Cancer in Children and Pesticide Exposure

Summary of Selected Studies

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Table of Contents

About the Table

This table is a selective summary of studies of cancer in children* with potential exposure to pesticides. Most are from articles published in English in peer-reviewed journals. The studies are listed in chronological order by author – the most recent first.

The source of the children's exposure could be the occupation of one or both of their parents as farmers, agricultural workers, sprayers, exterminators, formulators, or other jobs. Their exposure could be from household, lawn/garden, pet, or other pesticide use by parents or care givers. Or it could be from potential pesticide exposures from living on a farm, in an agricultural spray area, or near a pesticide factory, or other environmental exposures.

How the Studies Are Done

Epidemiology is the study of diseases and their causes in human populations. It compares groups of people with an exposure to those without it, or people with a disease to those without it.

In the studies in this table, groups of children with cancer or with pesticide exposure are the *"cases"*. Groups of children without cancer or without exposure to pesticides are the *"controls"*.

The aim is to find out if the children with cancer (the cases) are more likely to have exposure to pesticides than the children without cancer (the controls). Or to find out if the children with pesticide exposure (the cases) are more likely to have cancer than children without pesticide exposure (the controls).

How Study Results are Reported

Study results are reported as risk ratios. These ratios indicate whether the children with cancer were ***more*** likely to be exposed to pesticides (at increased risk), ***equally*** likely to be exposed to pesticides (no difference in risk), or ***less*** likely to be exposed to pesticides (at decreased risk) than the children without cancer.

Or whether the children with pesticide exposure were ***more*** likely to have cancer (at increased risk), ***equally*** likely to have cancer (no difference in risk), or ***less*** likely to have cancer (at decreased risk) than the children without pesticide exposure.

For example: In a study of leukemia**, the cases would be children with leukemia, and the controls children without it. There are three possible outcomes. The children with leukemia could be more likely, equally likely, or less likely to have exposure to pesticides.

1. More likely: If the ratio is greater than 1 (> 1), this means that the children with leukemia were more likely to have exposure to pesticides – that pesticide exposure ***increases*** the risk of leukemia. The size of the ratio indicates how much the risk is increased. A ratio of 1.4 means a 40% increase in risk. A ratio of 2.0 means a doubling of the risk, or a 200% increase. At least a doubling of the risk is considered more important than ratios less than 2.

2. Equally likely - If the ratio is equal to one (= 1) this means that there was no difference in pesticide exposure found in the children with or without leukemia – pesticides did ***not*** increase the risk of leukemia in the study.

3. Less likely - If the ratio is less than one (< 1), this means that children with leukemia were less likely tobe exposed to pesticides than children without it, or the risk was ***decreased***. The smaller the number the lower the risk. A ratio of 0.80 means that children with leukemia are 20% less likely to have been exposed to pesticides. A ratio of 0.40, that they are 60% less likely.

When studying humans, it is impossible to determine every factor that might influence the results of a study. It might have occurred anyway, by chance. It is possible that any increase in risk was not from pesticides, but something else. This could be something the researcher didn't think of, or didn't even ask about. Or it could be from pesticide exposure in combination with other unknown or unstudied factors. Therefore, finding an increase in risk does not mean that pesticides "cause" leukemia.

This is why it is common to report an increase in risk by stating that "pesticide exposure increases the risk of leukemia in children", or "pesticide exposure is a risk factor for leukemia in children", and not that pesticides "cause" leukemia.

Are the Study Results "Significant"?

There are methods to determine how strong the link or associations between leukemia and pesticides are, and if they occurred by chance. They are called tests of statistical significance. The statistical part is usually left out, and the results reported as "significant" or "not significant". The two most common tests are the "p" value, and confidence intervals.

1. "p" value: This tests whether the findings could have occurred by chance 5% of the time or less. The 5% is converted to a fraction and written as 0.05. For example, you will see the results as "$p = 0.05$" (read as p equals point 0 5), or "$p < 0.05$" (read as p less than point 0 5), or "$p \leq 0.05$" (read as p less than or equal to point 0 5).

