

## The Need for Pesticide Education for Health Care Providers

### Introduction

Pesticides are ubiquitous in American society. We use them in our homes, workplaces, schools and communities. In fact, Americans are at risk for both acute and chronic health effects from agricultural and non-agricultural pesticides exposures:

- *The US Environmental Protection Agency estimates approximately 250-500 physician-diagnosed cases occur per 100,000 agricultural workers (Blondell, 1997).*
- *Data collected from Poison Control Centers found that in 1996, more than 40,000 adults were sufficiently exposed to various types of pesticides to warrant a call to their local Poison Control Center. These exposures were non-agricultural in nature and are believed only to represent less than 30% of the incident cases of acute pesticide-related illness in the United States (Litovitz et al, 1997; Chafee-Bahamon et al, 1983; Harchelroad et al, 1990; Veltri et al, 1987).*
- *Chronic health effects represent a range of adult and childhood illnesses, such as cancer, as well as reproductive and central nervous effects.*

Because of the widespread use of pesticides and the potential for related adverse health effects, primary care providers need to be prepared to recognize, manage, and prevent pesticide-related health conditions in their patients and communities.

The public expects that their primary care providers are prepared to deal with pesticide-related health problems, as well as other environmental-related illnesses. But all too often providers are not able to respond effectively. A survey of environmental medicine content in US medical schools found that 75% of medical schools require only about seven hours of study in environmental medicine over four years (Schenk et al, 1996). Furthermore, once in practice, health care providers' awareness and understanding of pesticide-related illness may or may not ever expand.

The current lack of adequate environmental education for health care providers sounds an alarm for leaders in the health care community, whose professionals are not prepared to deal with pesticide-related illnesses as they are presented. Primary care providers are on the frontline of health care and therefore can play a key role in identifying, treating and preventing potential pesticide poisonings and exposure.

The *National Strategies for Health Care Providers: Pesticides Initiative* aims to improve health care by incorporating environmental issues into education and practice. The Initiative is focused on preparing primary care providers to recognize, manage and prevent pesticide-related health conditions. It is an initiative of The National Environmental Education Foundation (NEEF) in partnership with the US Environmental Protection Agency, and in collaboration with the US Department of Health and Human Services, the US Department of Agriculture, and the US Department of Labor.

Pesticide education is needed in medical and nursing schools, as well as in practice settings, including community clinics, hospitals, and work-place clinics. Providers need to be prepared to:

- Take an environmental history and be prepared to “problem solve” with patients who may have been exposed to pesticides.
- Readily diagnose if appropriate.
- Provide timely treatment for pesticide-related health conditions.
- Provide prevention education.
- Where appropriate, consult with local authorities.

### **Case Studies: Misdiagnosis of Infants & Children**

*Although public health experts are challenged to demonstrate successful prevention of pesticide-related illness, the following cases illustrate that further illness could have been avoided with properly educated and trained health care providers.*

EPA regulates an organophosphate insecticide called methyl parathion for use on specific crops. In the 1980s and 1990s, methyl parathion was used widely in indoor environments by unlicensed applicators. One published report describes methyl parathion-related illness among several siblings, two of whom died (CDC, 1984). Approximately two days before these children were correctly diagnosed, five of them were seen by their local physician and sent back to their contaminated home with a mistaken diagnosis of viral gastroenteritis.

In another case of organophosphate poisoning, Zweiner and Ginsburg (1998) reviewed a case series of 37 infants and children poisoned by organophosphates and carbamates. Of 20 cases transferred to Children’s Medical Center in Dallas, 16 (80 %) had an incorrect transfer diagnosis ranging from encephalopathy and seizure disorder to pneumonia and pertussis.

## **Why Pesticide-Related Health Conditions Are Relevant to Primary Health Care**

Public concern about pesticides can come from a variety of sources. Patients may have heard about pesticide issues in the national or local news, or read about the health effects of acute or chronic exposure to pesticides. Concerned patients may turn to their primary care provider for answers about their own risks of illnesses from exposure to pesticides. They may question providers about acute health effects, as well as potential chronic effects, such as cancer, birth defects, reproductive effects, or other conditions from pesticide exposure.

Providers may get questions from patients about the safe use of pesticides in the home, workplace or school, if their water supply contains harmful chemicals, and whether a skin rash or asthma attack may be related to a pesticide exposure. By helping patients recognize symptoms of pesticide-related illnesses, problem-solve and evaluate risks from pesticides, primary care providers can help patients reduce exposure and prevent future exposures.

### **Acute Health Effects**

While primary care providers may not encounter many patients who have experienced acute pesticide poisoning, it's important for them to have a basic understanding of signs and symptoms, and an ability to diagnose and refer. Many times it is the primary care provider who identifies possible sentinel cases that signify the presence of previously unrecognized pesticide hazards in the community. By notifying the proper authorities of real or potential poisonings, primary care providers can play a critical role in pesticide-related illness surveillance.

