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Catherine Karr MD, PhD , Helen Murphy FNP, MHS , Gwen Glew MD, MPH ,  
Matthew C. Keifer MD, MPH & Richard A. Fenske PhD, MPH

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## Pacific Northwest Health Professionals Survey on Pesticides and Children

Catherine Karr, MD, PhD  
Helen Murphy, FNP, MHS  
Gwen Glew, MD, MPH  
Matthew C. Keifer, MD, MPH  
Richard A. Fenske, PhD, MPH

**ABSTRACT.** The Pacific Northwest includes several regions of pesticide-intensive agriculture, and the health risks of pesticides to children have become a focus of scientific inquiry and public health concern. To prepare a curriculum for regional health care providers on pesticides and child health, we sought to review the experience, attitudes and needs in this subject from the intended target audience. Forty-nine key informants serving high volumes of farmworkers and farm families in agricultural areas of the region were identified: 23 physicians, nine physician assistants, five nurse practitioners, and 12 community health workers completed telephone surveys (98% response rate). These informants serve a high-risk group of children, yet only 49% had any pesticide related health training and only 22% had received child specific information. Regardless of previous training, 55% affirmed the statement, "I use pesticide information in my profession or practice." However, 61% were not comfortable responding to patient/client questions based on their training, background, and experience. Ninety-two percent of the informants endorsed that more pesticide information would be useful in their work, particularly information specific to child health. Format preferences for future training varied. Physicians most frequently mentioned Web-based training materials while mid-level clinicians' most highly requested format was written summaries. The option of a conference/workshop was particularly popular among community health workers. This key informant survey indicates an important pesticide training gap among

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Catherine Karr and Gwen Glew are affiliated with the Department of Pediatrics, University of Washington, Seattle, WA.

Helen Murphy, Matthew C. Keifer, and Richard A. Fenske are affiliated with the Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, WA.

Address correspondence to: Catherine Karr, MD, PhD, Acting Assistant Professor, Pediatrics, Adjunct, Environmental and Occupational Health Sciences, University of Washington, Box 359739, 325 9th Avenue, Seattle, WA 98104-9739 (E-mail: ckarr@u.washington.edu).

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**KEYWORDS.** Pesticides, medical education, child health

In the last decade, health risks to children from exposure to pesticides have become a focus of scientific inquiry and public health concern.<sup>1,2</sup> In particular, the organophosphorus (OP) insecticides have received attention, reflecting their inherent acute toxicity, historical importance in acute intoxication events, and widespread use in residential and agricultural settings.<sup>3,4</sup>

Evidence for their potential to induce long-term neurological sequelae in adults and animal neurotoxicity data demonstrating that early life exposures may impart neurobehavioral deficits have highlighted the need to understand the consequences of relatively low exposures to OP pesticides in children and the developing fetus.<sup>3,4</sup> In recent years, longitudinal cohort studies of pregnant women have yielded preliminary results suggesting a relationship between exposure to OP pesticides in pregnancy and early life with adverse birth outcomes including reduced head circumference and neurobehavioral problems in early childhood.<sup>5-7</sup> These observations may relate to concurrently described organophosphorus-induced toxicological mechanisms of neurotransmitter disruption during fetal development.<sup>8</sup>

Health care providers are at the forefront of recognizing health consequences of pesticide exposure in children and adults. They are also regarded as reliable and trustworthy sources of health risk and prevention information. However, it has been noted that health care providers receive little training in environmental health topics overall and national efforts to address this are underway.<sup>9,10</sup>

In preparation for creating a curriculum on pesticides and children's health, we first sought to assess the knowledge and attitudes of the target audiences on this topic and their preferences for related training material. A description of a targeted survey and the responses of 49 key informants including physicians, nurse practitio-

ners and physician assistants, and community health workers ("promotoras") are provided here. In our region, community health workers (CHWs) or promotoras are additional important sources of health information for Latino farmworking families. As such, they are critical end users as well.