If the "p" value is less than or equal to 0.05, the findings are considered to be statistically significant; that is, they are unlikely to have occurred by chance. The smaller the "p" value the more significant the findings. For example" $p \leq 0.01$" (read as p less than or equal to point 0 1) means that it could have occurred by chance 1% of the time or less.

2. Confidence intervals: Another widely used test is called the confidence interval. It shows how close the risk ratio found in the study is to the "true" or expected value. The chosen level is usually 95%. This means that 95% of the time the study results will lie within the calculated interval. Another way of saying this is that 5% of the time they will not.

Because it is an interval, there are two numbers with the lower number written first. If the lower number of the confidence interval is less than or equal to one (≤ 1), than the increase in risk is "not significant" or "non-significant". If the lower number of the interval is greater than one (> 1) then the increase in risk is considered "significant".

If the number of cases is small, the confidence interval can be very wide. When there is a very wide interval between the lowest and the highest number, the less confidence you have in the findings. It usually means that the number of cases found were very small.

The larger the number of people in the study (the sample size), the narrower the confidence interval, and the more significant the findings.

Commonly Used Ratios

FR	Fecundability Ratio	SMR	Standardized Mortality Ratio
OR	Odds Ratio	SHR	Standardized Hospital Ratio
PMR	Proportionate Mortality Ratio	SMbR	Standardized Morbidity Ratio
PCMR	Proportionate Cancer Mortality Ratio	SIR	Standardized Incidence Ratio
PR	Prevalence Ratio	SPR	Standard Proportional Ratio
RR	Relative Risk (or Rate Ratio)	SRR	Standardized Rate Ratio

* By definition a child has not yet reached his or her 15th birthday. So children includes the age group 0 through 14.

** Leukemia is used as an example, but the discussion refers to all of the cancers listed in the table.

Study Type Num. Cases	Source and/or Type of Exposure	Type of Cancer	Results (95% CI)	Author Year
Case-control 162 case 162 controls	1995-1999 Northern California Household pesticides	Leukemia Pest control services at any time 1 yr before to 3 yr after birth 2^{nd} year after birth Insecticide exposure 3 mo before pregnancy During pregnancy During first year of life During second year of life During third year of life Herbicide exposure	**OR** 2.8 (1.4-5.7) 3.6 (1.6-8.3) 1.8 (1.1-3.1) 2.1 (1.3-3.5) 1.7 (1.0-2.9) 1.6 (1.0-2.7) 1.2 (0.7-2.1) No sig. association	2002 Ma
Ecological / incidence 7,143 cases	1988-1994 California Agricultural pesticide use	Childhood cancer Pesticide use density All types of cancers Leukemia (propargite use) Test for trend	**RR** No association 0.95 (0.80-1.13) 1.48 (1.03-2.13) Not significant	2002 Reynolds
Case-control 106 344 controls	Australia Parental work on farms	Ewing's sarcoma Farm father concep.and/or preg Farm mother concep. and/or preg. Mother handled pesticides Child lived on a farm	**OR** 3.5 (1.0-1 1.9) 2.3. (0.5-12.0) 2.0 1.6 (0.9-2.8)	2002 Valery
136 Cases 266 Controls	UK Mosquito control	Acute Leukemia -infants [1] Mosquitocides (propoxur)	**OR** 9.68 p = 0.003	2001 Alexander
Case-control 538 cases and matched controls	Pediatric Oncology and Child. Cancer Group[2] Home use of pesticides	Neuroblastoma Pesticide use in the home Pesticide use in the garden Garden use chn diag. > 1 yr	**OR** 1.6 (1.0-2.3) 1.7 (0.9-2.1) 2.2 (1.3-3.6)	2001 Daniels
Cohort study birth -14 years	Sweden Paternal occupational exposure to pesticides	Type of Cancer Nervous system tumors Leukemia	**OR** 2.36 (1.27-4.39) No association	2001 Feychting
177 cases 2006 controls	1988-1994 West Germany	Wilms tumor Pesticide exposure	**OR** No association	2001 Schuz
466 cases 2,458 controls	1993-1997 West Germany	Astrocytoma Wood preservative exposure Exposure to pesticides	**OR** 1.91 (1.22-3.01) No association	2001 Schuz
Case-control 268 each	US / Canada Children's Cancer Group[2] Home pesticide use and parental occupational exposure	Non-Hodgkin lymphoma Increase freq. home pesticide use Trend for use on most days Exterminations within the home Postnatal exposure Occupational exposure pesticides Burkitt lymphoma	**OR** 7.3 p = 0.05 3.0 p = 0.002 2.4 p = 0.001 1.7 ns all types 9.6 p < 0.05	2000 Buckley