#### ***Agricultural Exposures***

Agriculture accounts for 76% of the conventional pesticides used each year (US EPA, 1999b). Pesticide handlers and agricultural workers appear to be at greatest risk for acute pesticide poisoning. Based on states with required reporting of pesticide-related health concerns, EPA estimates there are approximately 250-500 physician-diagnosed cases occur per 100,000 agricultural workers (including pesticide handlers) (Blondell, 1997). Migrant and seasonal farmworkers are especially at high risk since they often work and live in areas where pesticide exposures can be significant.

#### ***Non-agricultural Exposures***

A substantial number of people in the United States are at risk of acute pesticide poisoning from non-agricultural uses. Data collected from Poison Control Centers found that in 1996, more than 40,000 adults were sufficiently exposed to various types of pesticides to warrant a call to their local Poison Control Center. It is estimated that as many as 60% of these individuals developed symptoms of pesticide poisoning. These figures are thought only to represent less than 30% of the incident cases of acute pesticide-related illness in the United States (Litovitz et al, 1997; Chafee-Bahamon et al, 1983; Harchelroad et al, 1990; Veltri et al, 1987).

An estimated 84% of American households use pesticides, according to a 1990 EPA survey (Whitmore et al, 1992). Homeowners annually use 5-10 pounds of pesticide per acre on their lawns and gardens, many times the amount applied by farmers to corn and soybean fields (Robinson et al, 1994). They also use pesticides in the form of disinfectants, including pine oil cleaners, bathroom cleaning products, and cleaning materials for swimming pools. In addition, structural pest control operators and workers in nurseries, greenhouses, and landscaping are also at risk for work-related exposures.

## Chronic Health Effects

Patients may also discuss their concerns about the potential danger of chronic exposure to pesticides with their primary care providers, and providers also must be cognizant that patients may be unaware of exposures. There is recent evidence that the general U.S. population is exposed to an array of organophosphate insecticides, the most widely used insecticides available. There is also a growing body of scientific literature detailing health effects from chronic exposure to pesticides.

Common concerns about chronic exposure to pesticides include:

- **Cancer.** Over 60 active ingredients for pesticides have been classified as probable human carcinogens by EPA or the International Agency for Research on Cancer. Although most of these pesticides are no longer on the market or have had their uses severely restricted, their potential to cause cancer in persons previously exposed is still a concern. A review by the National Cancer Institute (NCI) lists 15 pesticides for which there is evidence of cancer in human epidemiologic studies (Zahm et al, 1997).
- **Central nervous system effects.** Many insecticides and fumigants are designed specifically to target the nervous system of the pest they are intended to control. There is increasing human evidence in the form of case reports and epidemiologic studies that suggests that humans may experience chronic neurologic or neurobehavioral effects following high levels of exposure to certain types of pesticides (Keifer and Mahurin, 1997). Several reports have also found chronic neurological sequelae (reduced neurobehavioral function) after acute organophosphate poisoning (Savage et al, 1988; Rosenstock et al, 1991; Steenland et al, 1994; Stephens et al, 1995).
- **Reproductive effects.** Many pesticides have been identified as developmental or reproductive toxicants based on animal studies. Sever et al (1997) concluded, “there is increasing evidence for reproductive and developmental effects of both maternal and paternal pesticide exposures. Areas of particular concern include infertility and time to pregnancy, spontaneous abortion, neural tube defects, and limb reduction defects.”
- **Asthma.** An Institute of Medicine report (Institute of Medicine, 2000) concluded that although there is evidence suggesting that high level exposures to some pesticides may elicit persistent asthma, there is not enough evidence to say whether an association exists between pesticide exposures at the levels typically encountered in nonoccupational or residential settings and the development or exacerbation of asthma.

## Children’s Pesticide Exposures

Children may be more susceptible than adults to environmental health risks because of their physiology and behavior. They eat and drink more and breathe more air in proportion to their body weight than adults. They also play close to the ground and put objects in their mouths. Their bodily systems are still developing, and they may be less able than adults to metabolize and excrete the pollutants (Landrigan 1997). In the agricultural setting, children may be exposed to pesticides in a number of ways: through prenatal exposure, from being in the fields where their parents work, contact with pesticide residues on parents’ clothing, living in migrant camps next to camps being treated and working in the fields themselves (U.S. Congress, Office of Technology Assessment, 1990). A report by the General Accounting Office (GAO, 2000) found that improvements were needed to ensure the safety of farmworkers’ children.

