4. Overview of Environmental Threats to Children's Health

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DR. MILLER: I would like to introduce the next speaker, Dr. Lorin. Dr. Lorin is professor of pediatrics and director of the pediatric residency program at Baylor College of Medicine. He's also an attending physician at Texas Children's Hospital and Ben Taub General Hospital, in Houston. His background is in pediatric pulmonology, and he's had a longstanding interest in environmental factors affecting children's health.

DR. LORIN: Good afternoon. I always like to begin this talk by paying tribute to my heroine, Rachel Carson. Carson trained as a marine biologist. About six or seven years after World War II, she noticed that the birds in her area were disappearing and the fish in the lakes were dying, and she thought that this might have something to do with all the airplanes that were spraying chemicals everywhere. These chemicals had been developed as nerve gases and poisons during World War II, and they were being dropped not only on growing fruits and vegetables but also on the side of the roads to keep the vegetation pest free and on the trees to control elm disease and other plant parasites. The chemical companies said that the material was absolutely benign to everything except insects, but Carson realized otherwise.

Carson was a very courageous person. She was vilified by the agricultural complex and the industrial complex, who called her everything from an alarmist to an extremist to a Communist. In 1962 she published Silent Spring, and if you have not read it, you must. It should be required reading for anyone who is interested in environmental medicine.

Rachel Carson was an environmentalist before the term had been invented and at a time when green still referred to the color of money. So I think we need to remember and pay tribute to this woman who almost single-handedly started the environmental movement. Unfortunately, Rachel Carson died from breast cancer about two years after publication of the book.

I would like to talk to you about environmental health for children from the point of view of a primary care pediatrician. I do have a background as a pulmonologist, but I'm not an active pulmonologist anymore. I'm a generalist.

I have three main learning objectives to cover with you. The first is for you to understand how our environment is becoming more and more dangerous. I suspect most of you already know a good deal about that. The second learning objective is for you to understand why children are especially vulnerable to environmental toxins. I will elaborate on some of the points Dr. Amler touched on. The third objective is for those of you in clinical practice, whether you're physicians or nurses, to be able to respond in your practice to questions about environmental toxins and be able to advise parents about dealing with environmental toxins.

Now, if you think Stephen King is scary, don't read about this material at bedtime. If you're worried about the threat of chemical terrorism, you also need to worry about what we are doing to ourselves right now. Certainly the thought of a crop duster loaded with nerve gas is frightening, but just what do you think is in those airplanes now? Not plant vitamins. It is a time to be frightened, very frightened.

There are four ways in which environmental issues can present in your practice with children. The first—and this does not happen all that often—is when you diagnose an environmentally acquired disease such as lead poisoning or organophosphate poisoning. That's fairly straightforward.

A second situation is where a parent asks about a child's symptoms. "You know doc, my child seems to get a lot of infections. Could it have anything to do with the stuff spewing out of the chemical plant near where we live?" I'm from Houston, where a lot of the patients do live close to chemical plants, and that's a tough question to answer. You may know that these chemicals can affect the immune system, but still it's hard to say if it's having a role for that particular child.

The third situation is where a parent asks a question about environmental health. "Is it okay for me to eat fish while I'm pregnant or while I'm nursing, or how much fish can my young child eat?" These questions are more manageable, and there are some recommendations and guidelines.

And finally, the fourth way environmental issues can arise in your practice is when, as Dr. Amler suggested, you take an environmental history. You can do this not only for the child who presents with symptoms but also during a well child visit. Ask what sort of chemicals are in the home? If the parent says there are no chemicals, you can say "Well, if I go your house, will you give me $5 for every chemical that I find under the sink, in the garage, in the closets, et cetera?" You would probably make a lot of money that way. Also ask the parents if they know what's going on in school.

So to our first objective, to understand why our environment is getting worse. Let's look at the epidemic. The incidence of diseases like autism seems to be increasing. Some of this increase may be due to changing definitions; we now think about autistic spectrum disease rather than just autism.

Perhaps parents of children with autism are more willing to seek help, but that can't account for the entire increase, nor does it account for clustering in certain communities like Brick Township, New Jersey, where there was a very high incidence of autism in a small community.

There's been a doubling of the incidence of atrial septal defects, a type of congenital heart defect. There's no reason to suspect any change in our ability to diagnose that entity, so that increase is probably real, and the same for the increase in obstructive uropathy in young children. The incidence of cancer in children has increased from 130 cases per million in 1975 to 150 per million in 1995, a small but significant increase.