Employed ≥1 year 1950-85	British Columbia sawmill workers exposed chlorophenates	Cancer in children (40 cases) All-cancer Leukemia Brain cancer	**SIR** 1.0 (0.7-1.4) 1.0 (0.5-1.8) 1.3 (0.6-2.5)	2000 Heacock
183 cases 372 controls	1976-1987. New York State (excluding NY City) Parental pesticide expos.	Neuroblastoma Mother occup. expos. insecticides Father occup. expos. creosote Father occup. expos dioxin	**OR** 2.3 (1.4-3.7) 2.1 (1.1-4.3) 6.9 (1.3-68)	2000 Kerr
2358 cases [3] 2,588 controls	1993-1997 West Germany Parental occupational and residential pesticide exposure	Non-Hodgkin lymphoma Home use insecticides PCO [4] Frequency parents' home use Leukemia Pesticide use on farms Pesticide use in gardens	**OR** 2.6 (1.2-5.7) p for trend = 0.02 1.5 (1.0-2.2) 1.0 (0.8-1.2)	2000 Meinert
Cancer mortality	1980-1989 4 US States[5] Phenoxy Herbicides	Wheat acres agric. vs urban counties Brain, leukemia - boys and girls All cancers - boys	 Increased risk Increased risk	2000 Schreinem-achers
504 new cases [6] and matched controls	US/Canada Children's Cancer Group[2] and Pediatric Oncology Group	Neuroblastoma Father landscaper/groundkeeper Mothers farmer/ farm worker Mother: florist/garden store	**OR** 2.3 (1.0-5.2) 2.2 (0.6-8.8) 2.4 (0.6-9.9)	1999 Olshan
539 cases and matched controls	1992-1996) Child. Cancer Group[2] Parental occup. pesticide exposure	Neuroblastoma Landscapers/groundskeepers Mat. occ. florists/garden store Farm workers	**OR** 2.3 (1.0-5.2) 2.4 (0.6-9.9) 2.2 (0.6-8.8)	1998 DeRoos
449 cancer mortality	1959-63,70-78, 1979-90 England/ Wales	Kidney cancer (based on 42 deaths) Paternal occup. pesticide expos.	**PMR** 1.59 (1.18-2.15)	1998 Fear
Case-control 531 cases, 801 controls < 20 years of age	1984 - 1991 San Francisco Los Angeles Seattle Parental occup.on a farm	Brain cancer (all) Maternal exp. pigs Mat. exp. horses during preg Primitive neuroectodermal Child prenatal exp. pigs Maternal prenatal exp. pigs Child prenatal exp. poultry Maternal prenatal exp. poultry Child farm residence > 1 year or first on farm < 6 months old	**OR** 3.8 (1.2-12) 2.2 (1.0-4.8) 4.0 (1.2-13) 11.9 (2.8-51) 3.0 (1.1-8.0) 4.0 (1.2-14) 3.9 (1.2-13)	1998 Holly
Case-control	Ontario, Canada Parental occupational pesticide exposure	Ewing's bone sarcoma Mother in farming Osteosarcoma Father in farming	**OR** 7.8 (1.9-31.7) 2.1 (0.8-5.7)	1998 Hum
2358 cases 2588 controls	1992 - 1994 West Germany	Maternal Occup.Pesticide Expos. Leukemias Lymphomas	 Increased sig Increased sig	1998 Kaatsch