In non-agricultural settings, children may be exposed to pesticides in their houses, yards, day cares and schools. In 1996, Poison Control Centers were notified about approximately 80,000 children who were exposed to common household pesticides in the United States, one-quarter of whom developed symptoms of pesticide poisoning. In 1992-98, there were an estimated 24,000 emergency department visits annually resulting from pesticide exposure, of which 61% of the cases involved children younger than age 5

(McCaig, 2000; McCaig and Burt, 1999). These figures may represent only a fraction of the incident cases of acute pesticide-related illness in children.

## **Challenge of Diagnosing Pesticide Exposure**

The short-term and many of the long-term health effects associated with pesticide exposure can easily be mistaken for other agents or health conditions. Primary care professionals who can recognize a potential pesticide exposure are more likely to make the correct diagnosis. They need to be familiar with the settings that predispose patients to pesticide exposure, the symptoms associated with these exposures, and appropriate diagnostic methods. Yet many health professionals receive little training in pesticide health issues.

A 1994 survey of environmental medicine content in US medical schools (Schenk et al, 1996) found that:

- Ninety U.S. medical schools (76%) reported requiring environmental medicine content in the curriculum, but only two schools (2%) had a dedicated course.
- Fifty schools (42%) reported no instruction in taking an exposure history.
- Among schools with required environmental medicine instruction, the average time in the curriculum was only seven hours over the four years of medical education. An average of three hours of environmental medicine instruction was provided in preclinical courses and four hours in clinical courses.

Health professional groups, academic institutions, and government and community organizations have called for improved health care provider training in environmental health. The American Medical Association, for instance, adopted a resolution urging Congress, government agencies, and private organizations to support improved strategies for the assessment and prevention of pesticide risks. In addition, two Institute of Medicine committees recommended an integration of environmental health issues throughout the various stages of training and clinical practice for health care providers. (Institute of Medicine, 1995a and 1995b). A third Institute of Medicine committee on environmental justice recommended enhancing health professionals' knowledge of environmental health as well as environmental justice issues (Institute of Medicine, 1999).

## **Necessary Knowledge and Skills**

Primary care providers can be extremely effective in addressing pesticide exposures in their patients and communities. However, they do not need to become experts in order to fill an important and critical role. Based upon a recommendation from an Institute of Medicine report (Institute of Medicine, 1988) "that all primary care physicians should be able to identify possible occupationally or environmentally induced conditions and make the appropriate referrals for follow-up," some of the important pesticide knowledge and skills primary care providers should possess include:

- Taking a brief and relevant environmental and occupational history
- Possessing a basic awareness of environments in which patients live, work, and play
- Recognizing possible signs and symptoms of pesticide exposure
- Identifying possible sentinel cases
- Diagnosing possible associated health conditions, including those of sensitive populations such as children and the elderly
- Having ready access to a recommended referral list of resources and contacts
- Calling upon an appropriate specialist or expert to assist them

- Recognizing when to report exposure incidents to the proper health authorities
- Participating in surveillance systems
- Providing basic preventive guidance for patients.

## Conclusion

Primary care providers can play a much-needed role in recognizing a potential pesticide exposure and in working with pesticide/environmental health experts and resources. They can do this without extensive expertise but must be prepared with increased education and training to identify exposures and work with experts to manage their patients' pesticides-related illnesses. In an educational setting, primary care providers can work with occupational and environmental medicine specialists to design and integrate a pesticides module into a toxicology course for medical students. Faculty can take advantage of existing user-friendly teaching materials, along with user-friendly guides and curriculum maps that indicate where pesticide topics can be inserted.

Two projects that are part of the *National Strategies for Health Care Providers: Pesticides Initiative* will be particularly useful. *National Pesticide Competency Guidelines for Education* and *National Pesticide Practice Skill Guidelines* define education competencies and practice skills that will lead practitioners to effective recognition and management of pesticide-related health conditions and exposures. And the Initiative's Information Gateway is a print, telephone, and web-based resource through which primary care providers can easily access information and educational resources about pesticides.

In a practice setting, primary care providers can incorporate an environmental history into their practice and refer patients to appropriate experts in the event of a suspected poisoning. One resource for primary care providers is the U.S. Environmental Protection Agency's *Recognition and Management of Pesticide Poisonings*, which provides health professionals with information on the health hazards of pesticides currently in use. It deals primarily with acute effects and provides consensus recommendations for management of poisonings and injuries caused by current pesticides (U.S. EPA, 1999a). More resources are under development.

Through effective education and training, health care professionals can build on their existing skills in toxicology, pharmacology, history-taking, and risk communication to provide much-needed guidance to patients on pesticide-related health conditions. With that tenet as its cornerstone, the *National Strategies for Health Care Providers: Pesticides Initiative* will enable primary care providers to improve the recognition, management, and prevention of health effects from pesticide poisonings and exposures.

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