
HOUSEHOLD EXPOSURE TO PESTICIDES AND CHILDHOOD HEMATOPOIETIC MALIGNANCIES

- THE ESCALE STUDY -

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Epidemiology of childhood hematopoietic malignancies

Most common cancers (40% of childhood cancers, IR $\approx 55/10^6$)

470 acute leukemia (AL): 80% lymphoblastic, 20% myeloblastic

80 Hodgkin's lymphoma (HL)

100 non-Hodgkin's lymphoma (NHL)

Few known risk factors

Ionising radiation at high level (AL)

Chemotherapeutic agents (AL)

Immune deficiencies (HL, NHL)

Down's syndrome (AL) and rare genetic disorders (AL, HL, NHL)

Suspected risk factors

Infectious agents / hygiene

General environment

Pesticides, road traffic (benzene), tobacco

Electromagnetic fields at extremely low frequency

Genetic factors

Individual susceptibility / genes x environment interactions

Pesticides and childhood hematopoietic malignancies

Occupational spraying and application of insecticides

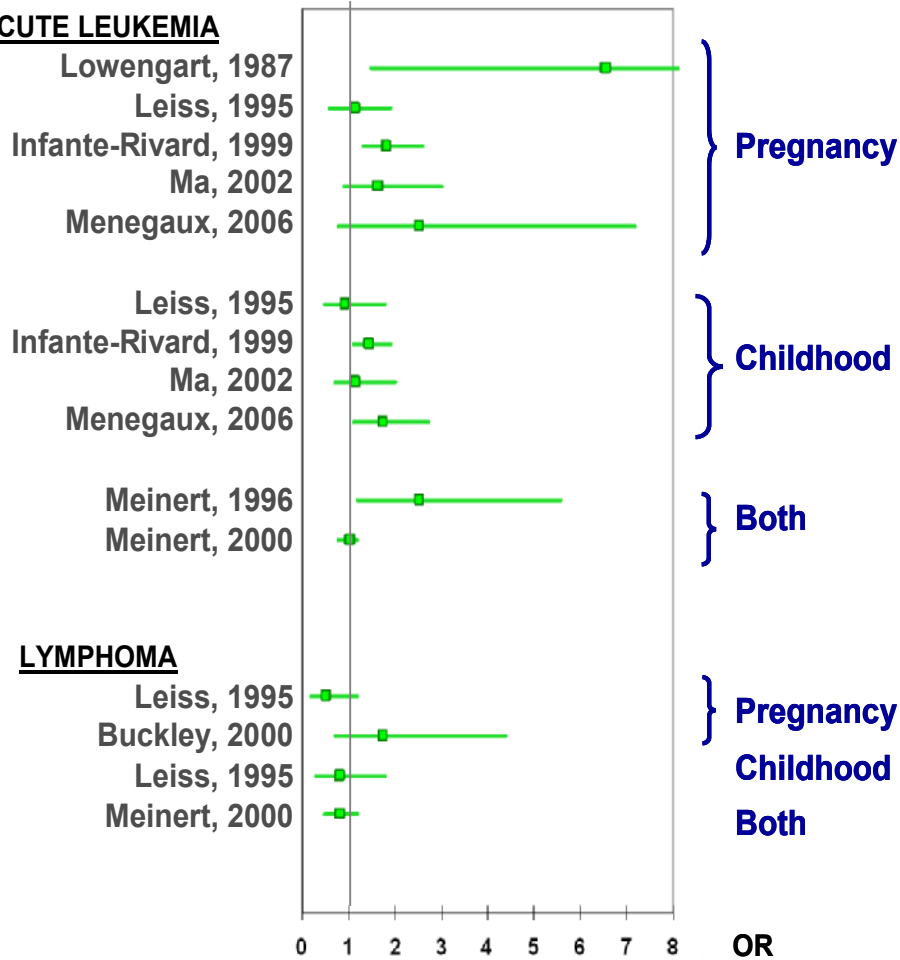
→ probably carcinogenic (IARC 2A)