The prevalence of asthma rose from 3.5 to almost 6 percent between 1982 and 1994, and as Dr. Amler mentioned, asthma death rates doubled from 1979 to 1993. The death rate has now leveled off, perhaps even down a bit, but that is because of improved treatment rather than any decrease in the prevalence of asthma.

There has been a general decline in sperm counts in adult males throughout North America and Europe, and you've probably heard about the small penis size in alligators in Lake Apopka in Florida. No, I don't know who performed the measurements.

The National Academy of Science has estimated that 3 percent of developmental disabilities in children are due to known toxins, and we believe there's a substantial amount due to toxins which we have not either identified or incriminated. Forty states have issued health advisories warning pregnant women to limit or avoid fish consumption, particularly game fish, fish from lakes and streams, because of mercury contamination.

Environmental toxins are ubiquitous. (Figure 4-1) They're in the air we breathe, the water we drink, the food we eat, and remember, as Dr. Amler said, children eat things that aren't really food. We call this pica, and children sometimes do this intentionally and sometimes accidentally. Also toxins can enter the body transcutaneously, through contact with the skin. And there can be pollutants and toxicants in medications. It's only recently that we're removed thimerosal, a mercury-containing compound from immunizations such as the MMR. Now we are concerned about phthalates in IV tubing, plastic IV bags, and other medical devices. So environmental toxins can even be in things that we prescribe as physicians or nurses.

The mechanisms of toxicity are very broad. (Figure 4-2) In children we're particularly interested in mutagens and teratogens and their effects on the incidence of congenital malformations and specific congenital syndromes. Many pollutants are neurotoxins, and in children we have to be especially concerned about neurodevelopmental toxins. Later in this conference, you will hear about endocrine disrupters. Toxicants can be irritants and allergens, especially to the airway and the skin. Toxicants can injure a variety of other organs, including the liver, the kidney, and the retina. And of course, pollutants can be carcinogenic.

Let's very briefly look at what some of the toxins are. Many of them are industrial chemicals that get into the environment by accident. They may have been dumped, but it wasn't really the intent to put them in the environment. PCBs (polychlorinated biphenyls) and dioxins are notorious pollutants. The PCBs were manufactured intentionally as insulating material; the dioxins were a byproduct of that process or a product of the degradation of the PCBs. Other solvents used as vehicles for pesticides are put into the environment intentionally. Heavy metals remain a problem, as do volatile organic compounds and polycyclic aromatic hydrocarbons. As Dr. Amler mentioned, there are more than 80,000 registered chemicals used by industry in the United States, and of these 80,000, how many have been tested for toxicity? The answer is less than 20,000, and of these, very, very few have been tested in children or in developing animals.

The amount of toxins being produced and dumped into the environment is truly staggering. (Figure 4-3) In 1998, 1.2 billion pounds were reported to the Toxics Release Inventory, but it's been estimated that there are really about 24 billion—not million—24 billion pounds per year. Currently 4 billion pounds of pesticides per year are used commercially and residentially. So we're talking incredible numbers.

In regard to the emission of potential developmental and neurologic toxins, compared to other states, Texas is number one, two, three, eight or 26? Take a guess.

VOICE FROM AUDIENCE: Number one.

DR. LORIN: Close. Actually we lost out to Louisiana; thank goodness for Louisiana. Texas is number two, not something to be proud of.

Pesticides include insecticides, insect repellants, herbicides, fungicides, and rodenticides. Most of these agents are neurologic toxins, but they can also be neurodevelopmental toxins. They can be endocrine disrupters, and many of them are carcinogenic. A number of the worst have been banned in the United States, but they have not been banned worldwide and so still get into the air and the oceans. Many that have been restricted in the U.S. to agricultural or commercial use are illegally sold or used residentially. Dr. Amler gave an example of a situation where they had to actually move people out of something like 11,000 homes and churches. Some pesticides that are not meant for residential use are sold on the black market in low income areas of New York City, for example, where low income individuals have a tremendous roach problem and Raid just doesn't handle it. So they buy these commercial preparations not meant to be used in the home.

Heavy metals. Lead is one pollutant for which there is some good news. Thanks to the removal of leaded gasoline from the market in the United States and some other measures, the percentage of U.S. children with elevated blood leads has fallen dramatically over the last 25 or 30 years, and frank lead neurotoxicity and encephalopathy is now rare.