## METHODS

### *Key Informant Recruitment*

Key informants were defined as individuals who came from settings serving high volumes of farmworkers and farm families in agricultural areas of Washington, Idaho, and Oregon. Those in Washington were identified from a list of clinics developed by the Washington State Department of Labor & Industries as part of its effort to identify health care providers for training on a newly required cholinesterase monitoring program (N = 76).<sup>11</sup> The list reflects the clinical sites serving workers and their families residing in areas with the most frequent use of cholinesterase-inhibiting pesticides (organophosphates and carbamates). For Idaho and Oregon clinician contacts, we relied on an unpublished migrant clinic report that assessed provider continuing medical education needs (N = 6, available upon request). Community health workers are not consistently employed at clinics serving the agricultural workforce. We relied on a newly established community health worker network representing 35 individuals in the region to identify key informants likely to counsel agricultural workers and their families.

Personal contacts at a listed site were approached for a recommendation on whom to interview, the criteria being a clinician (physician, physician assistant, or nurse practitioner) or a community health worker seeing a high volume of agricultural worker families. The

clinic manager was our first point of contact for situations in which we had no prior personal contact. This method was used to identify the other key informants for interviews. Because of our focus on child health, we targeted pediatricians and family practice physicians. To reach our goal sample, remaining interviewees were “cold-called” from the lists above, based on our experience with where they were located and likelihood of serving a population of primarily farmworkers.

### ***Study Procedure***

We aimed to interview approximately 20 physicians, 10 physician assistants or nurse practitioners, and 10 community health workers, using a telephone survey. This sample size was based on available resources. An option to mail in a written form of the survey was offered to respondents not desiring phone interviews. The survey instrument and study were approved by the University of Washington Human Subjects Division.

The survey instrument was developed by the authors and field-tested with several providers to ensure understandability and efficiency (less than 15 minutes to perform). Questions were designed to establish respondent familiarity, experience, interest, motivation, and suggestions regarding information and curriculum materials on pesticide exposure and child health. The finalized survey was administered to the key informant physicians by a study team physician (GG) while the mid-level practitioners and community health workers were surveyed by a study team nurse practitioner (HM). The same instrument was used for all groups. A summary of the responses of the key informants and their characteristics were prepared.

## ***RESULTS***

### ***Characteristics of the Key Informants***

Twenty-three physicians, nine physician assistants, five nurse practitioners, and 12 community health workers completed surveys during the spring of 2005. The interviewees identified based on personal contacts were 22% of the physicians, 14% of the mid-level practi-

tioners (MLPs) and 42% of the community health workers (CHWs). The interviewees identified based on recommendation from a clinic manager or other interviewee were 74% of the physicians, 86% of MLPs and 50% of the CHWs. The remainder were identified from “cold calling” from the lists described above.

The physicians were trained as pediatricians (10) or family practice physicians (11) (exceptions were one emergency medicine physician and one internal medicine-pediatrics physician). Two-thirds of the community health workers/promotora informants were community-based, while the remaining third functioned in a supervisory role from a clinical site.

All but one of the key informants who were contacted and invited to participate completed the survey. Four physicians and one physician assistant requested a mailed survey rather than providing telephone responses. One of the mailed surveys was not returned (i.e., non-respondent).

The clinical providers had been in practice an average of more than 10 years, while the CHWs were relatively new in their roles (a mean of 2.9 years). As dictated by our selection criteria, all of our informants served farmworkers and/or farmer families (growers). Unlike the clinical provider informants, very few of the CHWs worked with growers.

### ***Previous Pesticide Training and Use of Pesticide Information in Current Practice***

Approximately half of the informants answered “no” to the question, “Have you had any training on health issues related to pesticides?” and fewer (22%) had any child specific training (Table 1). However, those who had any training overwhelmingly endorsed the statement that they used the training they had received in their professional practice (more than 80% for all groups).

The lack of training was slightly greater among the non-physician informants (Table 1). Sporadic lectures and written materials comprised the format of most of the training received—as determined based on a question to those who endorsed any training. It stated, “if yes, specify the type and length of training” (open ended, no prompts). Only two of the 23 physician respondents cited experience in med-

TABLE 1. Key informant self-reported pesticide training and current use of pesticide information in professional practice

	Total (49)	Physician (23)	Mid-Level Practitioner (14)	Community Health Worker (12)
	N (%)	N (%)	N (%)	N (%)
Any previous training on pesticides & health? <sup>1</sup>				
Yes	24 (49)	13 (57)	5 (36)	6 (50)
If yes, child-specific info? <sup>2</sup>				
Yes	11 (22)	7 (30)	2 (14)	2 (17)
Use pesticide info. in your practice/profession? <sup>3</sup>				
Yes	27 (55)	8 (35)	9 (64)	10 (83)

The related survey instrument questions as they were specifically presented during interview were:

<sup>1</sup>Have you had any training on health issues related to pesticides? Yes or No

<sup>2</sup>If yes, did it involve issues related to children (exposure and or health effects)? Yes or No

<sup>3</sup>Do you use pesticide information in your profession/practice? Yes or No

ical school or residency as the basis for their affirmation of any training. Overall, the community health workers reported their experience reflected specific training sessions and extended workshops.

