2.

Health Effects of Lawn-Care Pesticides

HEALTH EFFECTS OF THE MOST COMMONLY USED LAWN AND GARDEN PESTICIDES

- Over 90 percent of lawn treatments comprise 35 active ingredients and about 220 chemicals have home lawn uses.[25]

- The table below shows the 10 most commonly used conventional pesticide active ingredients in the home and garden market. Six of the top 10 pesticide active ingredients in the home and garden sector are herbicides and four are insecticides. The rankings are based on the estimated amount of conventional pesticides used in the non-agricultural sector taken from proprietary EPA databases.

- Five of the most popular pesticides in the U.S. home and garden sales market (2,4-D, glyphosate, MCPP, dicamba, and diazinon) have been associated with non-Hodgkin's lymphoma (NHL) in epidemiological studies, as shown in the chart on the following page. Non-Hodgkin's lymphoma is the sixth most common malignancy in America, with nearly 54,000 cases estimated to have occurred in 2002. Between 1973 and 1997, the incidence increased by 80 percent.[26] According to scientists at the National Cancer Institute, "Since the use of pesticides, particularly phenoxy herbicides, has increased dramatically preceding and during the time period in which the incidence of NHL has increased, they could have contributed to the rising incidence of NHL."[27]

- Four of the five top-selling pesticides have also been associated with birth and/or reproductive effects, and at least three of these pesticides can cause nervous system damage at high doses. All five of these pesticides are sold in Connecticut and three, 2,4-D, dicamba, and MCPP, are the most common pesticides found in popular "weed and feed" products.

MOST COMMONLY USED CONVENTIONAL PESTICIDE ACTIVE INGREDIENTS

Home and Garden Market Sector, 1999

(Ranked by Range in Millions of Pounds of Active Ingredient)

Active Ingredient	*Type*	*Rank*	*Range*
2,4-D	H	1	7-9
Glyphosate	H	2	5-8
MCPP	H	3	3-5
Dicamba	H	4	3-5
Diazinon	I	5	2-4
Chlorpyrifos	I	6	2-4
Carbaryl	I	7	2-4
Benefin	H	8	1-3
Malathion	I	9	1-3
DCPA	H	10	1-3

Note: H indicates herbicide and I, insecticide.
Based on EPA proprietary data.
Source: USEPA. 1998-1999 Pesticide Market Estimates. Available at http://www.epa.gov/oppbead1/pestsales/99pestsales/usage1999_3.html#table3_7a

Health Risks of Most Commonly Used Conventional Pesticide Active Ingredients

Active Ingredient	EPA Cancer Classification [28]	IARC Classification	Other Cancer Studies	Birth Defects/ Reproductive Effects	Neurological Effects	Other Risks
2,4-D	Unclassifiable, ambiguous data	2B, Possible	Higher incidence of NHL in people exposed to 2,4-D.[29 30 31 32]	May cause birth defects at high doses[33] and reproductive effects at moderate doses in animals.[34]	Neurotoxin.[35] Skin exposure may affect the nervous system.[36]	Direct contact may cause irreversible eye damage.[37] Long-term exposure may damage kidneys and liver.[38 39]
Glyphosate	Not likely	Not listed	Associations found between glyphosate exposure and NHL.[40]	Industry-sponsored tests showed no birth/reproductive effects.[41]	Industry-sponsored tests showed no neurotoxic effects.[42]	Inert ingredients in glyphosate formulations may be more toxic than glyphosate.
MCPP	Not listed	2B, Possible	Associated with cancer of soft tissues and NHL in people employed in the manufacture of MCPP.[43]	Causes birth defects in rats at moderate to high doses.[44]	Data not available.[45]	Mutagenic at high doses.[46]
Dicamba	Unclassifiable, inadequate data	Not listed	Study of men found risk of NHL statistically significantly increased.[47]	Suspected of causing birth defects in humans.[48]	Neurotoxic in animals.[49]	May cause severe and permanent damage to the eyes.[50] A manufacturing contaminant is linked to adverse health effects.[51]
Diazinon	Not likely	Not listed	Parental use associated with increased risk of brain cancer in children;[52] associated with an increased risk of NHL in men.[53 54]	Birth/reproductive effects in animals and birds.[55 56]	Neurotoxic.[57]	May be mutagenic.[58]

Weed and Feed Pesticides Commonly Contain 2,4-D, Dicamba, MCPP

2,4-D

- 2,4-D is the most commonly used herbicide in the world[59] and the most widely used pesticide by homeowners and lawn-care professionals in the U.S. American homeowners applied between seven and nine million pounds of 2,4-D on their lawns and gardens in 1997–1999.[60]