251 cases and 601 controls	Europe [7] Parental exposures	Brain cancer Father worked in agriculture	**OR** 2.2 (1.0-4.7)	1997 Cordier
Case-control	Denmark Parental occupation in agriculture	Testicular cancer Parents occup. in agriculture Childhood residence on a farm Subjects' occup. in agriculture Childhood residence area high nitrate in ground water	 No associations No associations No associations Increased risk	1997 Moller
Case-control 224 cases and 218 controls	Los Angeles Home Pesticide Use	Brain cancer Sprays/foggers only (multivar.) Mother prep/apply/clean/ child <5 Not following label instructions Prenatal expos. flea/tick prods. Prenatal exp. flea/tick < 5 at diag. Mother prep/apply/clean flea/tick Did not evacuate after spray/dust Number pets treated Termite treatments Lice treatment Pesticides for nuisance pests Yard and garden pesticides [8]	**OR** 10.8 (1.3-89.1) 5.4 (1.3-22.3) 3.7 (1.5-9.6) 1.7 (1.1-2.6) 2.5 (1. 2-5.5) 2.2 (1.1-4.2) 1.6 (1.0-2.6) trend p = 0.04 No increase No increase No increase No increase	1997 Pogoda
Cancer incidence 1,275 (323,292)	1952-1991 Norway Children whose parents were farmers in 1969-1989 census	Brain cancer Pig farming Pig farming [9] Chicken farming [13, 10] Grain farming [13, 11] Horticulture [13, 12] Pesticide purchase Born between April - June Born between July - March Leukemia [13] Pig farming Soft tissue sarcoma [14] Wilms tumor Eye Neuroblastoma Osteosarcoma Hodgkin disease [15] Testis [16] Ovary Nervous system (193 ICD7) Bone Endocrine glands (195 ICD7) Hodgkin disease Leukemia	**RR** 1.59 (1.16-2.17) 3.11 (1.89-5.13) 2.42 (1.44-4.08) 1.72 (1.05-2.84) 1.54 (0.89-2.65) 3.28 (1.39-7.76) 6.15 (2.66-14.2) 2.30 (1.0-5.3) 2.10 (1.07-4.12) **RR** 1.25 (0.53-2.92) 8.87 (2.67-29.5) 3.17 (0.93-10.9) 2.51 (1.03-6.13) 2.90 1.38-6.11) 2.68 (1.35-5.30) **SIR** 124 (101-152) 131 (86-193) 141 (94-131) 122 (83-172) 122 (71-196) 117 (85-156) 101 (83-122)	1996 Kristensen

Cohort of 166,291 158 cancer cases	1952-91 Norway Parents who were farm holders	Testicular cancer Fertilizer use Nonseminoma Fertilizer use Grew up on a farm	**RR** 2.44 (1.66-3.56) 4.21 (2.13-8.32) Increased risk	1996 Kristensen
Case-control 173 219 local/state controls	1988-1992 Germany Lower Saxony Occupational home and garden pesticide exposure	Leukemia Parental agricultural expos. Home garden exposure Prevalence of pesticide use Comm. with increased leukemia Comm. wo increased leukemia	**OR** Inc. but not sig. 2.52 (1.0-6.1) Garden use 21% Garden use 10%	1996 Meinert
Case-control 2,521	1976-1983 Denver, Colorado Home pesticide use	Soft tissue sarcoma Yard treatment [17] Yard treatment [18] Yard treatment [19] Leukemia Pest strips[19, 25] Pest strips[17, 25] Pest strips[18, 25] Yard treatment[17] Yard treatment[19] Yard treatment[18] Brain cancer Pest strips[17, 25] Pest strips[19, 25] Pest strips[18, 25] Home extermination[18] Home extermination [19] Home extermination [17] Lymphomas Home extermination[18] Home extermination[17] Home extermination[19] Pest strips[19, 25] Pest strips[18, 25] Pest strips[17, 25]	**OR** 3.9 (1.7-9.2) 4.1 (1.0-16.0) 0.8 (0.5-1.2) 3.0 (1.6-5.7) 2.6 (1.7-3.9) 1.7 (1.2-2.4) 1.1 (0.8-1.5) 1.1 (0.6-1.9) 0.9 (0.5-1.8) 1.8 (1.2-2.9) 1.5 (0.9-2.4) 1.4 (0.7-2.9) 1.4 (0.6-2.7) 1.3 (0.7-2.1) 1.1 (0.4-3.0) 1.8 (1.1-2.9) 1.6 (0.9-2.9) 1.2 (0.4-3.9) 1.4 (0.7-2.5) 1.3 (0.4-2.7) 1.1 (0.6-1.9)	1995 Leiss
Case-control 109	1987-1989 Brazil Farm work Frequent use of pesticides	Wilms tumor Paternal exposure to farm work Maternal exposure to farm work Diag. > 2 yrs of age (paternal) Diag. > 4 ys of age (maternal) Boys - paternal exposure Boys - maternal exposure Girls - paternal exposure Girls - maternal exposure	**OR** 3.24 (1.2-9.0) 128 (6.4-2-569) > 4 14.8 (2.2-98.8) 8.56 (2.1-35.1) 4.60 (0.8-26.4) 1.31 (0.4-4.1) 2.03 (0.5-8.9)	1995 Sharpe
155 astrocytic glioma cases, 166	US / Canada Child. Can. Group[2] Parental expos. pest.	Brain -primitive neuroectodermal Mat. farm resid. during preg. Child farm resid. at least 1 yr	**OR** 3.7 (0.8-23) p=.06 5.0 (1.1-56) p.04	1994 Bunin

