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Risk of amyotrophic lateral sclerosis and passive residential exposure to pesticides: comparison of questionnaire-based with GIS-based exposure assessment methods

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Background/Aim

Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disease with still unknown etiology. Among environmental factors, pesticides have been investigated due to their potential neurotoxic effects. Within a population-based case-control study conducted in two Italian regions, we aimed to investigate ALS risk due to passive residential exposure to pesticides using two methodologies.

Methods

The exposure assessment was carried with an individual questionnaire, which collected information of the entire residential history of subjects, focusing on rural residence or in the vicinity of agricultural areas. It was compared with assessment based on geographical information system (GIS), avoiding direct contact with study subjects. To do that, we computed the percentage (≥50%) of rural land use within the 100-m round buffer around each subject"s residence, according to cover maps of two periods available from the Department of Agriculture, recent (2003-2009) and historical (1978-1989) ones. Risk for passive residential exposure to pesticides was computed using a sex and age adjusted logistic regression model for both methods, and their agreement was assessed using Cohen"s kappa (k).

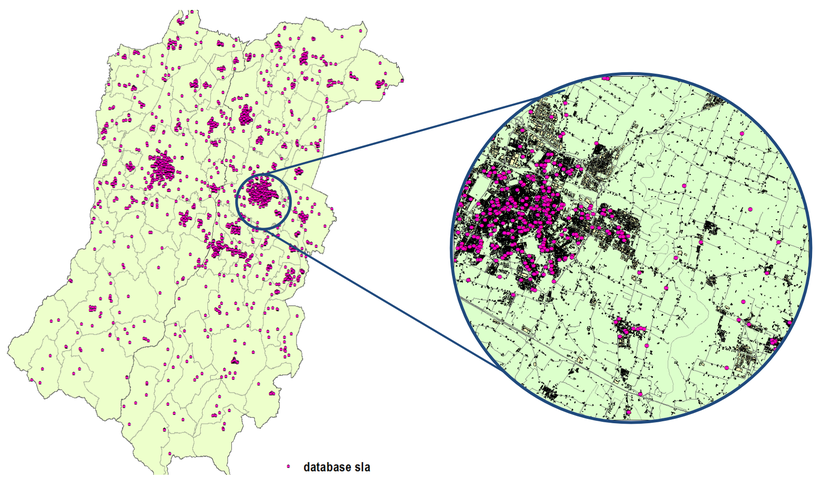
Results

The odds ratio (OR) with their 95% confidence intervals (CI) for passive residential exposure to pesticides was 1.67 (95% CI 0.87 to 3.20) from the questionnaire-based assessment, while ORs from the GIS-based assessment were 1.05 (0.40 to 2.73) and 1.13 (0.49 to 2.63) for the recent and historical period, respectively. The agreement between two methods considering all participants was generally moderate to high, with k of 0.564 (95% CI 0.361-0.767) and 0.648 (0.494-0.802) for recent and historical periods, respectively. Analyses divided between cases and controls yielded similar results, with k of 0.468 (0.133-0.803) in cases and 0.630 (0.382-0.879) in controls for recent period, and 0.642 (0.380-0.904) in cases and 0.652 (0.464-0.840) in controls for historical one.

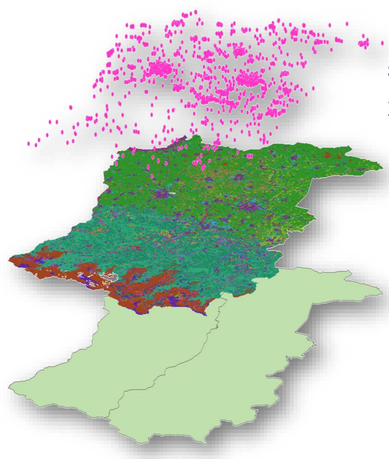
	All subjects	Cases	Controls
Recent period			
Considering ≥30% land use for exposure			
Agreement (%)	87.0	85.3	88.1
Expected agreement (%)	74.2	73.6	74.6
Cohen's kappa (95% CI)	0.497 (0.312-0.682)	0.442 (0.138-0.745)	0.532 (0.300-0.763)
Considering ≥50% land use for exposure			
Agreement (%)	91.4	88.5	93.1
Expected agreement (%)	80.2	78.4	81.3
Cohen's kappa (95% CI)	0.564 (0.361-0.767)	0.468 (0.133-0.803)	0.630 (0.382-0.879)
Historical period			
Considering ≥30% land use for exposure			
Agreement (%)	86.4	85.3	87.1
Expected agreement (%)	66.6	67.3	66.1
Cohen's kappa (95% CI)	0.594 (0.444-0.744)	0.549 (0.290-0.808)	0.620 (0.437-0.803)
Considering ≥50% land use for exposure			
Agreement (%)	89.5	90.2	89.1
Expected agreement (%)	70.2	72.5	68.7
Cohen's kappa (95% CI)	0.648 (0.494-0.802)	0.642 (0.380-0.904)	0.652 (0.464-0.840)

Exposure assessment

GIS: Geoferencing subjects' residence addresses



GIS: integration of layers and buffer creation



geocoded residences

land use

basemap

Percentage of land cover map of agricultural use in a 100 meter buffer: 30/50% of agricultural land use was considered as exposed

Questionnaires

Have you ever lived in country house or farm?

Description of type of crops (and pesticides)

Conclusions

Our results showed a slight increased risk of passive exposure to pesticides using the questionnaire-based assessment, with less conclusive results from the GIS-based one.
The similar agreement either between periods and case/control status, suggested also that no substantial information bias and differential exposure misclassification occurred when assessing pesticides exposure in our population.

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