- EPA has concluded that 2,4-D is "not classifiable as to human carcinogenicity."[61] Several studies, however, have found a statistically higher incidence of non-Hodgkin's lymphoma in people exposed to 2,4-D.[62 63 64 65]

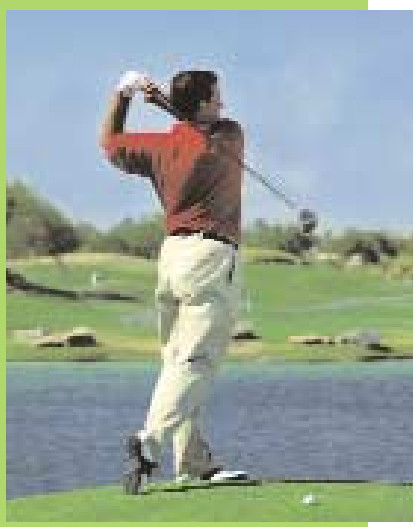
- A scientific review of the data on 2,4-D has concluded that 2,4-D may cause birth defects at high doses and that humans may be at risk for birth and reproductive effects though no direct evidence in humans exists.[66 67 68]

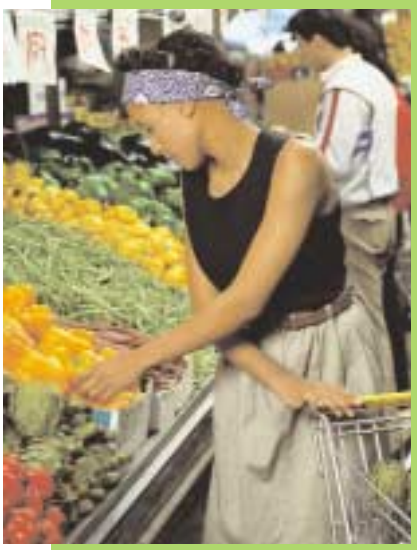
- In the mid-1990s, studies of Minnesota farming regions found a higher rate of birth defects among children of crop workers who conceived the children during the months when 2,4-D was sprayed. Areas with high 2,4-D and MCPA use had higher incidence of birth defects compared with regions that had low use of 2,4-D and MCPA.[69]

- Due to uncertainty about 2,4-D's reproductive and developmental effects, the U.S. Forest Service advises that "female workers should not be employed in back-pack or hack-and-squirt applications of 2,4-D."[70]

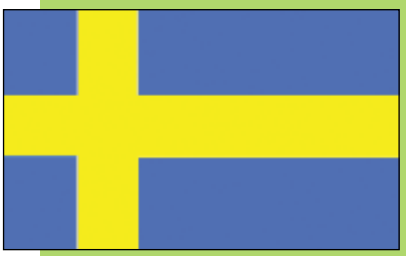
- Short-term exposure to 2,4-D at levels above the maximum contaminant level (MCL) for short periods of time has been linked to nervous system damage,[71] while long-term exposure can cause damage to the nervous system, kidneys and liver.[72] Skin exposure may affect the nervous system and direct contact to the eyes may cause irreversible eye damage.[73] Liver disease has been reported in several golfers who licked their golf balls while playing golf on 2,4-D treated golf courses.[74 75]

Several studies... have found a statistically higher incidence of non-Hodgkin's lymphoma in people exposed to 2,4-D. [62 63 64 65]





Three countries have banned 2,4-D and at least three have severely restricted its use.



- Residues of 2,4-D have been found on fruits, vegetables, and wheat.[76]

- Studies have detected 2,4-D inside homes following outdoor application. Studies have found that 2,4-D can be tracked from lawns into homes, leaving residues of the herbicide in carpets, on surfaces, and in indoor air.[77 78] A simulation study calculated that it would be expected to persist in carpet dust up to one year after a lawn application.[79]

- Three countries have banned 2,4-D and at least three have severely restricted its use. Kuwait banned 2,4-D for environmental reasons[80] and Norway banned it because of concerns about health effects, especially cancer.[81] It is severely restricted in Denmark[82] due to concerns about groundwater pollution[83] and it was voluntarily withdrawn in Sweden because of concerns about health effects.[84] Belize restricted the use of 2,4-D to use on pastures due to hazards to livestock, crops, and the environment from drift[85] and Korea banned aerial spraying on forage crops and turf.[86]

Dicamba

- Dicamba is one of the most widely used pesticides by volume. Homeowners applied between three and five million pounds of dicamba on their lawns and gardens in 1997–1999.[87]

- EPA claims that data are insufficient to determine whether dicamba can cause cancer;[88] however, a Canadian study of men found the risk of NHL increased following exposure to dicamba.[89]