Case-control 75 cases, 113 controls	1985-1987 France (Paris region) Prenatal and Childhood Pesticide Exposure	Brain cancer Home treated during pregnancy Home treated during childhood Farm resid. during pregnancy Farm residence during childhood	**OR** 1.8 (0.8-4.1) 2.0 (1.0-4.1) 2.5 (0.4-16.1) 6.7 (1.2-3.8)	1994 Cordier
Case-control 82 cases, 164 controls	1985 - 1989 New South Wales Aust. Parental and environmental factors	Brain cancer Contact with horses Living on a farm Pesticide treatment home	**OR** No increase No increase No increase	1994 McCredie
Case-control 271 children	Children's Cancer Group[2] Maternal occupational pesticide exposure	Acute myeloid leukemia Preconception occupational Cumulative exposure (in hours) Postnatal home exposure [20]	**OR** 2.09 (1.04-4.17) Inc. trend p=.02 1.80 (1.11-2.89)	1994 Steinbuch
Cancer cluster 4 girls, 2 boys	1986-1989 Earlimart, Calif. Farm worker children	Leukemia [21] (3 cases) Rhabdomyosarcoma (1 case) Wilms's tumor (1 case) Burkitt lymphoma (1 case)	**RR** 3.15 p=0.008 6 observed 1.7 expected	1993 Coye
Abstract only article in Japanese	Japan Parents of children < 15	Acute lymphocytic leukemia More mothers in agriculture Paternal chem. expos ptc[22] Paternal prenatal pest. expos. Maternal. prenatal pest. exp.	 Increased sig Increased sig Increased sig	1993 Kishi
Case-control 234 cases	1984-1986 US and Canada Household insecticide exposure	Wilms Tumor Home extermination ever Home extermination once/year Home exterm. ≥2 times /year	**OR** 2.16 (1.24-3.75) 2.41 (1.14-5.09) 2.19 (0.94-5.08)	1993 Olshan
Case-control [23] 31 boys, 14 girls ≤10 years	1985 -1989 Missouri Parental use of household pesticides	Brain Cancer [24] Use of bomb indoors Flea collar use on pets Use of No-Pest strip [25] Any termite treatment Garden use of carbaryl Garden use of diazinon Yard herbicide use Garden/orchard insect. use Kwell (lindane) for lice Use on pets	**OR** 6.2 (11.4-28.3) 5.5 (1.5-20) [26] 4.4 (1.4-14.3) [27] 5.2 (1.2-22.2) [5] 2.9 (1.3-7.1) [5] 3.0 (1.-3-7.4) [6] 2.4 (1.1-5.6) [6] 4.6 (1.1-17.9) [5] 3.4 (1.2-9.3) [6] 2.6 (1.1-5.9) [6] 4.6 (1.0-21.3) [5] 1.9 (0.6-6.9) [6] 4.8 (0.9-24.7) [5] 1.8 (0.5-6.6) [6]	1992 Davis
Case-control 15 girls 28 boys	1978-1986 San Francisco Agricultural workers	Ewing's Bone Sarcoma Father agric. occ. 6 m ptc to dx [28] Father expos. herb/pest/fertilizer	**RR** 8.8 (1.8-42.7) 6.1 (1.7-21.9)	1992 Holly
Case-control	Three U.S. States[29] Parental agric occup.	Astrocytoma Agricultural job prior conception	**OR** Increased not sig	1992 Kuijten