Exposure of children

- Parents' work
 - Garden products
 - Indoor products
 - Flea control products
 - Pediculosis lotions
 - General environment, food and water
- } Domestic use

Pesticides and childhood hematopoietic malignancies

ACUTE LEUKEMIA



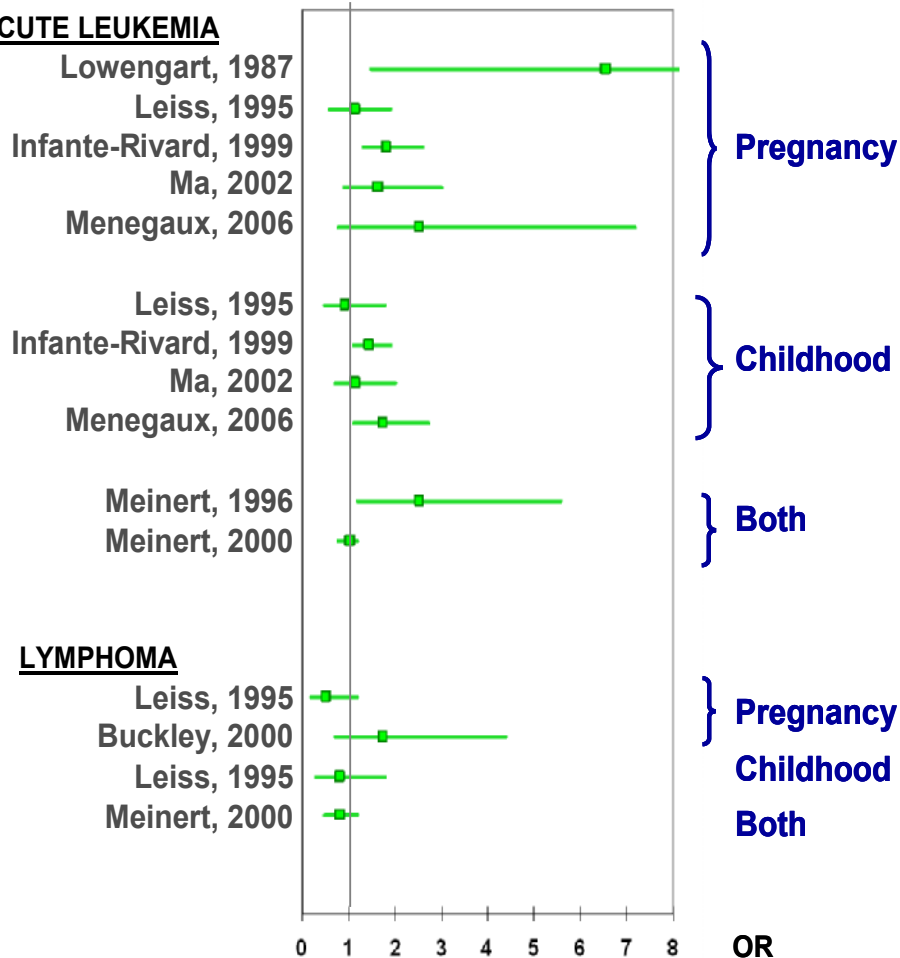
LYMPHOMA



Garden products

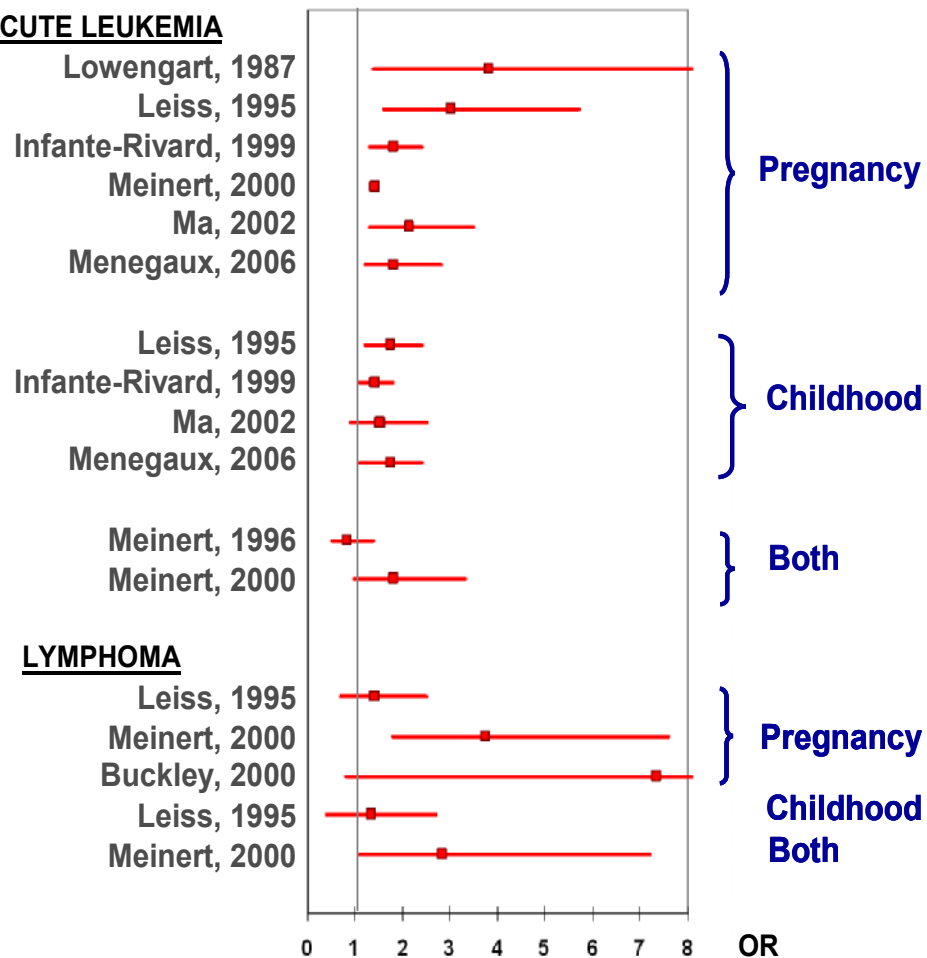
Pesticides and childhood hematopoietic malignancies

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Garden products

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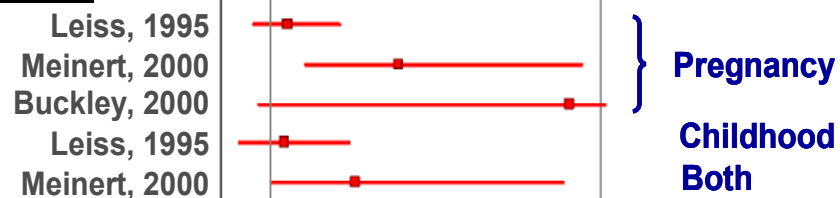


Indoor products

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Objectives

Investigating the relationship between

- **household pesticide use by parents during pregnancy**
 - Insecticides for home, pets, crops
 - Herbicides
 - Fungicides
- **and childhood acute leukemia and lymphoma**

⇒ data from the national case-control study ESCALE

The ESCALE study

Sampling

Cases **764 AL, 130 HL, 166 NHL** (participation rate: **90%**)

- Acute leukemia and lymphoma
- Children < **15 years**, diagnosed in **2003-2004**, living in France
- Non eligible cases
 - children deceased, in palliative care, or adopted
 - mothers deceased, not French speaking, serious psychiatric disorders

Controls **1681** controls (participation rate: **71%**)

Quota sampling in the general population

- Basis: telephone directory + randomly generated unlisted numbers
- Same **age and gender** as cases
- Representative of the French population in terms of
 - Region and degree of urbanization
 - Number of children under 15 years in the household

The ESCALE study

Data collection and statistical analysis

Telephone interviews with biological mothers (\approx 35 mn)

- **Parental household and occupational uses of pesticides**

Maternal during pregnancy / Paternal during or after pregnancy

Domestic use of insecticides (home, pets, cultivation), herbicides, fungicides

- **Other items**

Demographic and socioeconomic characteristics

Personal and family medical history

Residential history and environment (passive smoking, daycare...)