- Herbicide applicators experienced a 20 percent inhibition of the AChE nervous system enzyme. Researchers also demonstrated AChE inhibition in laboratory tests.[90] Neurological effects of dicamba have also been reported in animal studies.[91]

- Dicamba is suspected of causing birth defects (a human teratogen),[92] is moderately toxic by ingestion, is slightly toxic by inhalation or dermal exposure, and can cause severe and permanent damage to the eyes.[93]

- In 1991, South Africa banned dicamba from aerial application in Natal and totally prohibited the use of dicamba in other areas.[94]

MCPP

- MCPP is one of the most widely used pesticides by volume. Homeowners applied between three and five million pounds of MCPP in their homes and gardens in 1997–99.[95] The majority (96 percent) of the MCPP that is produced in the U.S. is used on turf (lawns, sport turf and commercial sod production). MCPP is registered for use on terrestrial nonfood crops,[96] so chronic toxicity testing is not required.

- Data on delayed neurotoxicity are not available and are not required because MCPP and its derivatives and metabolites are not organophosphates or cholinesterase inhibitors.[97]

- Data suggest that MCPP may cause cancer, birth defects, and mutagenic effects. A Danish epidemiological study found an association between MCPP and cancer of soft tissues and NHL in people employed in the manufacture of the herbicides,[98] while a more recent Canadian study of men found the statistical risk of NHL significantly increased following exposure to MCPP.[99]

- MCPP has not been thoroughly evaluated for its human carcinogenic potential.[100] EPA's Office of Pesticide Programs determined in 1988 that MCPP carries a risk of birth defects, and that it may be mutagenic.[101]

- MCPP is severely restricted in Denmark due to concerns about groundwater pollution[102] and was banned in Thailand because of concerns about its carcinogenicity.[103]

Data suggest that MCPP may cause cancer, birth defects, and mutagenic effects.[98]

Glyphosate is implicated in more pesticide exposure incidents than all other herbicides listed by the American Association of Poison Control Centers. — *American Journal of Emergency Medicine*

Glyphosate

- Glyphosate is not classified by EPA as being known to cause cancer, reproductive, teratogenic, or mutagenic effects, although there is some evidence to suggest risk for each type of effect.[104] A recent Swedish population-based study, for example, found associations between glyphosate and NHL.[105]

- While the nature of the toxicity of glyphosate is debated, it is noteworthy that glyphosate is implicated in more pesticide exposure incidents than all other herbicides listed by the American Association of Poison Control Centers (AAPCC).[106]

- Glysophate is the third most commonly reported cause of pesticide poisoning among agricultural workers in California[107] and is the most common cause of poisoning among California landscape workers.[108]

- Glyphosate ranked twelfth among pesticides resulting in poisonings when presented as "number of acute illnesses reported per million pounds used" in California.[109]

- Glyphosate has been found to be less toxic than Roundup, the popular formulation in which it is used. Roundup is advertised as "America's #1 weed and grass killer"[110] and is acutely toxic to humans when ingested intentionally or accidentally.[111] The inert ingredient polyoxyethyleneamine (POEA) was believed to be a possible cause of Roundup's toxicity in poisoning cases studied.[112]

- Roundup contains a number of inert ingredients that may cause adverse health effects. Some Roundup products contain up to 99 percent inert ingredients.[113]

Diazinon

- Homeowners applied between two and four million pounds of diazinon in their homes and gardens in 1999.[114]

- Nearly 75 percent of diazinon has been used in residential settings.[115] Recently the chemical constituted roughly 30 percent of the home insecticide market.[116] It is highly toxic to fish, aquatic invertebrates and birds.[117]

- Between 1994 and 1995, diazinon was believed to be responsible for more bird mortality than any other pesticide. Residential uses of the chemical are believed to be responsible for 50 percent of this mortality. Broadcast application of diazinon on turf is one of the greatest pesticide risks to birds; one granule or seed treated with the insecticide can kill a small bird.[118]

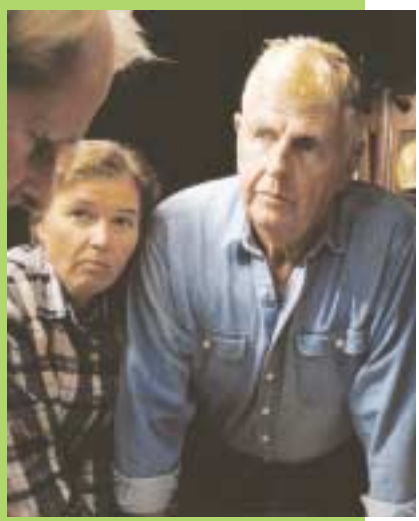
- Monitoring data indicate that diazinon is widespread in surface water nationally and is most commonly found in surface water in urban areas, as a result of runoff from residential use.[119]