That's the good news. The bad news is that we now realize that even low blood levels of lead correlate with neurodevelopmental problems. Years ago we thought a blood lead level less than 40µg/dL was fine, not to worry about it. Then the level of concern dropped down to 30, 20, and now even 10µg/dL is considered a warning signal.

True or false? Federal law prohibits the use of any paint with a measurable amount of lead for indoor residential use?

VOICE FROM AUDIENCE: False.

DR. LORIN: False, absolutely correct. There is a maximum permissible concentration of lead for indoor paint, and so indoor paint doesn't pose nearly the threat that it did years ago. But there are many important exceptions to this: paint used on appliances and windows and doors, mirror backing, artist's paint, and metal furniture not intended for child use, but that doesn't mean that the kid isn't going to sit there and suck on part of the furniture.

Outdoor and industrial paint contains lead, old houses still contain leaded paint, and just painting over the old paint with lead-free paint or low-lead paint doesn't accomplish much because if it peels off, the old paint comes with the newer paint. So you really need to scrape it down and replace it.

House dust contains lead; some imported vinyl miniblinds contain heavily leaded paint; some candlewicks give off lead fumes; and I just found out a couple of months ago that billiard chalk contains lead. And there's a report of a family that had elevated blood lead; they kept their wine in crystal decanters and apparently good crystal has lead in it and the alcohol was able to leach out some of the lead.

Tap water. Even though most current houses don't have lead pipes, they may have lead solder at the joints, and so contamination of drinking water at the home is possible. Some Middle East cosmetics contain lead, and some Latin American folk remedies contain appreciable amounts of lead. There have also been situations where an Asian folk medicine, imported or sent over by friends or family in the Orient, contained lead.

Mercury. There have been several incidents of massive accidental exposure, acute and chronic, to mercury which gives us some idea of what happens with very large doses. (Figure 4-4) In these situations there are cases where the mother was pregnant at the time of the exposure, and the mother did not develop any neurological or other manifestations, but the infants had neurological, developmental or visual abnormalities. So the child in-utero and the young child can be much more sensitive to these toxins than the adult.

Industry continues to dump mercury into the air, and from the air it drops down into the water and the soil. Incineration of medical waste is a major source of mercury pollution. Air, food, (especially fish) and water (especially lakes and streams) are still significantly polluted with mercury as well as with PCBs and dioxins.

Volatile organic compounds (VOCs), for example, benzene and xylene, exude, or off-gas, from furniture, particle boards, and the backing on new carpeting. These substances can reach high concentrations in the house, especially in energy efficient, well sealed or poorly ventilated houses.

The concentration of many toxic compounds is greater indoors than outdoors, so there may be something to going outside for fresh air. The toxicity can be specific or nonspecific. Formaldehyde, for example, tends to irritate the airways. Dr. Amler mentioned the very high concentration of formaldehyde in older trailers because of the insulation material. As it cures, it gives off formaldehyde.

Polycyclic aromatic hydrocarbons (PAHs) are interesting because they are ubiquitous. They occur in nature with forest fires, et cetera, but we contribute to them every time we fire up the backyard barbecue. Not only are you adding carcinogens to the meat that you're cooking that way, but you're also putting PAHs into the air and into the atmosphere. You ought to advise the children not to be around the grill. Don't say "Come and see how I turn the hamburgers." The kids should stay away until the cooking is finished. These substances are mutagenic and carcinogenic. They have profound respiratory effects. They can suppress the immune system. They can cause skin disorders, liver and kidney dysfunction.

That was a quick tour of some of the toxins that we deal with, but what I'd like to emphasize is why children are especially vulnerable to most of these environmental toxicants. Dr. Amler has pointed out that children breathe more rapidly than adults. They breathe more air per minute, per pound or kilogram of body weight than do adults. Let me give you an idea of the ratio. A newborn breathes around 400 to 500 ml of air per kilogram of body weight per minute, while an adult breathes about 100 to 150 ml per kg over the same minute.

Infants also drink more water, juice, milk and other liquids in proportion to their body weight than do adults. Infants commonly consume three to five ounces per kilogram per day. For an adult this would translate into 30, 12-ounce cans of soda or beer a day. That's a lot even for a Texan on July Fourth. Specifically in regards to fruit juice, children drink up to 30 times as much juice, including apple juice, per kilogram as do adults.

