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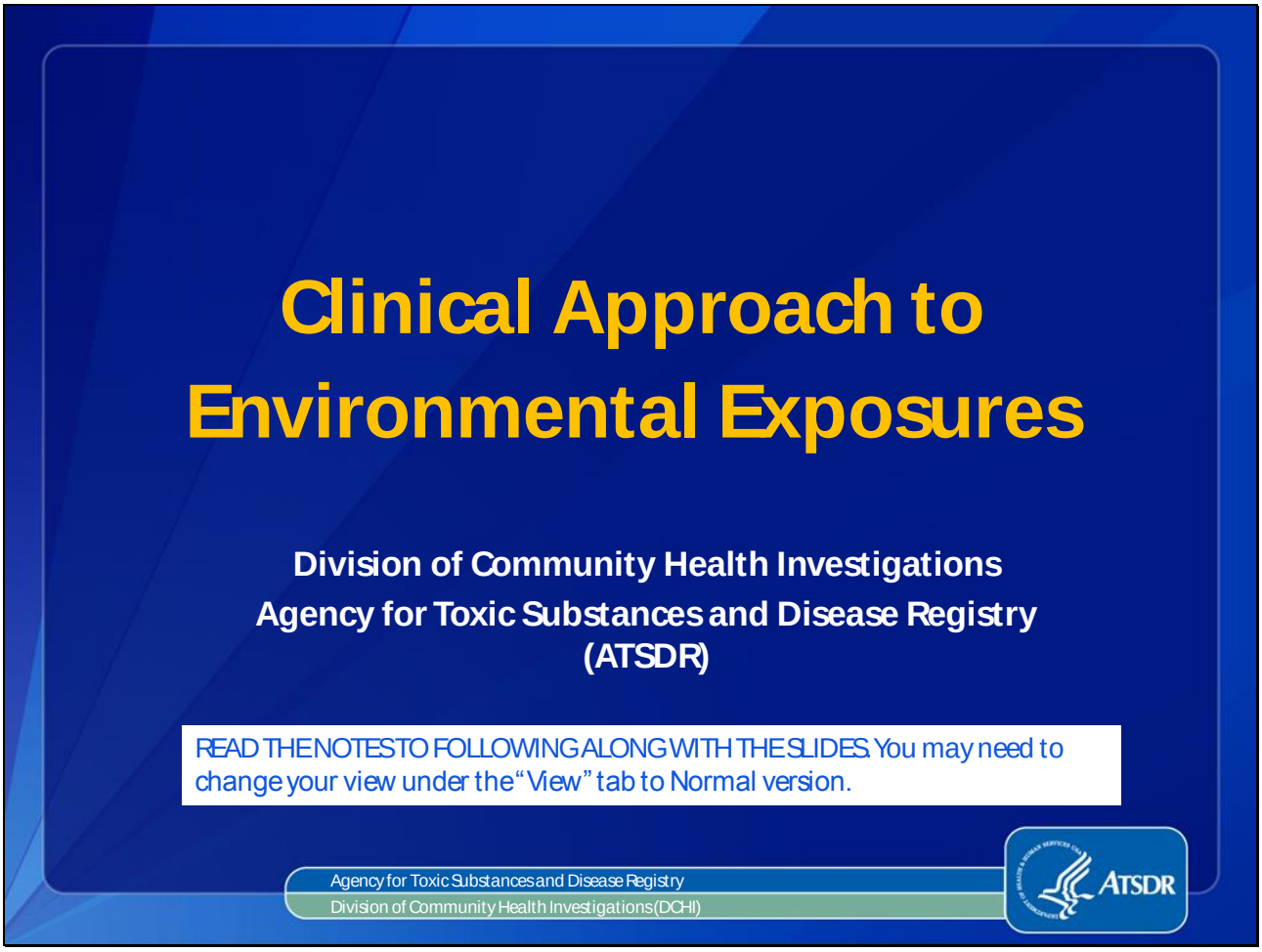
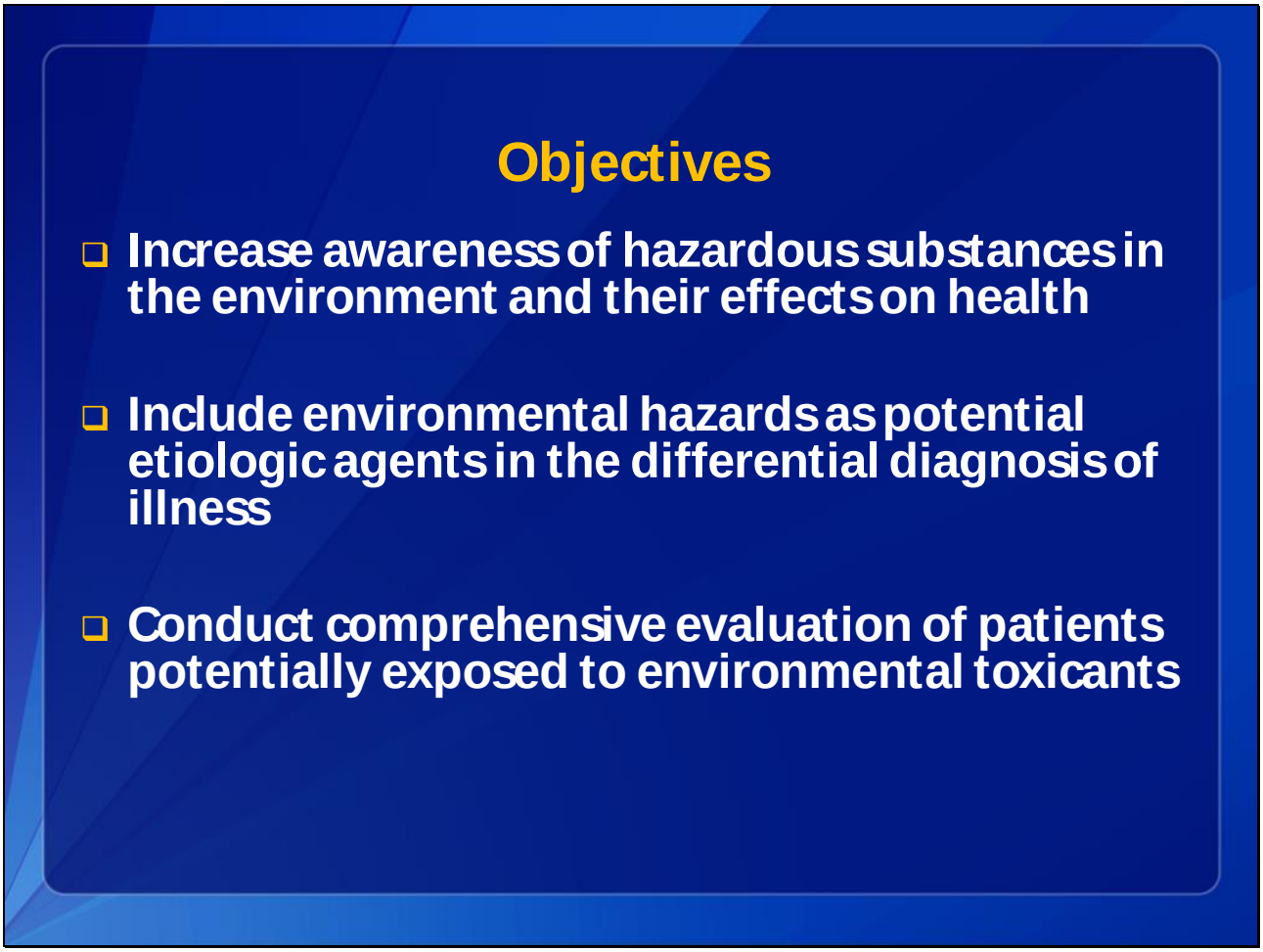


