Pesticides and Human Health —An Epidemiologic Approach—

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PESTICIDES cause several deaths in North Carolina each year, and they are responsible for many nonfatal poisonings. They rank fourth on the list of poisonings reported to the Duke Poison Control Center (*1*). Pesticide products are abundant because they are essential to agriculture and pest control in homes. In 1971 pesticide production in the United States exceeded 1 billion pounds (*2*), including 34,000 registered products representing 800 different compounds (*3*). Their widespread availability creates a significant health hazard.

The North Carolina Pesticides Program began in January 1969 as 1 of 16 federally sponsored programs initiated to determine the impact of pesticides on human health. Early activities were limited to air monitoring and submitting autopsy specimens for residue analysis. Over a 4½-year period, the program has expanded into an aggressive epidemiologic attack on many health-related problems of pesticides. The major activities of the program include investigation of acute poisonings, community usage studies, occupational exposure monitoring, information service, and legislation and control.

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Investigation of Acute Poisoning

During the spring of 1970, a voluntary pesticide poisoning reporting system was initiated. In this system, report forms are sent to practicing physicians, poison control centers, and health departments across the State. As completed cards are returned, reporting physicians are contacted, and when further information is required, a field investigation is begun. From 1970 to 1972, 381 cases of pesticide exposure were reported to the North Carolina Pesticide Program, and 154 were investigated in detail. Of the 381 cases, 155 were symptomatic, and 29 were fatal. Almost half the cases were children under 10 years old.

Onsite inspection of a farm or home often yields information that is not obtained by the most thorough routine history.

Case 1

A 7-year-old girl was in a comatose state when admitted to the hospital. She had experienced nausea and vomiting the evening before admission. She was treated symptomatically. After a restless evening, the patient lost her ability to walk, complained of difficulty seeing, and became progressively unresponsive. Physical signs included miosis, rales in both lung fields, and minimal response to painful stimuli. While the possibility of poisoning was considered, no history of exposure could be obtained despite careful questioning of her parents. An immediate inspection of her home revealed a discarded 5-gallon drum collecting rainwater in the backyard. The label identified the original contents as Dasanit, a potent organic phosphate insecticide. Neighborhood children reported that the girl had been making mudpies using a plastic bottle filled with water from the pesticide drum on the day she became ill. She had sprayed some of the water into her mouth. Her diagnosis was confirmed by a depressed blood cholinesterase level, and she had a dramatic clinical response to atropine and 2-PAM.

Many reports of child poisoning are those of asymptomatic episodes which involve questionable ingestions or exposure to low-toxicity compounds such as warfarin, but in our investigations, three-fourths of the patients in the older age groups were symptomatic. Many severe poisonings were due to occupational exposure—applying pesticides or harvesting treated crops. Twenty-six percent of all our cases were agriculture related.

Agriculture poisonings occur when farm personnel disregard the label precautions to wear protective clothing and respirators when mixing or applying pesticides or when they enter fields before the suggested waiting period after application.

Rural disposal site for pesticide containers

Case 2

A 15-year-old black male fainted while "cropping" (harvesting) in a tobacco field. He arrived at the hospital emergency room in a semistuporous condition with marked salivation, muscle fasciculations, and constricted pupils. The diagnosis of organic phosphate poisoning was confirmed by a serum cholinesterase that was less than 10 percent of normal, and he responded to atropine therapy. Investigation at the farm where he became ill revealed that 4 days earlier the patient had been operating a tractor-drawn spray rig in the tobacco field when a second rig passed and accidentally sprayed him with parathion (organic phosphate insecticide). He did not feel sick at the time, but he became gravely ill when he was exposed to pesticide residue on the tobacco leaves several days later.

Pesticide Studies

Community usage. The risk of poisoning in a community depends on usage patterns and prevalence of pesticides in the area. A countywide survey was conducted during 1969–70 to evaluate pesticide storage, disposal, and application paterns on 245 randomly selected farms. All active farms used some pesticides. The results suggested a serious poisoning potential when 68 percent of the farmers indicated that they had never used safety clothing during application. Seventy percent of the farmers discarded used containers in the woods or left them in the fields.

A recent survey of 100 retail outlets in one North Carolina county showed that almost 1,200 pesticides produced by 228 manufacturers were available, including some extremely hazardous and obsolete substances such as phosphorus and thallium sulfate. (Thallium products have not been registered for home use since 1965.) More than 40 products could be purchased for roach control alone, with toxicities varying from moderately toxic to super toxic, as classified by Gleason (*4*).

The types of stores which sell pesticides and the number of products they carry are shown in

Hogs rummage among empty pesticide containers

Number of pesticide products found in 97 retail stores in 1 county, North Carolina

Type	Stores surveyed[1]	Pesticide products found	
		Mean	Range
Grocery	18	14	2–39
Rural general	6	20	4–37
Service station	5	1	1–2
Hardware	6	40	6–60
Farm supply	35	51	12–113
Combination farm center	6	80	30–54
Variety	12	16	2–52
Pharmacy	7	20	13–51
Nursery	2	43	25–62
Total	97	32	1–113

[1] Of 100 stores surveyed, 3 did not carry pesticides.

the table. The plethora of products makes identification and treatment difficult, since frightened parents often recall only that their child got into "roach poison" without knowing whether it was sodium fluoride, boric acid, or an organic phosphate. Few retailers can offer expert advice on handling all the toxic compounds available to consumers.

Occupational exposure. Pesticides are formulated by 23 plants in North Carolina. Supplied with bulk chemicals from large manufacturers, these small plants combine and repackage products for farm and home use. Plant workers are at high risk from inhalation and dermal absorption of pesticides.

For several years, personnel from the pesticide program have monitored cholinesterase levels in three groups of formulators. While no clinical illness has occurred in the plants under surveillance, we have recommended removing workers from exposure areas when their cholinesterase levels became depressed. We also participate in a study with the North Carolina State University Agricultural Extension Service monitoring blood cholinesterase levels among groups of tobacco and cotton scouts who make field counts of insects to determine the need for pesticide applications.

Discussion

The North Carolina Pesticide Program publishes monthly newsletters and poison control notes which supply physicians with up-to-date information, including treatment advice, about morbidity patterns which occur throughout the State. We have distributed charts describing available pesticides, signs of poisoning, and treatment methods to 158 emergency rooms throughout North Carolina. Manuals on pesticide poisoning have been distributed to physicians on request.

Collecting information on pesticide misadventures is of little value if there are no remedies to the problem. Our data have provided impetus for legislation, already passed in the General Assembly, creating tighter controls on the use of pesticides. Members of our staff sit on the interagency North Carolina Pesticide Board and the North Carolina Pesticide Advisory Committee. These two groups are responsible for regulating all aspects of pesticide use in the State, from licensure to the difficult problems of environmental contamination and disposal.

While the North Carolina Pesticide program is still too young to have brought about a dramatic reduction in pesticide morbidity, the trend is encouraging. Excellent cooperation between physicians, poison control centers, and our program has resulted in improved identification and treatment of persons with pesticide poisoning. Farmers are shifting pesticide usage from highly toxic parathion to less dangerous carbamates and bacterial controls. The North Carolina Department of Agriculture and the North Carolina State University Extension Service have begun a drive to educate farmers in the safe use of farm chemicals. The North Carolina Pesticide Board has restricted sales of many of the most toxic pesticides. It is also working toward improving facilities for disposal of hazardous waste. Continuing epidemiologic analysis of acute poisonings and usage patterns, maintaining surveillance of exposed workers, and continuing promotion of regulatory control should result in further progress.

REFERENCES

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