For the group as a whole, regardless of previous training, 55% affirmed the statement “I use pesticide information in my profession or practice” (Table 1). The context of this information for clinical providers (physicians, mid-level practitioners) was weighted toward use in anticipatory guidance and clinical suspicion rather than responding to patient questions. In contrast, the community health workers reported more use of the information in the context of answering their client’s questions as well as providing anticipatory guidance.

### *Patient Pesticide-Related Questions*

Table 2 summarizes the key informant responses regarding their experience with pesticide-related questions from patients/clients. The clinical provider informants were more likely to report some level of inquiry from patients, whereas a large proportion of community health workers (42%) noted they “never” receive questions from their clients on these issues.

Most (61%) of the key informants were not comfortable responding to patient/client questions based on their training, background, and experience (Table 2). Of the informant groups, only the community health workers included some informants (25%) that responded that

they were “very” comfortable with these questions.

All respondents were asked who in their profession or workplace was most likely to discuss pesticide issues with patients. A list of possibilities, including the professions of respondents plus nurses or “other,” was provided. The most popular choice in all groups was physicians. Nurses were also noted commonly to be responding to these questions.

Respondents were asked where they thought patients/clients received the information on pesticides that prompted questions. Close to a third of the informants responded that they did not know. Among those who felt they had some idea, the most common source selected was “word of mouth.” Radio and TV ranked second across all groups.

### *Pesticide Information: Currently Used Sources, Preferred Educational Format*

We queried informants regarding the importance of gaining more general knowledge about pesticides and more knowledge about children and pesticides (Table 3). The responses to these questions were quite similar for the community health workers and mid-level practitioners, with the majority of both groups choosing to reply that these were very important. On the other hand, only 39% of physicians thought gaining additional knowledge about general pesticide information was very important. When it came to child health specific information, physician

TABLE 2. Key informant experience with patient pesticide questions

	Total (49)	Physician (23)	Mid-Level Practitioner (14)	Community Health Worker (12)
	N (%)	N (%)	N (%)	N (%)
How often clients ask about pesticide-health? <sup>1</sup>				
Never	14 (29)	7 (31)	2 (14)	5 (42)
Rarely	21 (43)	12 (52)	6 (43)	3 (25)
Sometime	11 (22)	3 (13)	5 (36)	3 (25)
Often	3 (6)	1 (4)	1 (7)	1 (8)
Do they ask about pesticides and: <sup>2</sup>				
Skin problems?	15 (31)	3 (13)	9 (36)	3 (25)
Asthma?	12 (25)	6 (26)	4 (29)	2 (17)
Birth outcomes?	6 (12)	2 (9)	3 (21)	1 (8)
Cancer?	7 (14)	4 (17)	0 (0)	3 (25)
Neurodevelopment?	6 (12)	3 (13)	2 (14)	1 (8)
How comfortable are you in responding to pesticide health questions? <sup>3</sup>				
Very	3 (6)	0 (0)	0 (0)	3 (25)
Somewhat	16 (33)	9 (39)	5 (36)	2 (17)
Not at all	30 (61)	14 (61)	9 (64)	7 (58)

The related survey instrument questions as they were specifically presented during interview were:

<sup>1</sup>How often do your patients/clients ask you about pesticide-related issues?

Never  Rarely  Sometimes  Often

<sup>2</sup>(Probes) Do they question you about:

- Acute health conditions (e.g., skin, asthma)
- Birth outcomes
- Cancers
- Neurodevelopmental problems

<sup>3</sup>With your training, background and or experience, how comfortable do you feel answering patients'/clients' questions/ (if they had them)?

Very  Somewhat  Not

responses changed toward greater interest and 65% of physicians said this was very important.

In addition, respondents were asked about their interest in gaining knowledge specific to child neurodevelopment and pesticides. None of the groups distinguished their interest in children specific information from their interest in child neurodevelopment specific information.