And of course, infants also eat more food. The daily intake during the first year of life averages around 180 milligrams per kilogram, while for an adult it's only 16 milligrams per kilogram. So children are also getting more of the contaminants and pollutants in those dairy products. They also eat more meat, more eggs, and surprisingly (but the figures show this to be true), they also eat more fish per kilogram of body weight, than do adults. An infant commonly will consume 100 calories per kilogram per day. For a 70-kilogram adult, this would equal 7,000 calories a day, and even on our worst binges, most adults don't come close to that.

Infants also have a larger surface area relative to their body weight than do adults, and toxins can be absorbed more easily across this larger surface area, and also, their skin is more permeable and more absorptive. Recall the problem with topical hexachlorophene in infants; and now a similar concern with povidone-iodine (betadine). Because of this combination of increased permeability and relatively larger surface area in the infant and young child, we need to be careful in the use of topical c hemicals in this age group. Something like DEET applied to the skin of a child is going to be a much greater dosage per body weight than for an adult.

Neonates have increased gastrointestinal absorption of things like calcium, and that's good, but they also have increased absorption of lead and mercury, and obviously that's not good. Not only will infants get a larger dose per kilogram of toxicants, but they also will absorb more of that dose.

Infants have a higher gastric pH, and that leads to more generous growth of bacteria in the gastrointestinal tract, and the bacteria convert dietary nitrates to nitrites. Although both nitrates and nitrites can cause methemoglobinemia, nitrites are more potent, and therefore, infants are more vulnerable because of that conversion. In addition, infants have lower levels of methemoglobin reductase, the enzyme that ordinarily gets rid of methemoglobin, and they have higher levels of hemoglobin F which also tends to be more stable once it's converted to methhemoglobin. All these factors combine to make the infant much more vulnerable to methemoglobinemia from nitrates or nitrites in food or in well water, where they leach in from the soil.

Children live close to the ground. They crawl on the ground, and dust and chemicals and fumes tend to concentrate on the ground. Therefore, they have a greater exposure. They also, as Dr. Amler showed you, will put their hands into the dirt and put just about anything into their mouths. This exposes children to a higher concentration of contaminants.

Children spend more time swimming in lakes, ponds, and streams than do adults. Again, more exposure. Also, wading pools are more often contaminated with fecal organisms than the adult pools, for obvious reasons.

Most importantly, children are not only growing, they are developing, and the developing brain is especially vulnerable to many toxins, including lead and mercury.

In pediatrics we need to be concerned about not only what the child is taking but what the mother is taking as well—exposure both in-utero and via breast feeding. Dr. Amler mentioned a fact that we don't like to publicize too much, and that is that human milk contains significantly more contaminants such as dioxins and PCBs than does cow milk or commercial formula. We all feel that the benefits of breast feeding outweigh the potential toxicity, and breast is still best, but you can see in this slide, which Dr. Lynn Goldman provided, that the greatest exposure is in the first few years of life. And exposure is even greater for those children who are breast fed as opposed to formula fed. (Figure 4-5) I emphasize, this is not a reason for not breast feeding.

Children have a longer shelf life than adults. There are two aspects to this: one is a heavier total lifetime exposure; the other is a longer time over which they can develop diseases with a long latency. Let me illustrate this for you. (Figure 4-6)

Our environment is becoming more and more polluted; there's no question about it. Prior to World War II, there were far fewer manmade chemicals and there were no organophosphates being sprayed into the environment. In Figure 4-6 you can see that around the end of the war there was a takeoff of chemical proliferation. It has gotten worse, and it's projected that unless things change dramatically, it will get still worse.

Now, let's say somebody is going to live 70 years and they were born in 1960 and they're going to die in 2030, The exposure for that individual is the colored area under the dashed triangle. Now let's look at a child born in the year 2000 who is also going to live 70 years and will die in 2070. The exposure for that individual is the colored area under the dotted triangle. If you take those two areas out and put them together, you see (Figure 4-6) that the exposure under the dotted area is almost twice as great as that under the dashed area. So the later a child is born the greater the lifetime exposure. It's not only worse for our children than for us; unless something is done, it's going to be even worse for our grandchildren.

Now, let's say (Figure 4-7) that there's a certain environmental exposure in the year 2010 and that exposure leads to an increased risk of cancer with a latency period of 10 or 20 years. Well, obviously you can see that the older individual who is exposed at that time and is going to die five years later is not as likely to develop cancer as the child or the younger adult, who is going to go on to live another 20 or 30 years. So it's a greater burden and it's a greater latency period.

