



## Kids on the Frontline in Minnesota

*The science is very clear: our food system's continued reliance on pesticides is harming the health of children in Minnesota's rural communities and beyond.*

Children in agricultural communities are exposed to pesticides above and beyond the exposures all kids share from residues on food and applications in schools, parks, homes and gardens.

Pesticides applied in agricultural fields rarely stay where they're put, traveling on wind currents and contaminating water and soil. These chemicals are found in nearby homes, schools and playgrounds.

In recent years, the science linking pesticide exposure to childhood health harms has gotten consistently stronger—particularly for childhood cancers and neurodevelopmental harms. National health data show that these and other childhood diseases and disorders are on the rise.

Scientists have understood for years that children are particularly vulnerable to the harms of pesticides. Relative to their size, kids eat, breath and drink much more than adults; an infant takes in about 15 times more water per pound of body weight. Up to age 12, a child inhales roughly twice as much air. For rural children, economic and social stressors can further amplify the health risks of agricultural chemicals.

Children living in agricultural communities—in Minnesota and beyond—are bearing the burden of our ongoing reliance on pesticides. It's time to build a system of food and farming that protects and promotes the wellbeing of all children, while also supporting thriving rural economies and ensuring a safe and healthy food supply.

### State agriculture in focus

With 74,000 farms, Minnesota is among the top 10 states in the country in terms of farm acreage; it is fourth in the nation in agricultural exports and fifth in income from agriculture. Twenty-six million of the state's 51 million acres of land are under agricultural production. Corn, soy and wheat are grown on the majority of farmed acres, just over 18 million combined.

Minnesota ranks third in the nation for soy and spring wheat production, and fourth in the country for corn. Though the total number of farms under organic production remains small (599 operations in 2012), Minnesota ranks seventh in the nation in total organic acreage with over 150,000 acres planted, and first in organic production of both corn and soy.

Other significant crops grown in the state include sugarbeets, alfalfa, oats, dried beans, barley, sweet corn, peas, sunflowers and potatoes. As of 2014, Minnesota was tied with Michigan for seventh in the country with 43,000 acres of potato production.

TABLE 1

Top Eight Agricultural Pesticides in Minnesota (2011)

Pesticide	Pesticide	Volume (million lbs)	Associated health effects	Crops registered for use in MN
Glyphosate	Herbicide	27	"Probable" carcinogen**	corn, soy, wheat
Metam sodium	Fumigant	5.8	Carcinogen, acute toxicity, developmental or reproductive toxicant, suspected endocrine disruptor	potatoes
Acetochlor	Herbicide	3.9	Slight acute toxicity, carcinogen, suspected endocrine disruptor	corn
S-Metolachlor	Herbicide	1.8	Possible carcinogen, suspected endocrine disruptor	corn, potatoes, soy
Propionic acid	Herbicide	1	Acute toxicity	corn, hay
Chlorpyrifos	Insecticide	0.79	Cholinesterase inhibitor, moderate toxicity, suspected endocrine disruptor	corn, soy, wheat
Atrazine	Herbicide	0.75	Slight acute toxicity, carcinogen, suspected endocrine disruptor	corn
2,4-D	Herbicide	0.72	Moderate toxicity, possible carcinogen, suspected endocrine disruptor	corn, wheat

MN Department of Agriculture sales data, [http://www2.mda.state.mn.us/webapp/lis/chemsold\\_default.jsp](http://www2.mda.state.mn.us/webapp/lis/chemsold_default.jsp). For associated health effects, see PAN's [whatsonmyfood.org](http://whatsonmyfood.org) & [pesticideinfo.org](http://pesticideinfo.org). \*\*The World Health Organization listed glyphosate as a probable carcinogen in 2015.

## Key crops & pesticides

Although pesticide applicators in Minnesota keep track of every chemical they use requiring a permit, they are not required to disclose that information to the public. Specific details about the location and volume of use is not available. However, use patterns for the state's primary crops—based on U.S. Department of Agriculture's Chemical Use Surveys and the state's pesticide sales data—give an approximation of potential exposures in agricultural communities.

According to USDA data, herbicides were applied to more than 97 percent of corn, soy and wheat fields across the country in 2014. More than 1,000 herbicide products are currently registered for use on corn, and more than 300 for soybeans.

Almost half (49%) of spring wheat fields were also treated with fungicides, and 12 percent were treated with insecticides. An increasingly common practice is an additional "non-pesticidal" use of the herbicide glyphosate to desiccate wheat before harvest, which is done for convenience during harvest but is not for the purpose of managing weeds.

Conventional potato production is also particularly chemical-intensive, according to USDA data. The top three chemicals reported for use in potato fields are the herbicide metribuzin and the fungicides chlorothalonil and mancozeb. Organophosphate (OP) insecticides, like dimethoate, are also commonly used in potato production. Soil fumigants like metam sodium are generally applied at very high rates per acre and are prone to drift off-site.

## Pesticide exposure & children's health



Children in agricultural communities can face exposure to pesticides in air, water and dust, at home and at school or on playgrounds. As listed in Table 1, six of the top eight pesticides used in Minnesota have been linked to cancer. In addition, six of the top pesticides used in the state are suspected endocrine disruptors, and three have been linked to developmental harms or birth defects.

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### Cancer

According to the Centers for Disease Control and Prevention (CDC), leukemia and brain tumors are the most common—and fastest rising—types of cancer among children; these two childhood cancers have risen between 40 and 50 percent since 1975. There are links between pesticide exposure and increased risk of leukemia and brain tumors.