Table 3 identifies how informants felt about the utility of this information in their day to day work. A clear affirmation of this was observed for all groups (92%). Of the clinical providers who felt it would be useful, they indicated it would be most useful for the purposes of anticipatory guidance and clinical problem solving, followed by usefulness in answering patient questions.

Respondents were asked for their preference of formats to summarize and disseminate educational materials. A list of possibilities was provided and respondents were requested to

choose their top three. The most popular formats selected were Web-based training or information, written summaries, and workshops/conferences. Physicians most frequently mentioned Web-based continuing education training programs. Mid-level clinicians' most highly requested format was written summaries. The option of a conference/workshop was particularly popular among the community health workers.

When given a list of potential sources of pesticide information consulted in their normal course of work, clinician key informants most commonly reported relying on the poison control center network (62%), the Internet (41%), and colleagues/experts (35%) in the community. Community health workers also relied heavily on colleagues/experts (50%) and the internet (43%) but were not as likely to cite the poison center (8%) as a commonly used source.

TABLE 3. Key informant impressions regarding new pesticide information

	Total (49)	Physician (23)	Mid-Level Practitioner (14)	Community Health Worker (12)
	N (%)	N (%)	N (%)	N (%)
How important is it to you to gain more knowledge re:				
Pesticides, in general? <sup>1</sup>				
Very	29 (59)	9 (39)	11 (79)	9 (75)
Somewhat	17 (35)	11 (48)	3 (21)	3 (25)
Not	3 (6)	3 (13)	0 (0)	0 (0)
Children's health & pesticides? <sup>2</sup>				
Very	36 (73)	15 (65)	12 (86)	9 (75)
Somewhat	12 (25)	8 (35)	1 (7)	3 (25)
Not	1 (2)	0 (0)	1 (7)	0 (0)
Would more pesticide info be useful in your work? <sup>3</sup>				
Yes	45 (92)	21 (91)	13 (93)	11 (92)
If yes, for: <sup>4</sup>				
Anticipatory guidance/prevention messages?	39 (80)	19 (83)	11 (78)	9 (75)
Clinical problem-solving		17 (74)	11 (78)	n/a
Answering client/patient questions	32 (65)	15 (65)	8 (57)	9 (75)

The related survey instrument questions as they were specifically presented during interview were:

<sup>1</sup>How important to you is gaining knowledge about pesticides in general?

Very  Somewhat  Not

<sup>2</sup>How important to you is gaining knowledge about the health risks of pesticide exposure to children?

Very  Somewhat  Not

<sup>3</sup>Do you feel that additional pesticide information will be **useful** in your work

Very  Somewhat  Not

<sup>4</sup>If yes **how** would you use it?

Anticipatory guidance  Clinical suspicion  To answer patient/client questions

State agencies and professional organizations were not commonly noted as resources (<10%).

Respondents were also queried as to suggested formats and means to reach the agricultural community on pesticide issues related to health. The majority of the community health workers had ideas on how to deliver pesticide-related information to their clients; however, close to a quarter of the clinical providers felt they could not make a suggestion. Furthermore, there were differences in opinions among the providers groups regarding how pesticide information should be disseminated to agricultural workers. The most common response among the physicians was pamphlets, whereas community health workers chose oral presentations. Radio ranked high among all three groups.

## DISCUSSION

Our results indicate there is both need for and interest in education and training regarding im-

plications of pesticide exposure on child health for this audience. These informants serve a high-risk group of children, yet only half had any pesticide-related health training and only 22% had received child specific information. For most of those with training "experience," the training consisted of sporadic lectures rather than a specific pesticide workshop or in-depth session.

The physicians were not specifically asked if they had learned about pesticides such as organophosphate poisoning in medical school or residency, which may be an expected routine topic. It may be that without a specific prompt, recall of this topic was poor. Alternatively, it may be that this topic was truly overlooked in the curricula of their training programs or that the question was interpreted to mean training outside of the standard health professions curricula. The survey as designed makes it impossible to discern this. However, even if the survey underreports true training experience, the

lack of recall may underscore a more important aspect—knowledge or topics covered in early training may not be retained without reinforcement in practice or through Continuing Medical Education.