- Diazinon has not been found to be carcinogenic in laboratory animals and has been classified as "not likely" to be a carcinogen by EPA. Epidemiological studies, however, have found an association between diazinon use and the risk of certain types of cancer. In a Missouri study of children, garden diazinon use by parents was positively associated with brain cancer in their children.[120] Several studies of men by the NCI found that exposure to diazinon increased the farmers' risk of contracting non-Hodgkin's lymphoma.[121] [122]

- Diazinon inhibits cholinesterase, an enzyme that governs signal transmission across nerve cells. High levels of dermal and oral exposure to diazinon have induced death. Symptoms associated with poisoning in humans include weakness, headaches, tightness in the chest, blurred vision, nausea, vomiting, diarrhea, abdominal cramps, and slurred speech.[123]

- Diazinon has been associated with increased numbers of stillbirths and neonatal deaths in beagle dogs and birth defects (skull malformations) in pigs,[124] while reproductive effects of diazinon have been observed in birds.[125]

Broadcast application of diazinon on turf is one of the greatest pesticide risks to birds; one granule or seed treated with the insecticide can kill a small bird.[118]



Some inert ingredients are suspected carcinogens; others have been linked to central nervous system disorders, liver and kidney damage, birth defects, and some short-term health effects.
— Attorney General's Office of New York

- Diazinon was banned in Denmark in 1997 because of concerns about groundwater pollution, persistence in soil, and ability to poison aquatic organisms, birds and mammals.[126]

- Diazinon was banned in 1990 by EPA for use on golf courses and sod farms because of bird kills, but was still available for other lawn uses until 2003. In 2000, EPA, citing concerns over risks to children, announced that all indoor uses of diazinon would be terminated and outdoor residential lawn and garden uses would be phased out, ending about 75 percent of the current use of diazinon. Sales of diazinon for residential lawn-care use will be prohibited in 2003.[127]

Health Effects of Inert Ingredients

- Pesticide products contain "active" and "inert" ingredients. Active ingredients target pests or act as plant regulators, defoliants, desiccants or nitrogen stabilizers and must be identified on the label. Inert ingredients are not intended to affect a target pest (they are added to pesticides to help dissolve active ingredients, make them easier to apply, or preserve them) and they are not identified on pesticide labels.[128]

- The term "inert" is not defined on the basis of toxicity and may present a health risk. Some inert ingredients are suspected carcinogens; others have been linked to central nervous system disorders, liver and kidney damage, birth defects, and some short-term health effects.[129]

- The identity of inerts is protected as a trade secret under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) unless the agency determines that "disclosure is necessary to protect against an unreasonable risk of injury to health or the environment."[130]

- Inert ingredients can make up the majority of consumer pesticide products. The New York Attorney General's office examined pesticide products and found that 90 percent contained over 90 percent inert ingredients.[131] Roundup Fence and Yard Edger, for example, is 99 percent inert ingedients.[132]

- In 1987, EPA developed an "Inerts Strategy" designed to eliminate the most toxic "inert" ingredients from use, require improved label disclosure of "inert" ingredients, and increase the toxicity testing required for "inerts." EPA's inerts strategy resulted in categorizing inert ingredients into four lists.[133]

- **List 1 -** Inert Ingredients of Toxicological Concern. Product containing a List 1 ingredient must include the label statement "This product contains the toxic inert ingredient (name of inert)." There are seven chemicals on this list.

- **List 2 -** Potentially Toxic Inert Ingredients/High Priority for Testing. There are nearly 100 chemicals on this list.

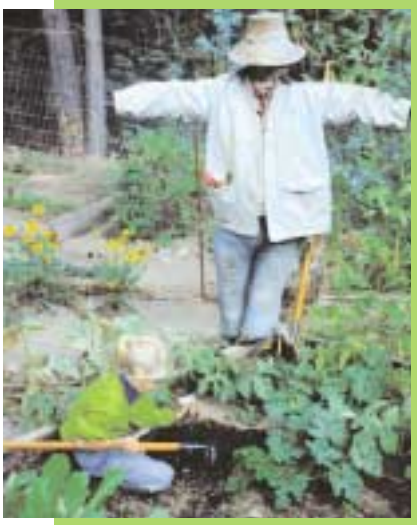
- **List 3 -** Inerts of Unknown Toxicity. There are 55 pages of chemicals on this list.