What is a quote safe exposure level? There are lots of problems with the studies that have looked at what makes for allegedly safe exposure. Fetuses and young animals are probably the most susceptible, yet the majority of studies have been on adult animals. The studies rarely look at exposure during critical periods in fetal development; that's just beginning to happen now. And the toxic effects of a substance may be different in children versus adults. For example, with exposure to PCBs, adults tend to develop chloracne and peripheral neuropathy while children have decreased mental capacity, decreased immune function, and decreased thyroid function.

Let's look at the concept of "acceptable risk." The acceptable risk is based on the prediction on the number of cases of serious toxicity—such as cancer—that will occur per hundred thousand or per million exposed individuals. It's hard to imagine how many cases of cancer would be acceptable. Some of us might like to say none, but nevertheless, this is what's used in setting policy.

What is an acceptable risk for our children? First of all, as I mentioned, almost all testing has been done in adults. Further, safe levels are calculated as if the toxicant being studied were the only toxicant to which the individual will be exposed, and as if exposure will be only through that one source, that one type of fruit for example. These toxins, however, are probably additive, possibly even synergistic, so we really ought to be concerned about aggregate risk and cumulative risk.

So if we look at "the acceptable risk" for say the amount of a certain pesticide that can be on an apple, the calculation is usually based upon the assumption that the apple will be the only source of that toxin, but indeed same pesticide may be on grapes, pears, et cetera. So even though it's supposedly an acceptable risk or safe if the child had one apple a day or one serving of grapes per day, what happens if the child has both? And as we've heard, children do tend to eat more fruit and fruit juices than adults.

Cumulative risk is when multiple toxins act via a similar mechanism. There is a certain acceptable risk for a particular pesticide or a specific organophosphate, but other pesticides may be in our food as well, and they work through the same pathway, and so their effects may be additive.

There is also the problem of the hot-potato concept. Even though the average amount of pesticide on a load of potatoes may be within "acceptable limits", individual potatoes may vary tremendously in terms of their concentration, and an individual potato may have 100 times greater concentration than the average.

Our last objective is to be able to respond to questions about environmental toxins in your practice. What can parents and children do, and what can you advise your patients and their families? First, let's talk about food. We, as humans, are at the top of the food chain. (Figure 4-8) In some ways that may be good, but in other ways it's not so good. We eat large predator fish like tuna. The tuna eat smaller fish; the smaller fish eat still smaller fish, which eat crustaceans. Most of the pollutants in the waterways settle on the bottom, and so the snails and the shrimp and the other bottom-dwellers eat them. They concentrate those toxins in their bodies, and then the small fish eat them, and the bigger fish eat the smaller fish, and so the concentration gets greater and greater as you go up the food chain. We're at the top; we're getting the heaviest concentration. In addition, as if this weren't bad enough, chemicals are applied to the crops and to animal feed in "allowable, acceptable risk" amounts, but it gets into our food chain. Other chemicals are applied in processing and in transport.

So what can you advise your families? (Figure 4-9) Whenever possible, purchase fresh produce in season; there will be less pesticides on it. Why? Not because the agricultural complexes are worried about the pesticides, but they can save money if they don't have to put pesticides on something that's being sold locally and therefore quickly, so locally grown produce is going to have less pesticides. Buy organically grown produce if possible and if economically feasible, and as you know, now there's going to be some new labeling. The fact that it's organically grown is not an absolute guarantee that there won't be pesticides in it, but in general, it will have far less. Wash the produce thoroughly. That's really important and worth emphasizing to parents. When appropriate, peel fruit and vegetables. Serve a varied diet. Avoid storage or microwaving in plastic containers because of concern about chemicals such as phthalates, and keep plastic wrap from contact with the food if possible.

Minimize children's intake of shellfish, fresh water fish and tuna and swordfish. (Figure 4-10) I'm not sure how many youngsters eat swordfish. Encourage pregnant women, nursing mothers, and women in the childbearing age in general to limit their intake of shellfish and the fish mentioned above. Incidentally, it does appear that canned tuna fish has less mercury than does the tuna in sushi or tuna steak.

Have children wash their hands after play and before eating. So grandma was right; cleanliness and hand washing really do help. They've been out playing in the grass, and there are herbicides and insecticides on the grass. It gets on their hands and then into their mouth with the food.