Our findings echo other reports and surveys which note a dearth of training on environmental health topics in general among medical practitioners despite an interest in and recognition of the importance of this information.<sup>9,10,12,13</sup> The lack of formal training on pediatric environmental health in medical and nursing curriculum has been documented and lamented.<sup>13</sup> Nonetheless, there is very little information specific to pesticide related training needs and perceptions, particularly among the population of providers and health care workers who serve farm families and farmworkers.

Two other somewhat similar surveys provide a useful comparison and context for our findings. The National Environmental Education and Training Foundation (NEETF) recently initiated a 10-year broad national program to integrate pesticide issues into the education and practice of primary care providers that will include pediatric information for rural and non-rural settings as well as adult and occupational related topics. In preparation, they conducted a pilot survey and interviewed focus groups of nurses, mid-level clinicians, and physicians in the metropolitan Washington, DC, area and surrounding rural counties regarding perceptions, attitudes, and beliefs about pesticide education.<sup>9</sup> In 2000, the Migrant Clinicians Network conducted a needs assessment survey of its member clinicians.<sup>12</sup> While it was not a pesticide-specific survey (the general topic was environmental and occupational health), the respondents were likely to engage a patient population at high risk for pesticide issues.

Our respondents were largely not comfortable (58-64%) with responding to patient queries regarding pesticides. Similarly, the NEETF survey reports 64-69% of their respondents feeling poorly prepared to respond to pesticide questions from patients. This may relate to the general lack of training in the topic of pesticides.

We found only about half of the clinicians we surveyed endorsed having prior training on pesticide-related health topics, echoing the

somewhat related inquiry of the Migrant Clinicians Network survey. The survey reported that 48% of responding clinicians noted no prior training in environmental or occupational health. It also noted barriers to training as lack of time, limited funds, and lack of awareness of training opportunities.

According to NEETF, most (data or frequency not provided) survey respondents did not frequently diagnose pesticide problems or receive questions about pesticides in their routine practice. Similarly, in our survey, few key informants responded that they were asked about pesticides often (6%) or sometimes (22%). This may reflect both the overall dearth of training, the lack of comfort with these topics, and/or the lack of patient knowledge about risks in their home or work environments.

Interest in pesticide health training specific to child health was high for our all of our providers. The physicians we surveyed were less interested in non-pediatric pesticide information. In the Migrant Clinicians Network survey, pesticides were the problem most likely noted to be an important environmental and occupational problem facing farm workers and their most important self-identified training need in environmental and occupational health. In the NEETF survey, 40% of the clinicians and 26% of the nurses felt it was important to obtain more information on pesticides. Neither the NEETF survey nor the Migrant Clinicians Network survey had focused questions regarding pesticides and child health.

The format preferences for future trainings varied. The clinicians in our regional survey were more interested in Web-based training and information, whereas the community health workers were most likely to prefer a workshop format. NEETF respondents noted a wide range of preferences for receiving new content; however, lectures and short courses were most commonly mentioned, and physicians noted the importance of including pesticide material as part of other, broader community medical education activities. The Migrant Clinicians Network survey found a strong preference for training in the form of specific or multi-topic in-person workshops. In contrast to the preference noted by our key informants, Internet-related materials were less highly ranked as “effective training formats.” While

many of the Migrant Clinicians Network survey respondents had access to a computer (87%), few had tried Internet-related training (26%). The relatively greater interest in Web-based training for our respondents may reflect that our survey is the most recent among these.

In summary, we evaluated information on the training experience and needs of healthcare providers in relation to pediatric pesticide exposure as well as recommended formats for patient information. This was based on survey of a group of 49 key informant physicians, mid-level practitioners, and community health workers serving farm worker and grower families in agricultural areas where heavy usage of organophosphate and carbamate insecticides occurs. This key informant survey indicates an important pesticide training gap exists among health care providers serving children at high risk of pesticide exposure. Methods to translate emerging evidence into clinical practice are needed. It appears the most effective format may vary depending upon the provider group. In-person workshops were of most interest to community health workers in our region, mirroring the preferences of clinicians and non-clinicians in related surveys from other areas. In contrast, Web-based material was identified as an important format for clinicians in the Pacific Northwest Region. A next step is to complete development of curriculum materials for use in our region in the formats requested; Web-based, print, and workshops. These materials can be piloted among the different health care groups and determinations made as to the effectiveness of these interventions.

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