Cancer Incidence 1,270 [30]	1979-1986 St. Jude's Hospital	Leukemia, lymphoma, solid tumor Having a garden using fertilizers, herbicides, pesticides	X^2=17.2 p= 0.03	1991 Schwartz-baum
201 cases [31] and controls	1982-1985 Child. Can. Study Grp [2]	Retinoblastoma Farming occup. mat. grandparents	**OR** 10 (1.4-43) p=.02	1990 Bunin
183 cases [32] 307 controls	1981-1984 Turin, Italy Parental occupation	Leukemia - ALL Farmer parents	**OR** Increased risk	1990 Magnani
Case-report 42 children	1980-1988, Kenya Agrochemical exposure	Aplastic anemia	Increased risk	1990 Riyat
Case-control 110	1975-1982 Columbus, Ohio Parental occup. in agric. forestry /fishing	Brain cancer DOT [33] preconception (6 cases) DOT [35] prenatal (4 cases) SIC [34] preconception (8 cases) SIC [30] prenatal (6 cases)	**OR** 2.7 (0.8-9.1) 1.6 (0.4-6.1) 2.8 (0.9-8.4) 2.0 (0.6-6.6	1990 Wilkins
Case-control 90 boys, 88 girls < 18 [35]	1980-1984 US / Canada Children's Cancer Group [2] Parental occupational pesticide exposure	Acute nonlymphocytic leukemia Age 5 or less >1000 days expos. Test for trend All cases >1000 days exposure Test for trend Father's exposure >1000 d Test for trend Age less than 5 >1000 days expo. Test for trend	**OR** 11.4 (1.5-88.7) p=.003 3.8 (1.5-9.7) p=.004 2.7 (1.0,7.0) p=0.06 2.1 (0.6-1.35) p= 0.31	1989 Buckley
52 cases [36] 326 controls	1983-1984 Italy Parental occupation	Soft tissue sarcoma Maternal occup. as farmer	Increased risk	1989 Magnani
Case-control 310 <15 years [37]	1974-1986 Shanghai Pesticide exposure	Acute Lymphocytic Leukemia [38] Mother occup. exp. pregnancy Acute Non-lymphocytic Leukemia [39] Mother occup. exp. pregnancy Mother agric. work pregnancy	**OR** 3.5 (1.1-11.2) 2.4 (0.5-11.0) 2.3 (0.9-6.3)	1988 Shu
Case-control 123 ≤ 10 years old	1980-1984 Los Angeles California Home and garden pesticide use [40]	Acute lymphocytic leukemia Indoor use either parent ≥1/wk Garden use either parent ≥1/mo Mother household use Mother garden use Father household use Father garden use	**OR** 3.8 (1.37-13.02) 6.5 (1.47-59.33) 3.2 p=0.02 9.0 p=0.02 4.0 p=0.02 5.0 p=0.07	1987 Lowengart
Cancer cluster [41]	1982-1985 McFarland, California Agricultural pesticides	Types of cancer Leukemias (2 cases) Wilms' tumor Astrocytoma Non-Hodgkin lymphoma Osteogenic sarcoma Fibrosarcoma Rhabdomyosarcoma	8 observed 1 expected	1986 California

Case-control 110 children < 20 yrs old	1975-1982 Columbus, Ohio Home use insecticides	Brain cancer Mothers use during pregnancy or prior to conception	**OR** Increased risk	1985 Sinks
Cancer Incidence 978	1959-1975 Finland Farm/garden/forestry	All cancers in children <15 Mother a farm wife Father agric/garden/forest	**OR** 2.16 $p < 0.10$ 1.42 $p < 0.01$	1981 Hemminki
Case-control [42] 84	1965-1975 Baltimore, MD. Home insecticide use	Brain cancer Compared to healthy controls Compared to cancer controls	**OR** 2.3 p=0.10 1.2 p=0.84	1979 Gold
7 Case reports	1975 Ohio Chlordane exposure	Neuroblastoma [43] Aplastic anemia [44] Leukemia [45]	—	1978 Infante
Case-report 9 children	1974-75 Miss/Ark/Tenn Insecticide exposure	Colorectal cancer All diagnosed same hospital	—	1977 Pratt

