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The pesticides we eat: pesticide health risks and EPA pesticide regulation

Elisabeth Newcomb Sinha

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Introduction

The public trusts that government agencies ensure the safety of the food supply by restricting pesticide use to harmless levels, though increased consumption of organic products may indicate consumer skepticism. Increased concern about pesticide exposure motivates more examination of the EPA's regulatory process. To what extent have pesticide regulations become more restrictive in response to dietary risks? Are regulatory outcomes especially protective of infants and children by restricting use on foods commonly consumed by children?

Many health, environmental, and economic concerns affect pesticide regulation, but dietary risk has been a primary motivator of government action. In 1996, the Food Quality and Protection Act directed the EPA to increase scrutiny of the dietary risks of pesticides in several ways. Instead of balancing dietary risk with the benefits of the pesticide, the EPA would adopt a "reasonable certainty of no harm" standard. This standard should preclude the interests of other stakeholders, such as farmers and pesticide manufacturers. The act also ordered the EPA to pay special attention to the risks to sensitive populations, such as infants and children.

To analyze the extent to which pesticide regulation is sensitive to dietary risks, I consider 2700 food uses of pesticides subject to the reregistration program. Many of these pesticides were first registered in the 1950s and 1960s, when safety reviews of pesticides were limited. The reregistration program provided a comprehensive review of the health risks of these pesticides.

Dietary risks

Dietary risk measures are not 'risk' in a strict sense, but ratios of estimated dietary exposure to pesticide to a 'safe' level of exposure to a pesticide:

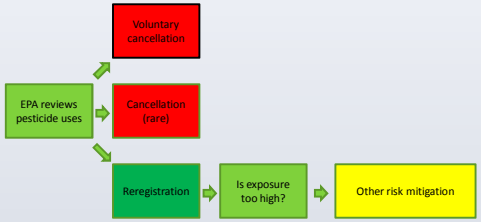
Dietary risk = estimated exposure/safe exposure (higher values=higher risk)

- Exposure = daily food intake*pesticide residue
- Safe exposure = Chronic Reference Dose

I calculate exposure and risk separately for population, children, and infants. There are special concerns about the effects of pesticides on infants and children. The National Academy of Sciences report, *Pesticides in the Diets of Infants and Children*, pointed out that since children are still developing, pesticides may affect them more than adults. Children also tend to eat a narrower range of foods, meaning that a large proportion of their diets derive from just a few commodities, and may consume more relative to their body weight than adults do.

Outcomes of Pesticide Regulation

Pesticides may be reregistered or cancelled. If they are reregistered, they dietary risk may be mitigated by reducing pesticide usage in other ways.



The dataset of pesticide reregistration decisions includes:

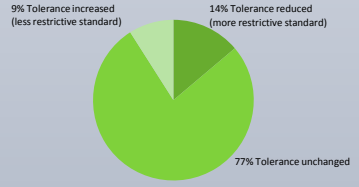
120 pesticide active ingredients:

- Herbicides: 97% reregistered
- Insecticides: 71% reregistered
- Fungicides: 77% reregistered

Over 200 crops:

- Field crops: corn, soybeans, wheat
- Fruits and vegetables: green beans, peaches, apples
- More obscure crops: taro, citron, lingonberry

If pesticide uses are reregistered, the EPA sets a maximum amount, or tolerance, of pesticide residue that can persist on food at the point of purchase.



Effect of dietary risk on pesticide cancellation and tolerance changes

Dietary risk has little effect on whether a pesticide is cancelled, but pesticides with high expenditures are significantly more likely to remain registered:

Log population dietary risk	-0.015*
	(0.009)
Log of pesticide expenditures	0.029***
	(0.010)
Expenditures missing	-0.083*
	(0.050)

Probit marginal effects. Outcome variable is one if pesticide use was reregistered, zero if cancelled. Robust standard errors clustered by active ingredient. *** p<0.01, ** p<0.05, * p<0.1

Above a dietary risk threshold for children (where estimated pesticide exposure exceeds safe exposure), pesticide uses are less likely to be reregistered:

Population dietary risk threshold			0.0822
			-0.05
Child dietary risk threshold	-0.118*		-0.0993***
	-0.063		-0.046
Infant dietary risk threshold		-0.107*	-0.1106*
		-0.061	-0.063
Constant	1.061***	1.078***	1.0781***
	-0.219	-0.229	-0.229

Probit marginal effects. Outcome variable is one if pesticide use was reregistered, zero if cancelled. Robust standard errors clustered by active ingredient. *** p<0.01, ** p<0.05, * p<0.1 One- and two-year-olds are classified as infants; children are aged 3-5 years. Models include 1300 observations for which dietary risk data was available.

Dietary risk has a significant effect on whether a pesticide tolerance is reduced, and pesticide expenditures do not predict whether a tolerance will be reduced:

Log population dietary risk	-0.061**	-0.063**
	(0.019)	(0.020)
Log of pesticide expenditures		0.015
		(0.038)
Expenditures missing		-0.155
		(0.107)

Ordered probit. Conditional on successful reregistration. A 1% increase in risk predicts a 1.3% increase in the probability of a tolerance reduction. Based on 1083 observations for which dietary risk data is available. Expenditures missing is a dummy variable that takes the value of one when the expenditures data is unavailable.

The EPA did not respond differently to dietary risk for pesticide uses with high expenditure.

Log of Population Risk*Expenditure Quartile 1	-0.0145	-0.0215**
	(0.00949)	(0.00948)
Log of Population Risk*Expenditure Quartile 2	-0.0250**	-0.0300**
	(0.0118)	(0.0128)
Log of Population Risk*Expenditure Quartile 3	-0.0129	-0.0205*
	(0.00969)	(0.0112)
Log of Population Risk*Expenditure Quartile 4	-0.0386*	-0.0481**
	(0.0215)	(0.0194)
Expenditure Quartile 2	0.0230	0.0172
	(0.0417)	(0.0400)
Expenditure Quartile 3	0.0789**	0.0761**
	(0.0373)	(0.0356)
Expenditure Quartile 4	0.170***	0.177***
	(0.0508)	(0.0483)
Constant	0.5021***	0.3751*
	(0.1847)	(0.2270)
Crop group effects	No	Yes
Observations	708	708

Probit. marginal effects. Quartile 4 contains the pesticide uses with the highest level of expenditure by farmers.

Conclusions

Pesticide uses with higher chronic dietary health risk are more likely to be cancelled by the EPA, though these coefficients are not significant at conventional levels. However, for pesticide uses that are reregistered, higher risk uses are significantly more likely to have more restrictive tolerances. Pesticide uses with higher chronic health risks to infants and children were less likely to be reregistered, with coefficients and significant levels mirroring that of the population.

References

National Research Council, Committee on Pesticides in the Diets of Infants and Children. *Pesticides in the Diets of Infants and Children*. Washington, DC: National Academy Press, 1993.

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