- **List 4 - List 4A** (minimal risk inert ingredients) and **List 4B** (inerts which have sufficient data to substantiate that they can be used safely in pesticide products). There are 27 pages of inert chemicals on this list.

- Lists of inert ingredients used in pesticide products are not readily available. A 1996 court decision, *NCAP v. Browner*, made information about inert ingredients in some pesticide products available under the federal Freedom of Information Act.[134] Some of these inerts are quite toxic. For example, Bonide Poison Ivy Killer, a 2,4-D product, contains naphthalene[135], a List 3 "inert of unknown toxicity" associated with destruction of red blood cells, nausea, vomiting, and diarrhea.[136] Another 2,4-D product, Brushmaster, contains xylene[137] (a List 2 inert) which, at high levels, can cause headaches, lack of muscle coordination, dizziness, confusion; difficulty in breathing and problems with the lungs; delayed reaction time and memory difficulties; increased numbers of fetal deaths; and delayed growth and development in animal studies.[138]

- In 1998, EPA was petitioned to require listing of all ingredients on product labels. EPA formally denied the petition in 2001.[139]

"In 1998, EPA was petitioned to require listing of all ingredients on product labels. EPA formally denied the petition in 2001."
—Northwest Coalition for Alternatives to Pesticides



Children are exposed to a variety of pesticides as a result of homeowners and condominium managers routinely using herbicides and insecticides.

Pesticide Poisonings

- Exposure to pesticides can lead to acute and chronic health effects. There are many symptoms of acute exposure, some of which include:[140]
  - Sweating
  - Headache
  - Fatigue
  - Slow pulse
  - Nausea and diarrhea
  - Central nervous system depression
  - Loss of coordination
  - Confusion
  - Coma
- In addition to the above side effects, pesticide poisoning can harm the reproductive system, nervous system, gastrointestinal tract and liver, kidneys, cardiovascular system, respiratory system, endocrine system, and blood.[141]
- According to the AAPCC's Toxic Exposure Surveillance System, of the 90,000 exposure incidents reported in 2001, more than half of these involved children younger than six.[142] EPA believes the AAPCC underestimates pesticide incident exposures by 50 percent and estimates that 25 percent of the childhood exposures result in adverse health effects.[143]
- People can be exposed to pesticides through food, air, and water. Runoff from pesticide use can contaminate groundwater, rivers, lakes, and streams. Although drinking water provided through municipal systems is tested regularly for increased levels of pesticides, private wells are not. Air currents can carry pesticides that have been sprayed to nearby areas. This "pesticide drift" can contaminate the air.
- Children are exposed to a variety of pesticides as a result of homeowners and condominium managers routinely using herbicides and insecticides. Accidental exposure can occur when pesticides are used or stored inappropriately by consumers who do not read the label or do not understand the information or the importance of the information provided on the label.[144]

- Examples of pesticide misuse are widespread. The Wisconsin Department of Agriculture, Trade and Consumer Protection has investigated numerous cases of residential pesticide misuse. Examples include a home treated with 37 pounds of carbaryl to control fleas; and a family that developed cardiac and neurologic symptoms soon after their home was fogged with nicotine.[145]

- The National Home and Garden Pesticide Survey performed by EPA found that:[146]

    - "85 percent of households had at least one pesticide on the property;
    - 76 percent of homeowners applied pesticides themselves, without professional help;
    - 47 percent of homes with children under the age of six stored pesticides within a child's reach;
    - 33 percent of individuals failed to take precautions while applying pesticides."

- The number of poisonings in the U.S. reported for active ingredients in lawn-care chemicals are listed in the table at right.

- Incident data from the AAPCC indicates that from 1993 to 1996, 90 percent of all reported accidental pesticide exposures were residential, and 50 percent of those involved insecticides.[148]

- EPA has no data on adverse reactions from exposure to treated lawns.[149]

- Organophosphates, including chemicals such as diazinon, are responsible for the most pesticide incidents reported to the AAPCC.[150] Organophosphate insecticides are the most widely used and available insecticides on the market. There are more than 30 organophosphate pesticides registered for use and all are associated with risks of acute and subacute toxicity.[151]

Number of Poisonings in the U.S. for Most Popular Lawn/Garden Pesticides[147]

Pesticide	*Number of Exposures*
2,4-D	155
Glyphosate	4,426
Dicamba	N/A
MCPP	2,000 (chlorophenoxy poisonings)
Organophosphates	9,564

In 1993, the Government Accounting Office (GAO) concluded that existing sources of information on pesticide illnesses in the U.S. were limited in coverage.... In 2000, a GAO report found that little had changed since 1993.