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Footnotes

1. Infant leukemia frequently involves breakage/recombination of the MLL gene in utero. A study of MLL gene fusions in pregnant women with and without exposure to carbamate insecticides, including Baygon (propoxur).
2. Children's Cancer Study Group. United States: Colorado, District of Columbia, Illinois, Indiana, Iowa, Michigan, Minnesota, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Wisconsin; Canada: British Columbia, Nova Scotia, Ontario.
3. 1,184 children with leukemia, 234 with non-Hodgkin's lymphoma, and 940 with a solid tumor.
4. Pest control operators (commercial exterminators).
5. Minnesota, North Dakota, South Dakota, Montana.
6. 73 paternal and 57 maternal occupational groups.
7. Milan, Italy; Paris, France, Valencia, Spain
8. Includes use of insecticides, herbicides, fungicides, or snail killer.
9. For non-astrocytic neuroepithelial tumours only.
10. Risk for all brain tumors also elevated but not significant OR 1.32 (0.93,1.86).
11. Risk for all brain tumors also elevated but not significant OR 1.29 (0.95,1.77).

12. For all brain tumors OR 1.25 (0.89,1.76).
13. There were no other elevated ORs for leukemia that were significant.
14. For pesticide spraying equipment, restricted to 1969 census subjects.
15. Mixed cellular type.
16. The OR for Testicular cancer based on pesticide exposure was not elevated
17. 2 years prior to diagnosis through diagnosis.
18. Birth through 2 years prior to diagnosis.
19. Last three months of pregnancy.
20. Exposure to household pesticide products used to control rodents.
21. All acute lymphocytic type.
22. Prior to conception.
23. Controls 108 children (57 boys, 51 girls) with other cancers (71 acute lymphocytic leukemia, 9 sarcomas, 8 lymphomas, 21 other types) from state registry, and 85 healthy children (50 boys, 35 girls) known by families of children with brain cancer.
24. Twenty astrocytomas, 11 medulloblastomas, 14 a mix of other types.
25. Active ingredient dichlorvos (DDVP).
26. Compared to friend controls
27. Compared to cancer controls.
28. Prior to conception to the time of diagnosis.
29. Pennsylvania, New Jersey, Delaware
30. 629 with leukemia, 237 with lymphoma, 404 with solid tumors.
31. 19 familial, 67 sporadic heritable, and 115 nonheritable; the familial cases were excluded from the analysis.
32. 142 acute lymphocytic leukemia; 22 acute nonlymphocytic leukemia; 19 non-Hodgkin lymphoma.
33. Department of Transportation
34. Standard Industrial Classification
35. 0-5 years N=32, 3-6 years N=18, 7-10 years N=16, 11-14 years N=22, ≥ 15 years N=13.
36. 36 cases rhabdomyosarcoma , 16 non-rhabdomyosarcomas.
37. 0-5 years 49.2%, 6-10 years 26.9%, 11-14 years 23.9%.
38. Acute non-lymphocytic leukemia represented 30.4% of the cases (primarily myeloid).
39. Acut lymphocytic leukemia represented 55.7% of the cases.
40. Home exposure of mothers during pregnancy and nursing, and fathers during pregnancy of the index child.
41. From 1975-1985 there were 10 cases of childhood cancer when 3 were expected. There was also an excess of fetal and infant deaths (miscarriages and stillbirths) in the time period from 1981 to 1983.
42. Compared to 76 children without cancer, and 112 children with other types of cancer.
43. Diagnosed in 5 children at same pediatric hospital; all had prenatal and/or extensive environmental exposure to chlordane.
44. In a 15 year old boy with exposure to chlordane and Isotox
45. In a 9 year old girl.