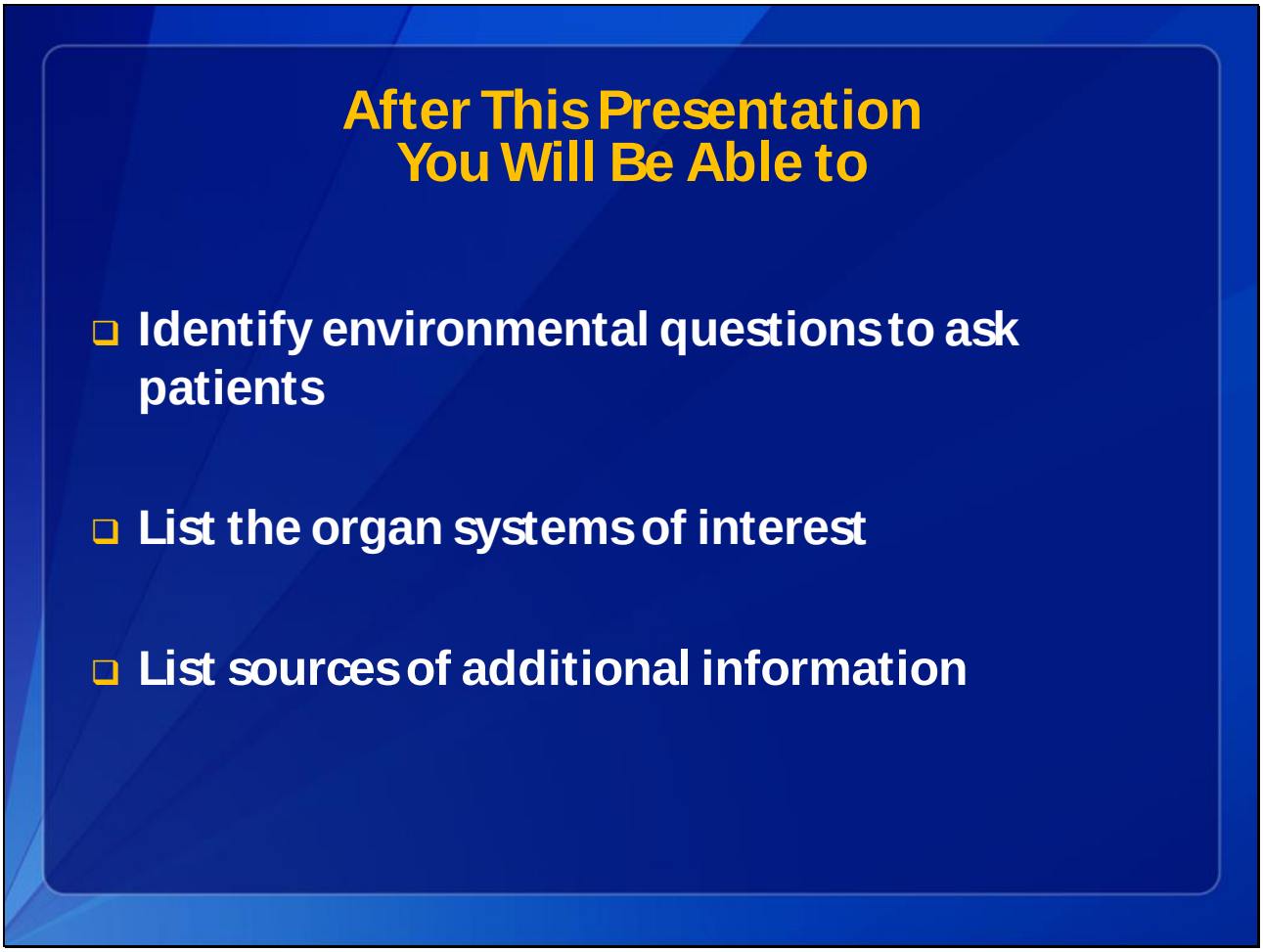
READ THE NOTES TO FOLLOWING ALONG WITH THE SLIDES. You may need to change your view under the "View" tab to Normal version.