- EPA considers glyphosate to have low oral and dermal acute toxicity,[152] though the inert ingredients in glyphosate formulations may be more toxic. Glyphosate poisonings are responsible for a large number of reported pesticide poisonings.[153] The inert ingredient POEA in Roundup has been found to be more toxic than glyphosate in studies on rats.[154]

- In 1993, the Government Accounting Office (GAO) concluded that existing sources of information on pesticide illnesses in the U.S. were limited in coverage, comprehensiveness, and quality and that without a system of monitoring pesticide illnesses, problems that might occur with the different uses of pesticides could not be identified. In 2000, a GAO report found that little had changed since 1993 and concluded that establishing state-pesticide illness reporting systems is key to improving the national information on acute pesticide illness. According to GAO, only six states (California, Florida, New York, Oregon, Texas and Washington) have a formal pesticide illness reporting and investigation system, and another three states (Arizona, Louisiana and New Mexico) have more limited systems.[155] The Centers for Disease Control and Prevention (CDC) indicates that Michigan and Iowa also have pesticide poisoning surveillance programs.[156]

- Connecticut is not among the states listed by GAO or CDC as having a pesticide surveillance program.

Data Inadequacies

- Data on the amount of pesticides used on residential lawns by homeowners in Connecticut are not available. Some states, including California and New York, currently collect and release pesticide use data and a few other states have recently passed laws to establish their own reporting programs.[157]

- Many pesticides used on lawns are not tested for chronic health effects. Only data on acute health effects are used to evaluate potential hazards associated with pesticides that are used on lawns. For lawn-care chemicals that are approved for use on food or feed crops, EPA has more extensive databases that include sub-chronic and chronic toxicity data.[158]

- Pesticides in many "weed and feed" products are found in combinations, yet EPA does not test for toxicity of these mixtures. For example, EPA has no data on the toxicity of the herbicides 2,4-D, MCPP and dicamba when combined. University researchers recently tested a weed killer (comprised of 2,4-D, MCPP and dicamba) by giving it to mice at low doses in their water and found a 20 percent increase in failed pregnancies at doses seven times lower than the maximum allowable rate for U.S. drinking water.[159]

- Most laboratory testing is done at high doses. Studies like the one cited above and the study on atrazine's effects on frogs at low, "ecologically relevant" doses[160] suggest that lower dose testing, the dose at which actual exposures occur, may have different toxicity findings.

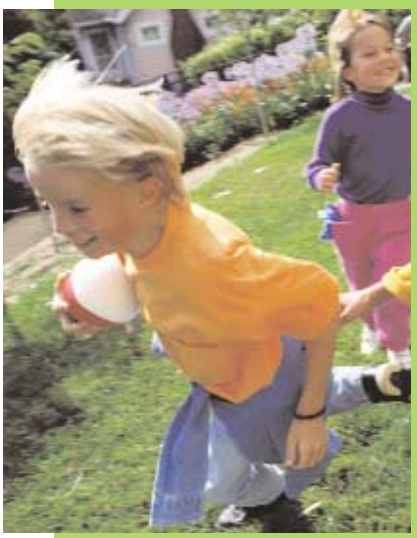
- Due to concerns about the uncertainty of long-term health effects of low-dose pesticide exposures and lack of surveillance systems to characterize potential exposure problems related to pesticide usage or pesticide-related illnesses, the American Medical Association has recommended that homeowners and others limit pesticide exposures and consider the use of the least toxic chemical pesticides or non-chemical alternatives.[161]

Health Effects of Pesticides on Children

- Children are often more susceptible to the toxic effects of pesticides than adults;[162] they take in more pesticides relative to body weight than adults, and have developing organ systems that are more vulnerable and less able to detoxify toxic chemicals.[163] In addition, the likelihood of developing cancer is greater if exposure occurs early in life, since cancer develops over time.

- Children are especially vulnerable to carcinogens before the age of five, when their cells are normally reproducing most rapidly, may be more susceptible to loss of brain function if exposed to neurotoxins, and may be more susceptible to damage to their reproductive systems.[164]

Children are often more susceptible to the toxic effects of pesticides than adults; they take in more pesticides relative to body weight than adults...



The use of household pesticides has been associated with a variety of childhood cancers.