How about water? Well, the water is contaminated too. Products of the chlorination process (disinfectant byproducts) have been incriminated in cancer and non-cancer effects. Perhaps as much as to 2 to 17 percent of bladder cancers in the U.S. may be due to these disinfectant byproducts. Municipal water or well water often contains lead or arsenic, nitrates, radon, chemical pesticides, bacteria, viruses, and parasites. Not only do the bacteria cause infection but they can produce toxins. Cyano-bacteria, for example, produce toxins which have nothing to do with infection but may be carcinogenic.

Check your water source. Your water company is supposed to send you a CCR each year. CCR means Consumer Confidence Report, which I think is an odd name for it, frankly. I've been in Houston 24 years; I don't think I've ever gotten one. I've tried to get it from my water company and got put on circular hold. I was eventually able to download some information from the web, but I've never gotten a report from the city.

Advise your parents not to use hot tap water for cooking or cleaning food. Let the cold water run for one minute before the first use each day. Hot water and standing water leeches lead and other toxins out of the pipes.

Bottled water is problematic. It's much, much more expensive than tap water, and it may or may not be better, particularly if it's sold in the same state in which it's bottled. There's very little regulation of bottled water, especially if it isn’t shipped interstate. Most of the regulation has to do with the bacterial (E. coli) content rather than chemicals. A lot of the bottled water on the shelves in our supermarkets in Houston comes from “natural wells” in Louisiana, and that makes me very worried.

Water filters at the tap are effective and can filter out the majority of lead, chlorine, cryptosporidium, giardia, lindane, et cetera. (Figure 4-11) None of the filters mention how much arsenic they remove, and my attempts to get information from the manufacturers have been unsuccessful, so I suspect that means that they do not filter out arsenic. Look for an ANSI approval rating on the package. You need to change these filters regularly, and although they may be cheaper than bottled water, they're still expensive, and many of the families who need these devices the most, those in low income housing, are the least able to afford them.

In terms of outdoor air, there is not a lot you can do. You can advise parents to minimize outdoor activity of children on days of high ozone alert, but we're not giving out gas masks yet. We may be stockpiling them for a terrorist attack, but we're not giving them out. The one thing you can do is advocate for cleaner air. At home you can do a little bit more. (Figure 4-12) We advise parents to look in the pantry, under the sink, in the garage, et cetera, and look at all the chemicals and chemical sprays there and get rid of as many as possible or put them out in the garage.

Avoid using areas that have been freshly painted, and avoid having the children in those areas. Don't let children play around deteriorating building materials, especially in older buildings which may have lead and asbestos. Keep children out of areas undergoing renovation.

One of the best ways to avoid roaches is to clean up and properly store all food and water. Avoid routine application of pesticides; use traps rather than sprays; treat when a problem exists, not prophylactically; And if you need to use a commercial service, look for one that understands what integrated pest management is—basically that's treating by necessity with the least toxic pesticide. The technicians should be certified, and they should be willing to tell you which chemicals they'll use and how they will apply them.

School. Dr. Amler has already given some examples of toxins in school. Many potent pesticides are used not only in the school as insecticides but also as on the school grounds as herbicides. In terms of acceptable risk, how many cases of childhood cancer are acceptable to keep the school lawns and fields free of dandelions? It may be worth using toxic organochlorines to protect against malaria and save thousands of lives in Africa, and it may or may not be worth spraying with organophosphates to prevent West Nile Fever, but personally I'd rather have my grandchildren play in the weeds and the dandelions than in the organophosphates and other poisons.

Parents should know what chemicals are being used in the school and on the school grounds and when they are being applied. Almost all states, including Texas, have some very definitive laws about this, including notifying parents when pesticides are being applied. If you call or go to the school, they're supposed to show you the records and tell you what is being used. In reality, this is often not done, both in Texas and in other states. You need to make advocates out of the parents in your practice and urge them to tell the school that they want to know what's being applied and when.

In conclusion, what can we do? (Figure 4-13) We can educate and advise parents and children about environmental dangers. We can be alert to signs of environmentally induced disease. We can be aware of the role of pollutants in exacerbating disease and symptoms. And finally, we can advocate for a better and safer environment.

Thank you all very much for your attention.

DR. MILLER: Thank you. We appreciate your overview. It was a lot to cover.