Slide 2



This presentation is to help you understand about potentially hazardous environmental exposures and use that information when examining your patients.

Slide 3



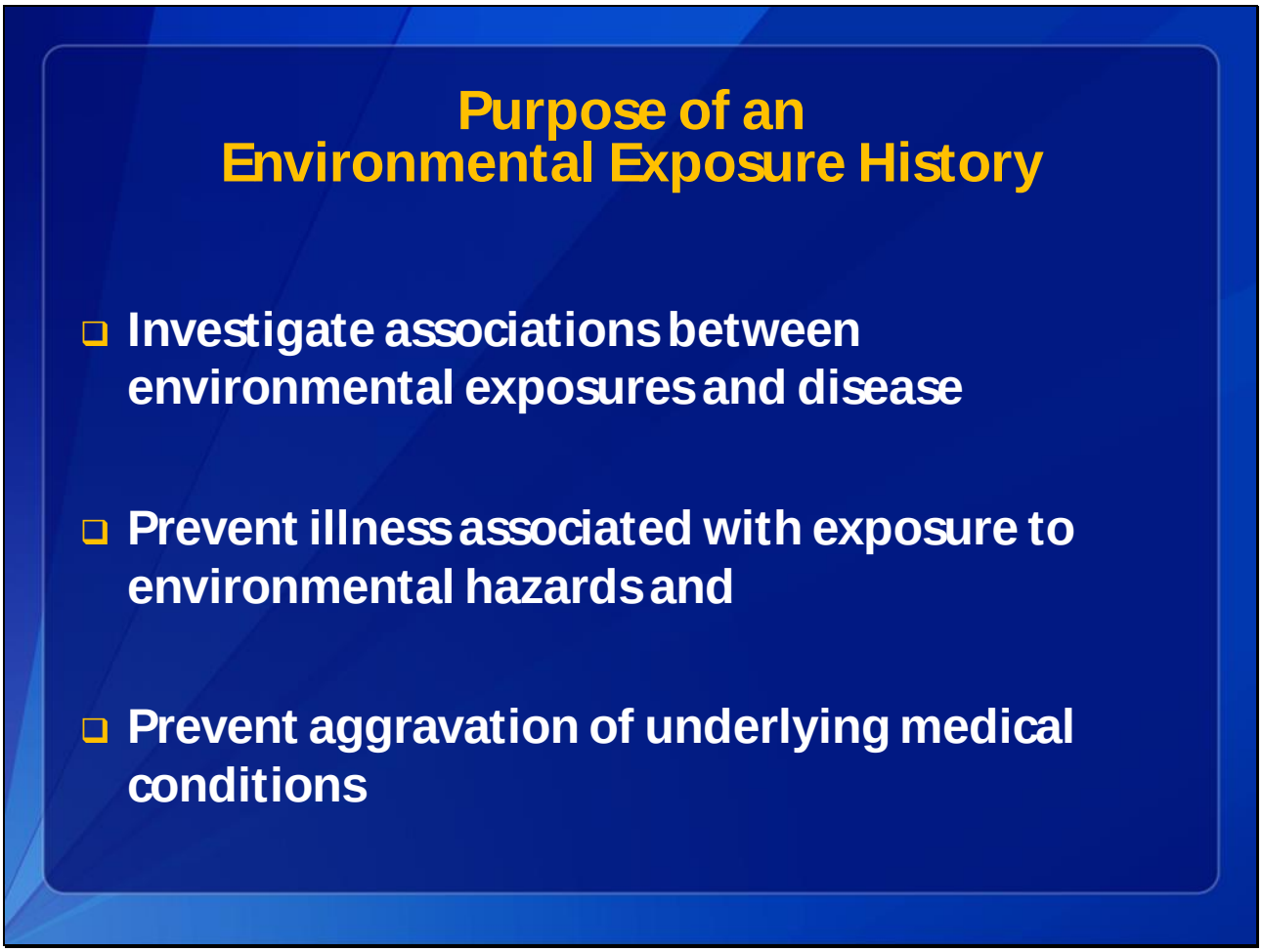
This presentation is not intended to make every clinician an expert in the area of environmental health. This presentation is to raise awareness about this issue and the role it may play in any given patient's situation.

