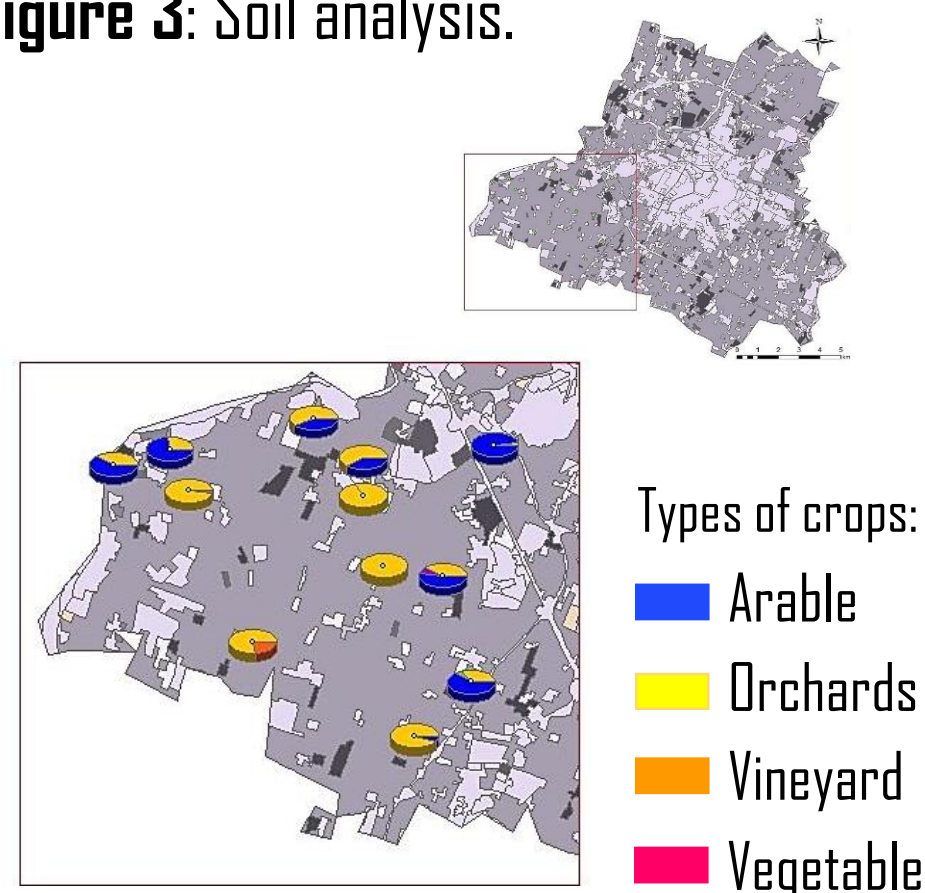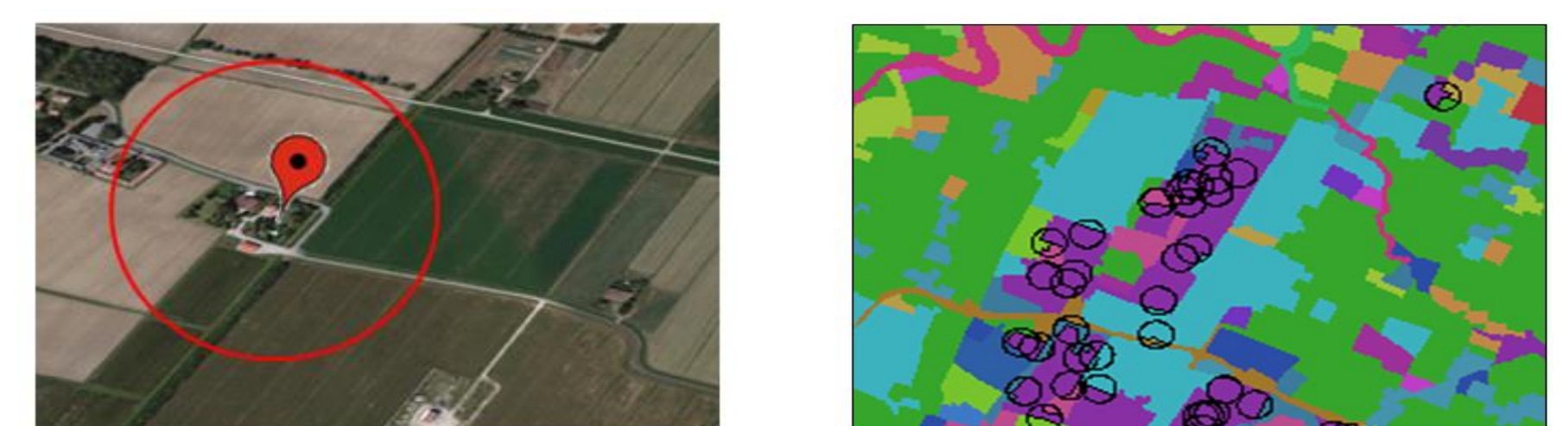- Vegetable

Figure 4: 100-meter radius buffers around children's houses and land use cartography with different types of crops.

Results

We computed the odds ratios (OR) of the disease and their 95% confidence intervals (CI) according to type and percentage of land use around child's home and adjusting for air pollution from vehicular traffic.

Adjusted OR (95%CI) of leukemia for children with >95% of arable soil (crops such as corn, wheat, soya, sugar beet) around their residence, characterized by use of Dicamba, 2.4-D, MCPA, diazines and pyrethroids, was 2.1 (0.5-8.7). Risk further increased among children aged less than 5 years (OR= 5.6 (0.8-41.7).

No other association between specific crops and disease risk emerged.

Table 2. Adjusted[1] odds ratios (95% confidence intervals) of leukemia for children with >95% of arable soil (crops such as corn, wheat, soya, sugar beet) in the 100-meter circular buffer around the child's home building).

	Arable soil				
	<95%[2]		≥95%		
	Cases/controls	OR	Cases/controls	OR (95%CI)	P-trend[3]
All subjects	80/326	1.00	3/6	2.14 (0.53-8.65)	0.285
Age <5 year	36/150	1.00	2/2	5.64 (0.76-41.73)	0.090
Age ≥5 year	44/176	1.00	1/4	0.90 (0.10-8.15)	0.926

[1]Adjusted for annual average atmospheric concentration (μg/m³) of benzene; estimates not possible for subject diagnosed after 2009 or residing in mountain municipalities
[2]Urban and residential use <95% used as reference category
[3]P for linear trend based on continuous values of land use

Conclusions

The excess childhood leukemia risk observed among children residing in rural areas close to arable soils seems to indicate a role of passive pesticide exposure in disease etiology.

- Bailey HD, Infante-Rivard C, et al. Home pesticide exposures and risk of childhood leukemia: Findings from the childhood leukemia international consortium. Int J Cancer. 2015; 137:2644-63.
- Booth BJ, Ward MH et al. Agricultural crop density and risk of childhood cancer in the midwestern United States: an ecologic study. Environ Health. 2015; 14(1):82
- Chen M, Chang CH, Tao L, Lu C. Residential Exposure to Pesticide During Childhood and Childhood Cancers: A Meta-Analysis. Pediatrics. 2015; 136(4):719-29.

Marco Vinceti: Department of Diagnostic, Clinical, and Public Health Medicine, University of Modena and Reggio Emilia. Via Campi 287, 41125 Modena, Italy. E-mail: marco.vinceti@unimore.it

Ramazzini Days 2015
22-25 October 2015 - Carpi, Italy