The overall childhood cancer rate in Minnesota is slightly above the national average, and overall incidence of leukemia and non-Hodgkin lymphoma are higher. Minnesota leukemia incidence is 16.0 per 100,000 and non-Hodgkin lymphoma 23.0 per 100,000, compared to nationwide numbers of 13.2 and 19.2 per 100,000, respectively.

One 2015 study from the University of Chicago and the National Cancer Institute found that children living near production of dry beans, sugar beets and oats were more likely to have leukemia. The study analyzed county-level agricultural census data and cancer incidence registries in six Midwestern states: Iowa, Illinois, Indiana, Michigan, Ohio and Missouri.<sup>1</sup>

### Neurodevelopmental effects

Prenatal and early childhood exposure to a range of common pesticides increases the risk of developmental disorders and delays, which continue to be on the rise nationwide.

Even at very low levels, these early-life exposures can cause permanent injuries to the developing human brain—which is particularly vulnerable to toxic chemicals. Some 15 percent of all U.S. children—one of every six—have one or more developmental disabilities. This num-

ber rose 17 percent between 1997-2008. For some disorders, the numbers are rising even more rapidly.

Nationally, the rise in rates of autism spectrum disorder (ASD) is particularly dramatic, with boys more affected than girls. According to CDC's latest estimates in 2012, one of every 68 U.S. children are affected, with boys more affected than girls. One in 42 U.S. boys is now on the autism spectrum. This represents a 123 percent increase in just 10 years.

A number of pesticides have been linked to increased risk of effects on neurodevelopment, and a compelling number of studies have reported adverse effects on cognitive development associated with exposure to various organophosphate (OP) insecticides.

- A 2014 UC Davis study of more than 1,600 children in California's Central Valley found that women who lived within a mile of agricultural fields where OP insecticides were applied during pregnancy had a 60 percent increased risk of having children with ASD. Living near fields where pyrethroids were applied also increased risk for both ASD and developmental disabilities.<sup>2</sup>
- Researchers from Chile reviewed more than two dozen studies published between 2002 and 2012 exploring the impact of pesticide exposure on children's developing nervous system. This meta-analysis found that "all but one of the 27 studies evaluated showed some negative effect of pesticides on neurobehavioral development."<sup>3</sup>

The rate of children diagnosed with ASD in Minnesota is slightly higher than the national average.

### Drift from potato fields

From 2006 to 2009, PAN worked with communities to collect air samples using the Drift Catcher at 19 sites in northern Minnesota. The fungicide chlorothalonil, which is frequently used on potatoes in Minnesota's wet climate, was found in 217 of the 340 air samples taken. More recently, in 2015, air monitoring samples were positive for metam sodium, a fumigant applied to potato fields prior to planting. Chlorothalonil is an EPA "probable" carcinogen, while metam sodium is a carcinogen, acutely toxic and a suspected endocrine disruptor.

### “Spring flush” & seasonal exposure

Surface water is contaminated with agrichemicals in a seasonal fashion, with very large amounts of water-soluble herbicides washing into water with spring rains. This seasonal occurrence is called the “spring flush” and has been documented by the U.S. Geological Survey (USGS) since at least 1991.

This seasonal exposure has an impact. Researchers in Minnesota found that conception in the springtime led to significantly more children born with birth defects, compared to children conceived in any other season. One study examined reproductive health outcomes from 1,532 children, including 695 farm families with parent-reported birth defects. Their data support the hypothesis that exposure to a number of environmental agents present in the spring—like her-

bicides—may be associated with an increased risk of birth defects.

In addition, increased odds of being born with neurobehavioral effects were associated with the use of the herbicide glyphosate, and significantly less male children were born to applicators who used fungicides.

Another study conducted nationally on birth defects, the month of conception, and the presence of the herbicide atrazine (as well as nitrates and other pesticides) in water found a significant association between the season of high levels of agrichemicals in the surface water during the month of conception and birth defects.<sup>4</sup>

## Necessary changes

It’s time to build a system of food and farming that protects and promotes the wellbeing of our children—while also supporting thriving rural economies and ensuring a safe and healthy food supply. The following common-sense changes are both possible and long overdue. We urge policymakers to:

- Set ambitious national and Minnesota-specific goals to reduce pesticide use.
- Establish a publicly accessible pesticide use reporting system in Minnesota to track and reward progress toward this goal.
- Prioritize phasing out the use of those pesticides most harmful to children. In addition, protective pesticide-free buffer zones should be established around schools, daycare centers and other sensitive sites in rural agricultural areas across Minnesota.
- Provide significant and meaningful support, incentives and recognition for farmers stepping off the pesticide treadmill. National and state programs must prioritize investment in healthy, sustainable and resilient agricultural production.

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1. Booth, Benjamin J., et al. “Agricultural Crop Density and Risk of Childhood Cancer in the Midwestern United States: An Ecologic Study.” *Environmental Health* 14, no. 1 (December 2015). doi:10.1186/s12940-015-0070-3.
  2. Shelton, Janie F., et al. “Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study.” *Environmental Health Perspectives*, June 23, 2014. doi:10.1289/ehp.1307044.
  3. Muñoz-Quezada, María Teresa, et al. “Neurodevelopmental Effects in Children Associated with Exposure to Organophosphate Pesticides: A Systematic Review.” *NeuroToxicology* 39 (December 2013): 158–68. doi:10.1016/j.neuro.2013.09.003.
  4. Garry V.F., et al. “Birth defects, season of conception, and sex of children born to pesticide applicators living in the Red River Valley of Minnesota, USA.” *Environmental Health Perspective*. 2002. 110(3): 441–449.

For a full list of relevant resources, see the report *Kids on the Frontline* at [www.panna.org/KoF](http://www.panna.org/KoF).