The basic idea is to be aware that environmental exposures may play a significant role in medical problems seen in patients.

Taking environmental exposure histories may give clinicians useful information about their patients.

Medical education for many professionals has been lacking in this area. The average amount of time spent teaching environmental health in a 4 year medical education is about 4 hours. During resident training, very little time is spent on this subject.

Slide 4

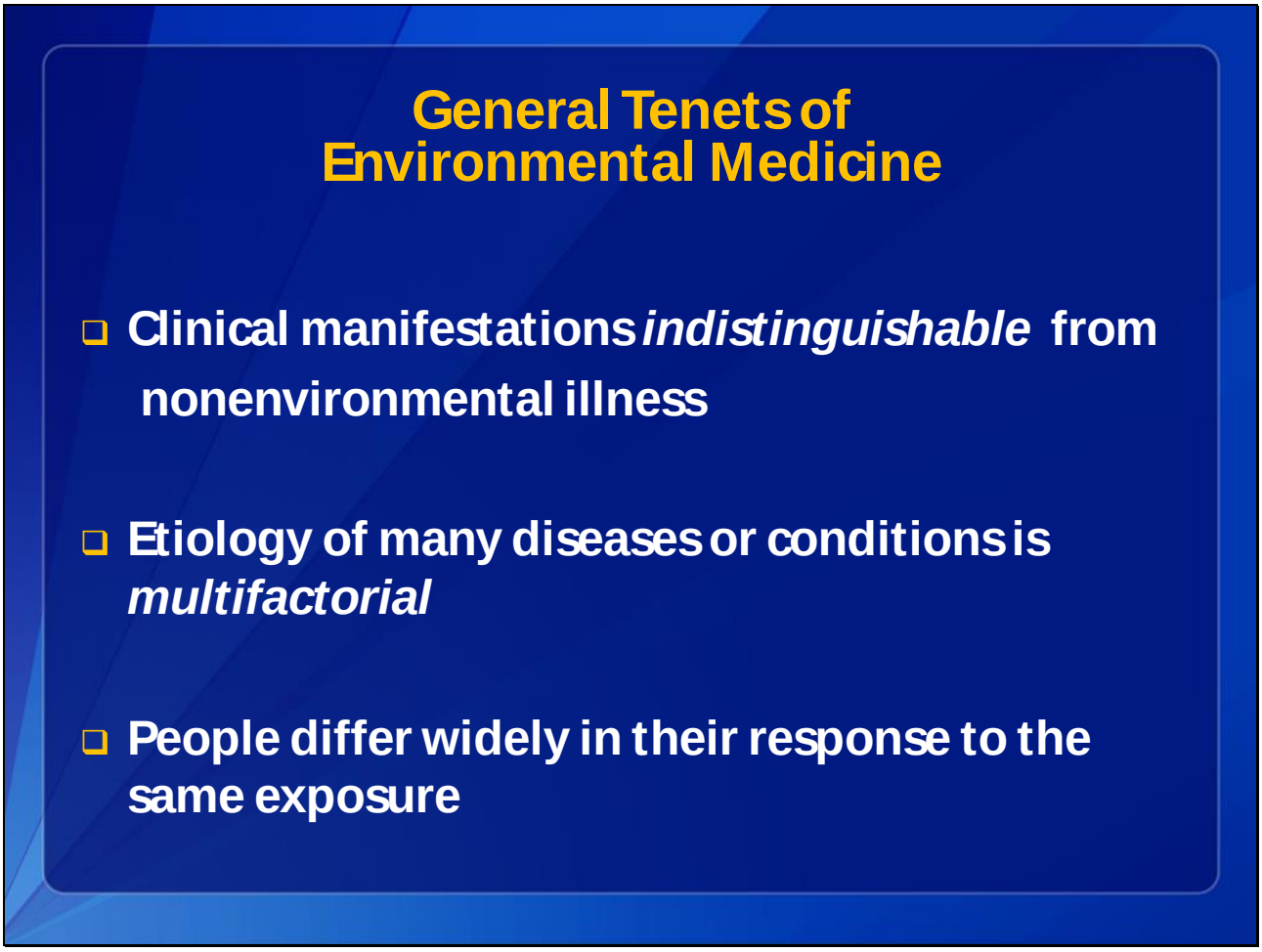


Taking a good environmental exposure history should only take a few minutes and much can be learned from it.

An environmental exposure history can direct further questioning. It may also help direct specific aspects of the physical examination or the ordering of laboratory tests, depending on what organ systems may be affected.

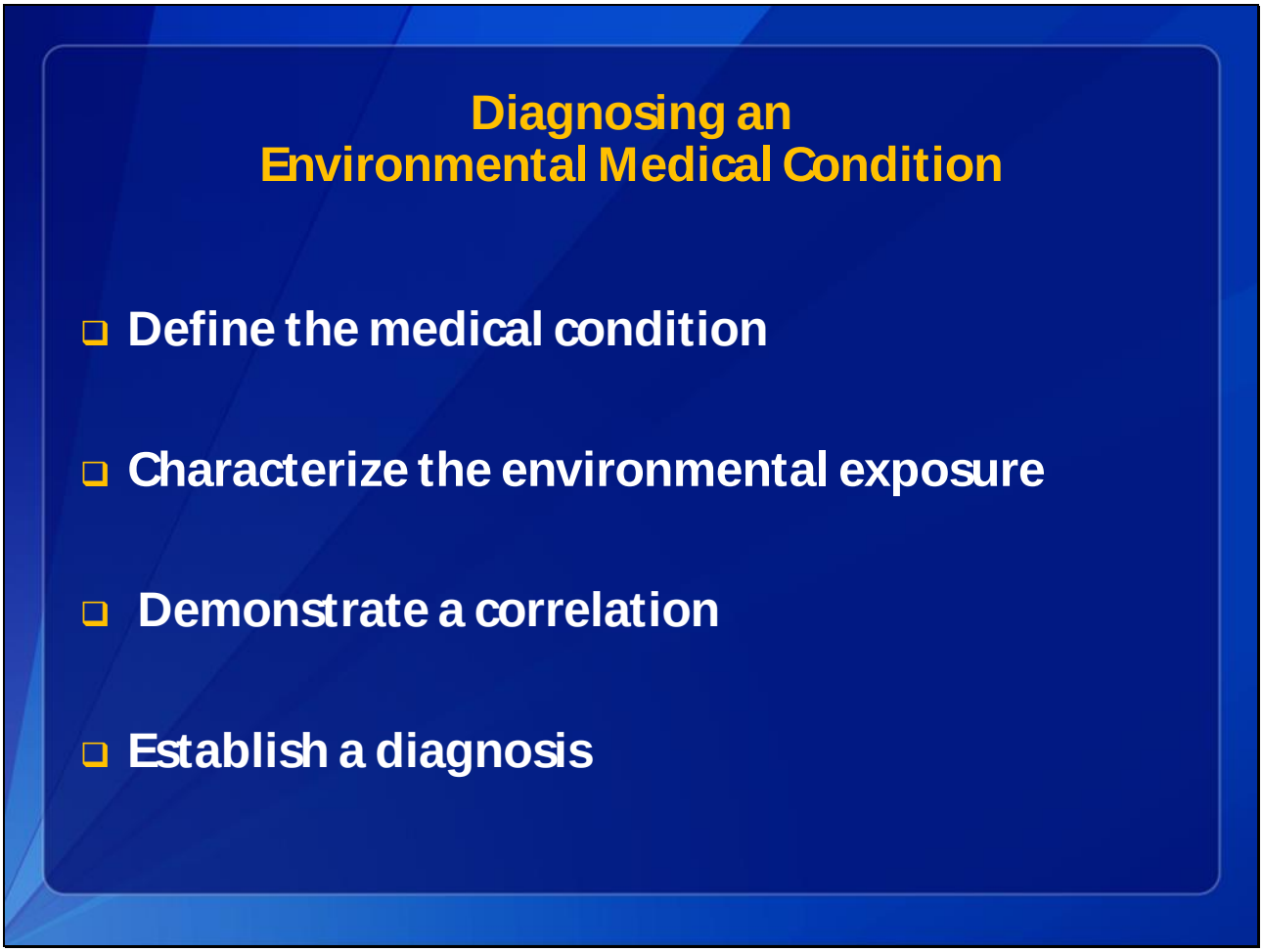
Knowledge of an exposure history is important for DIAGNOSTIC, THERAPEUTIC, and REHABILITATIVE purposes.