- Children can be exposed to lawn-care pesticides by playing near an area where pesticides are being applied or by playing outside following a pesticide application, drinking or bathing in water contaminated with lawn-care pesticides, or from parental exposure to lawn-care chemicals during the child's gestation or prior to conception. Exposure to lawn-care pesticides can even occur inside a child's home. Studies have found that 2,4-D can be tracked from lawns into homes, leaving residues of the herbicide in carpets, on surfaces, and in indoor air.[165] [166] Estimated post-application indoor exposure levels for young children from non-dietary ingestion may be as high as 30 micrograms/day from contact with tabletops. By comparison, dietary ingestion of 2,4-D is approximately 1.3 micrograms/day.[167]

- Childhood malignancies linked to pesticides in studies include leukemia, neuroblastoma, Wilms' tumor, soft-tissue sarcoma, Ewing's sarcoma, NHL, and cancers of the brain, colorectum, and testes.[168] Many of the reported increased risks are greater than those noted in studies of pesticide-exposed adults, indicating that children may be particularly sensitive to the carcinogenic effects of pesticides.[169]

- The use of household pesticides has been associated with a variety of childhood cancers. Yard treatments have been associated with soft tissue sarcomas[170]; household pesticides have been associated with childhood leukemia[171] [172] [173] [174] [175] and NHL[176]; flea/tick products have been associated with pediatric brain tumors[177]; and home and garden pesticides have been associated with neuroblastoma, particularly in children diagnosed after their first birthday.[178]

- Numerous studies have found that children living in households where pesticides are used have elevated rates of leukemia, brain cancer and soft tissue sarcoma.[179] The greatest risks of childhood leukemia have been found in children exposed to insecticides early in life,[180] children exposed during pregnancy,[181] children whose parents use pesticides in the home,[182] and in children whose families use pest strips.[183]

- Urine samples from 102 children ages three to 13 years old were tested as a part of the Minnesota Children's Pesticide Exposure Study during the summer of 1997. By-products of chlorpyrifos

were found in 93 percent of the samples.[184] In a separate study, 99 percent of 110 Seattle area children ages two to five had detectable levels of organophosphate residues in their urine.[185]

Toxicological Data Requirements for Lawn Pesticide Registration

- Before pesticides can be marketed and used in the U.S., they must meet toxicological data requirements. The producer of the pesticide must provide data from tests done according to EPA guidelines.[186] Pesticides registered for use on food crops must undergo testing to evaluate whether they have the potential to cause harmful effects on humans, wildlife, fish, and plants. Pesticides not intended for use on food are not required to undergo the same degree of testing as those used on food.

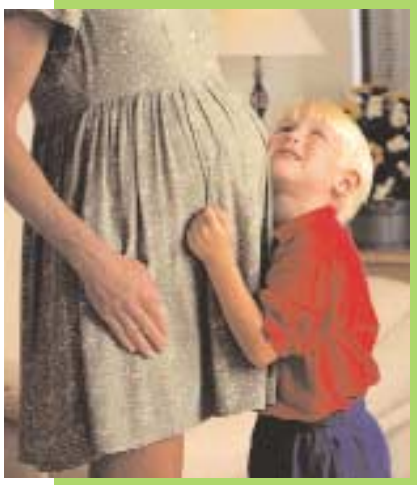
- Lawn pesticides are categorized by EPA as "terrestrial nonfood use" pesticides and are required to have the following data requirements for registration:[187]

    - Acute oral toxicity - rat
    - Acute dermal toxicity - rabbit
    - Acute inhalation toxicity - rat
    - Primary eye irritation - rabbit
    - Primary dermal irritation - rabbit
    - Dermal sensitization - guinea pig
    - Acute delayed neurotoxicity - hen (only for organophosphates or compounds structurally related to substances that cause delayed neurotoxicity).

- Data are not required to evaluate the long-term toxicity of lawn-care pesticides because EPA assumes that "exposure to lawn-care pesticides does not occur on a routine basis over long periods of time."[188]

- Since the majority of the most commonly used lawn-care chemicals (29 out of the 35) also are used on food or feed crops, the EPA has more extensive data bases for these chemicals, including sub-chronic and chronic toxicity data.[189] The third most heavily used herbicide, MCPP, has not been fully tested for chronic health effects since it is not allowed to be used on food crops.

Pesticides not intended for use on food are not required to undergo the same degree of testing as those used on food.



80 million pounds of conventional active ingredients are used on lawns and gardens in the United States. Herbicides/plant growth regulators are the most common type of pesticide used by homeowners.

- Despite EPA's requirements, most pesticides have not been fully tested to determine their potential to adversely affect developing organ systems and functions. During the past decade, scientists have become especially concerned that pesticides, including organophosphates, may interfere with normal growth and development in fetuses and children.

- In 1993, the NAS Committee on Pesticides in the Diets of Infants and Children concluded: "The data strongly suggest that exposure to neurotoxic compounds at levels believed to be safe for adults could result in permanent loss of brain function if it occurred during the prenatal and early childhood period of brain development."[190] Organophosphates are acutely toxic to the central and peripheral nervous systems of humans, and they can cause irreversible damage and death at high doses.