Statistical analysis

Odds Ratios (OR) estimated by unconditional logistic regression

Adjustment for stratification variables and potential confounders

Results

Cases // controls comparability

Cases and controls globally similar according to

- Stratification variables age and gender
- Professional status of parents
Parental educational level
- Degree of urbanization (rural/semi-urban/urban place of residence)
Type of housing (flat or house)

Results

Maternal household pesticide use during pregnancy

	Acute leukemia		
	n=764	OR	IC 95%
Any pesticide	54%	2.2	[1.8-2.6]***
Insecticides	53%	2.1	[1.7-2.5]***
Home	44%	1.9	[1.6-2.3]***
Pets	21%	2.0	[1.5-2.5]***
Crops	4%	1.5	[0.0-2.5]
Herbicides	7%	1.5	[1.0-2.2]*
Fongicides	2%	0.9	[0.5-1.7]

* : $p < 0.05$; ** : $p < 0.01$; *** : $p < 0.001$

Adjustment for age, sex, birth order (AL), housing during pregnancy, degree of urbanization at the place of conception

Results

Maternal household pesticide use during pregnancy

	Acute leukemia			Hodgkin's lymphoma			Non-Hodgkin's lymphoma		
	n=764	OR	IC 95%	n=128	OR	IC 95%	n=165	OR	IC 95%
Any pesticide	54%	2.2	[1.8-2.6]***	50%	1.3	[0.9-2.0]	56%	1.9	[1.3-2.6]***
Insecticides	53%	2.1	[1.7-2.5]***	48%	1.3	[0.9-2.0]	54%	1.8	[1.3-2.6]***
Home	44%	1.9	[1.6-2.3]***	46%	1.4	[1.0-2.2]	43%	1.4	[1.0-2.0]
Pets	21%	2.0	[1.5-2.5]***	17%	1.3	[0.7-2.2]	15%	1.2	[0.7-1.9]
Crops	4%	1.5	[0.0-2.5]	2%	0.5	[0.1-1.8]	6%	2.3	[1.1-4.9]*
Herbicides	7%	1.5	[1.0-2.2]*	7%	1.1	[0.5-2.4]	9%	1.5	[0.8-2.7]
Fongicides	2%	0.9	[0.5-1.7]	5%	1.9	[0.7-5.3]	2%	1.0	[0.3-2.9]

* : $p < 0.05$; ** : $p < 0.01$; *** : $p < 0.001$

Adjustment for age, sex, birth order (AL), housing during pregnancy, degree of urbanization at the place of conception

Other results

Paternal household use of pesticides

- Significant associations for AL (OR=1.5 [1.2-1.8]) and NHL (OR=1.7 [1.2-2.6])
- For AL association no longer observed after adjustment for maternal pesticide use

Occupational exposure to pesticides during pregnancy

No association

Subtypes

- **Acute leukemia** similar results for lymphoblastic or myeloblastic leukemia
- **NHL:** association clearer for Burkitt's lymphoma (OR=2.8 [1.7-4.7])
- **HL:** association only for mixed cell HL (19 cases, OR=3.8 [1.3-10.9])

Discussion

Cases and controls selection

- Cases identified by French National Registry of Childhood Blood Malignancies
 - High participation rates (90% for cases, 71% for controls)
 - Controls similar to the French population (French National Perinatal Surveys): educational level, birth order, maternal age, region of living
- ⇒ Selection on factors related to pesticide exposure unlikely

Exposure assessment : recall bias ?