Slide 5



Clinical picture mimics common maladies
Etiology is *multifactorial with* non-environmental factors playing a role.

Slide 6



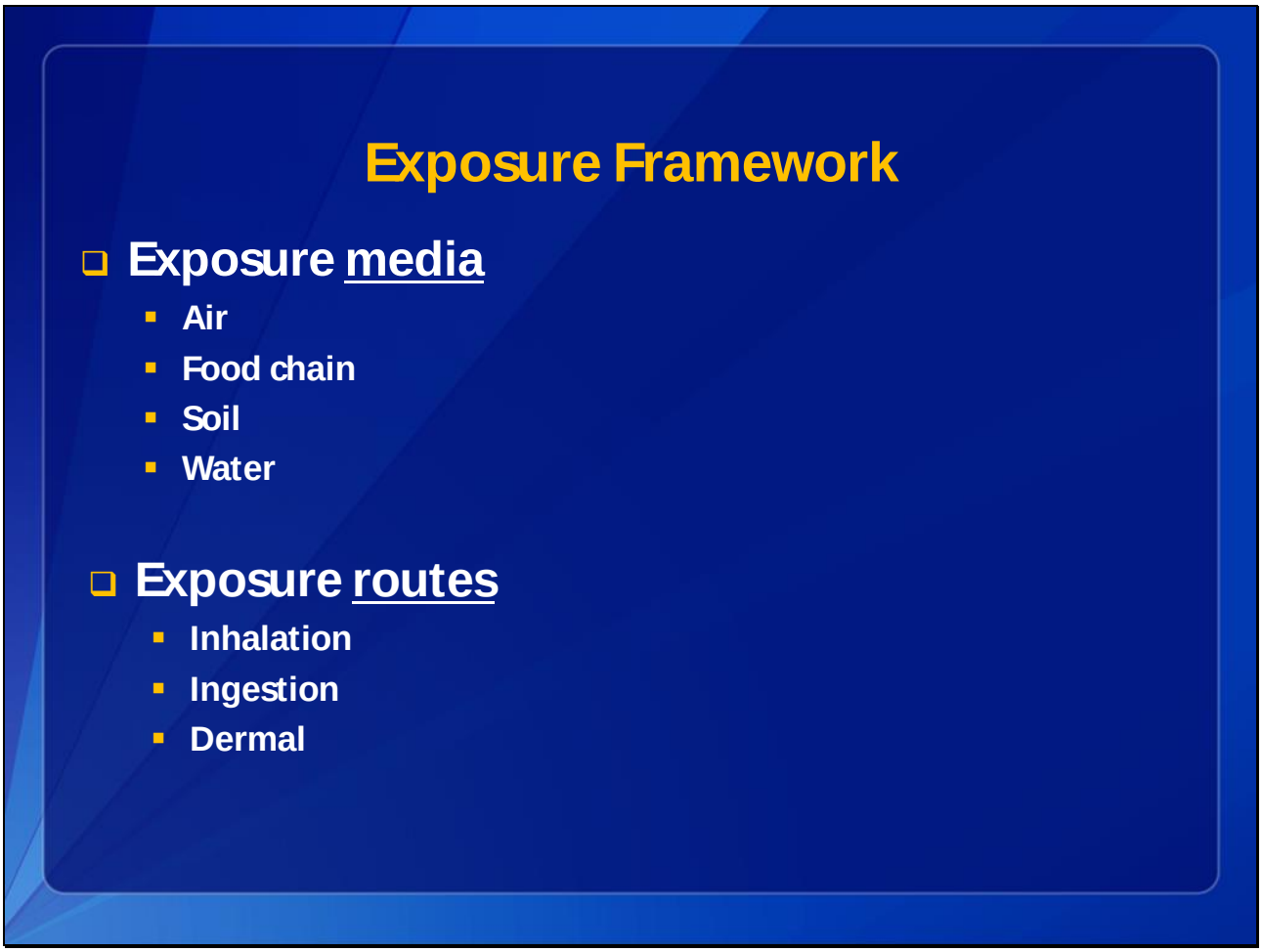
- Define the medical condition the same way you have been doing with all your patients: Ask the usual questions about symptoms, temporal relation between exposure and symptoms…
  -What are the symptoms?
  -Anyone else around the patient with similar/same symptoms?
  -What makes the person better/worse?