- EPA has largely neglected the testing of pesticides to identify possible harm to the developing nervous system. In one of its only reviews, EPA found that among nine pesticides tested, six were more harmful to young animals than to adults.[191]

Amount of Pesticides Used on Lawns and Gardens

- There is no national pesticide use reporting system in place in the U.S., although EPA and USDA do provide estimates of pesticide use based on statistical sampling methods and/or survey data. EPA uses information that it collects along with USDA surveys and other public and proprietary sources in order to estimate pesticide sales and usage in the U.S.[192]

- The table on the opposite page shows that 80 million pounds of conventional active ingredients are used on lawns and gardens in the United States. Herbicides/plant growth regulators are the most common type of pesticide used by homeowners.

U.S. Pounds of Conventional Pesticide Active Ingredient
By Pesticide Type and Market Sector, 1999 Estimates
(a.i. = active ingredient)

	Herbicides/ Plant Growth Regulators		*Insecticides/ Miticides*		*Fungicides*		*Nematicide/ Fumigant*		*Other Conventional (1)*		*Total*	
Sector	*Mil lbs of a.i.*	%	*Mil lbs of a.i.*	%	*Mil lbs of a.i.*	%	*Mil lbs of a.i.*	%	*Mil lbs of a.i.*	%	*Mil lbs of a.i.*	%
Agriculture	428	80%	93	74%	45	57%	115	82%	25	76%	706	77%
Ind/Comm/ Gov	52	10%	19	15%	24	30%	24	17%	7	21%	126	14%
Home & Garden	54	10%	14	11%	10	13%	1	1%	1	3%	80	9%
Total	534	100%	126	100%	79	100%	140	100%	33	100%	912	100%

Source: USEPA. 1998-1999 Pesticide Market Estimates. Available at http://www.epa.gov/oppbead1/pestsales/99pestsales/usage1999_table3_4.html
(1) "Other Conventional" pesticides include rodenticides, mulluscicides, aquatic and fish/bird pesticides, and other miscellaneous conventional pesticides.

- Though the home and garden use of pesticides represents a small percentage of overall pesticide application when compared to the agricultural sector, it may cause greater human exposure. Homeowners use up to 10 times more chemical pesticides per acre on their lawns than farmers use on crops.[193] In addition, homeowners applying their own pesticides may be directly exposed through inhalation, dermal exposure, and ingestion.

- The percent of pesticides used in homes and garden varies by state. In New York, the Office of the New York Attorney General estimates that in New York, more pesticides are used by commercial applicators in non-agricultural settings than by farmers for food crops. This estimate was developed from reports by commercial applicators demonstrating "the overwhelming amount of pesticides that are used in suburban and urban areas."[194]

The Office of the New York Attorney General estimates that in New York, more pesticides are used by commercial applicators in non-agricultural settings than by farmers for food crops.[194]

Lawns cover 30 million acres of land in the United States. The industry that has evolved to take care of lawns has become a multibillion-dollar business.[195]

Percent of Households Using Pesticides in the Home and Garden in the U.S.

- According to the most recent data available, nearly 75 percent of U.S. households used some type of pesticide in their home and over half of all households (56 million) are estimated to have used insecticides.
- Lawns cover 30 million acres of land in the United States. The industry that has evolved to take care of lawns has become a multibillion-dollar business.[195] Consumers spent about $2 billion on pesticides for the home and garden in 1997.[196]

Number of U.S. Households Using Pesticides, 1996

	Number of Households (In millions)
Total U.S. households	100
Insecticides	56
Fungicides	38
Herbicides	14
Repellants	17
Disinfectants	42
Any pesticides	74

Source: Aspelin A and Grube A. Pesticide industry sales and usage: 1996 and 1997 market estimates. USEPA Office of Pesticide Programs. Table 7. Available at http://www.epa.gov/oppbead1/pestsales/97pestsales/table9.htm. EPA estimates based on Agency file information and various other sources, including 1997 Census of Agriculture.

User Expenditures for Pesticides in the U.S. For Home and Garden, 1997 Estimates[197]

	Million Dollars	*Percent of Total Pesticide Sales(1)*
Herbicides/ Plant Growth Regulators	$493	7%
Insecticides/ Miticides	$1,378	39%
Fungicides	$26	3%
Other (2)	$164	24%
Total	$2,061	17%

(1) Includes agriculture and industry/commercial/government sales
(2) Includes nematicides, fumigants, rodenticides, molluscicides,
Source: USEPA. 1996–1997 Pesticide Market Estimates: Tables and Charts. Table 2.