- Household exposure to pesticides based on interview
The case and control interviews conducted in the same manner (interviewers, structured questionnaire, closed questions)
- Positive associations not observed systematically (AL, NHL, insecticides ++)
- No information on frequency / on precise time periods of exposure

Discussion (2)

Confounding factors

- No known strong confounding factors
- Factors known to be related to pesticide exposures were accounted for
 - degree of urbanization
 - type of housing (house, flat)
 - animal contacts
- Risk factors were accounted for
 - delayed common infections
 - family history of cancer

Conclusion

- The study findings strengthen the hypothesis that domestic use of pesticides may play a role in the etiology of childhood hematopoietic malignancies
- Prenatal period may be a particular vulnerable time window
- Consistency with previous published studies for NHL but only a few studies
- Consistency with previous published studies for leukemia
⇒ advisability of preventing pesticide use by pregnant women ?

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Agence Française de Sécurité Sanitaire de l’Environnement et du Travail (AFSSET)

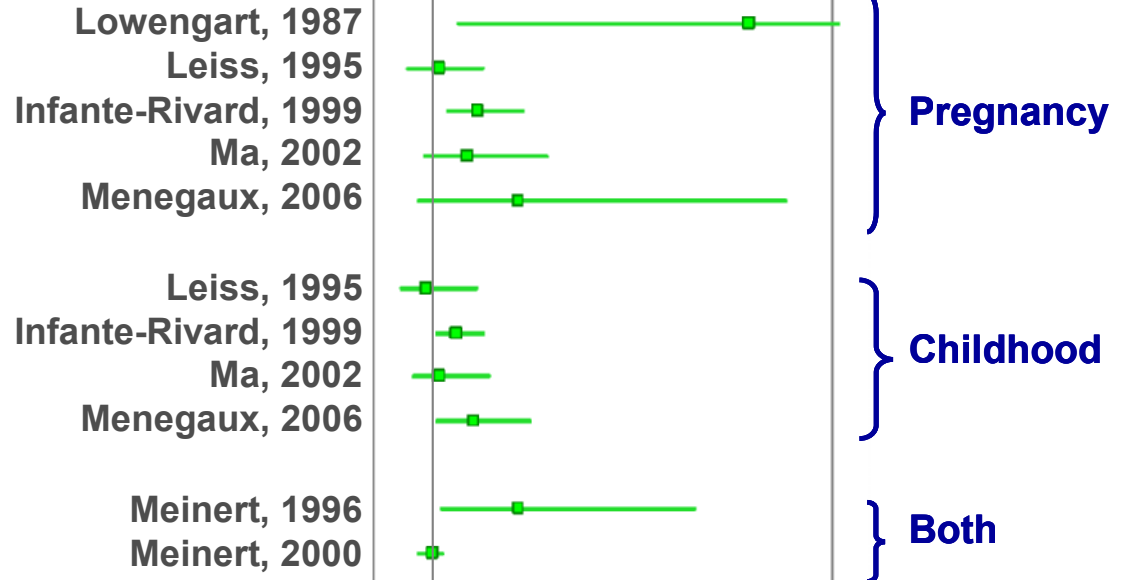
Association Cent pour sang la vie

Pesticides and childhood hematopoietic malignancies

Exposure of children

- Parents' work
- **Garden products**
- Indoor products
- Flea control products
- Pediculosis lotion
- General environment, food and water

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0 1 2 3 4 5 6 7 8 OR

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ACUTE LEUKEMIA

Lowengart, 1987
 Leiss, 1995
 Infante-Rivard, 1999
 Meinert, 2000
 Ma, 2002
 Menegaux, 2006

Leiss, 1995
 Infante-Rivard, 1999
 Ma, 2002
 Menegaux, 2006

Meinert, 1996
 Meinert, 2000

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Leiss, 1995
 Meinert, 2000
 Buckley, 2000
 Leiss, 1995
 Meinert, 2000