- *Describe* the exposure by confirming a completed exposure pathway
  A source →a factory spillage
  Transport → through ground water
  Exposure point or area →drinking unfiltered water from the tab
  Exposure route →oral ingestion
  Potentially exposed population → you and your family

- Demonstrate a correlation between the exposure and the clinical manifestations. There is dose-response relationship where low level exposure causes no health effects in most instances.

- Make a diagnosis based on your best interpretation of all available data.

Slide 7

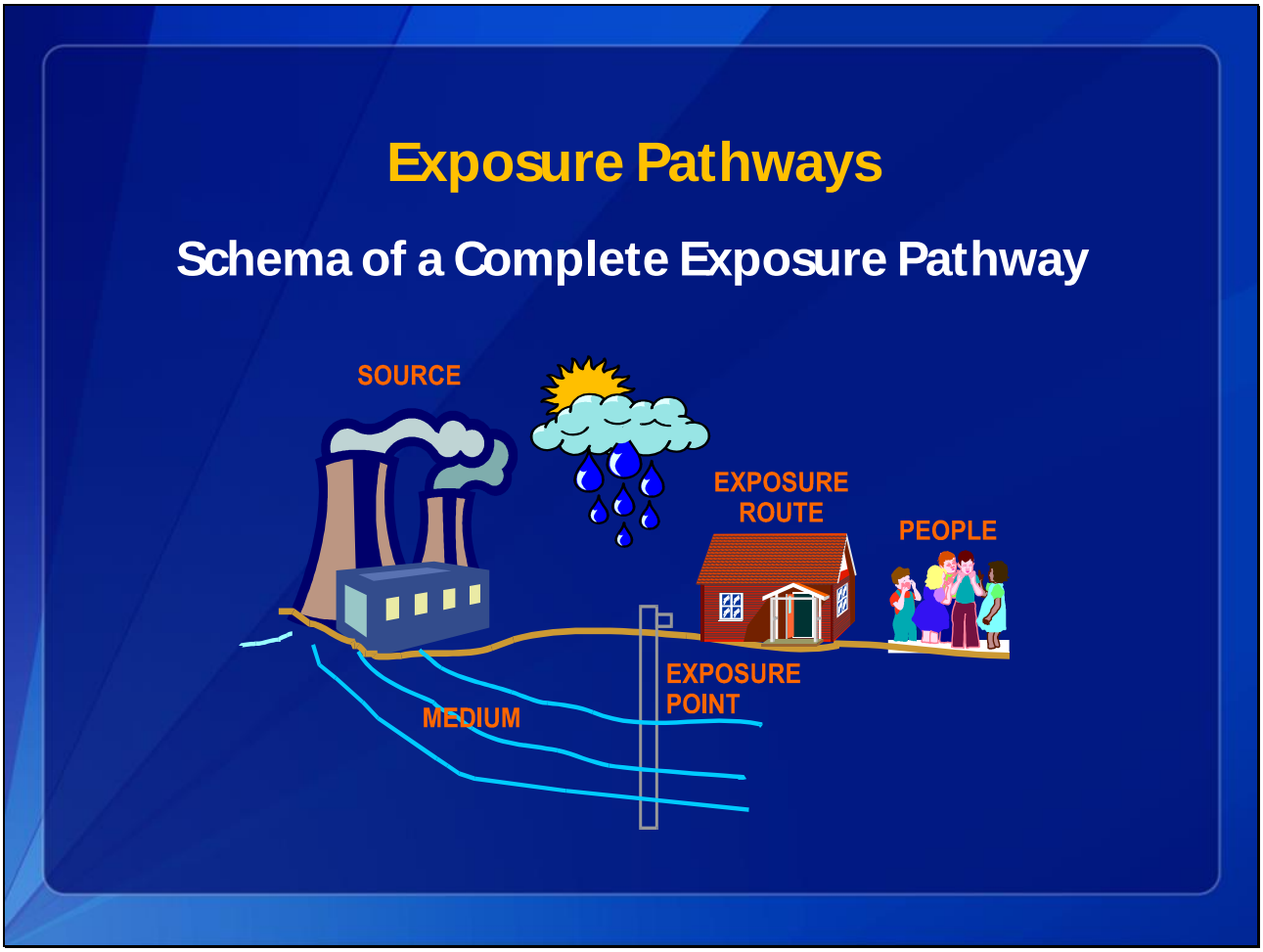


There has to be a source and an exposure.
If you are NOT exposed to a chemical, it will not make you sick.
A completed exposure pathway is needed before a person can be affected or get sick from a chemical.
On the other hand, exposure to a chemical DOES NOT necessarily mean a person will get sick.

Exposure Framework (cont…)

- Exposure timing
  - Duration and
  - Frequency
- Exposure dose
  - The dose makes the poison!

Slide 9

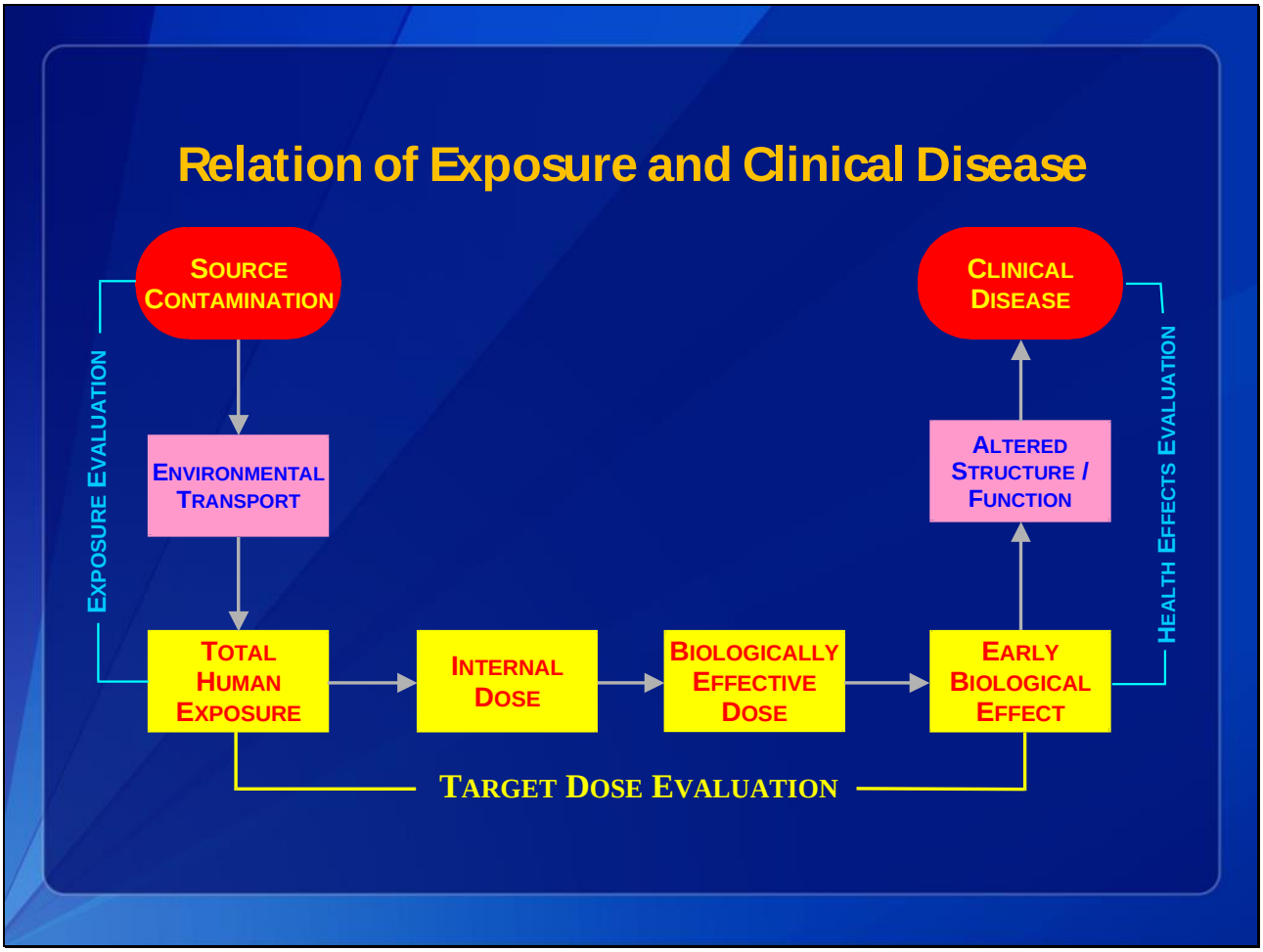


An exposure pathway is the route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it.

An exposure pathway has five parts:
1-a source of contamination (such as an abandoned business);
2-an environmental media and transport mechanism (such as movement through groundwater);
3-a point of exposure (such as a private well);
4-a route of exposure (eating, drinking, breathing, or touching), and
5-a receptor population (people potentially or actually exposed).

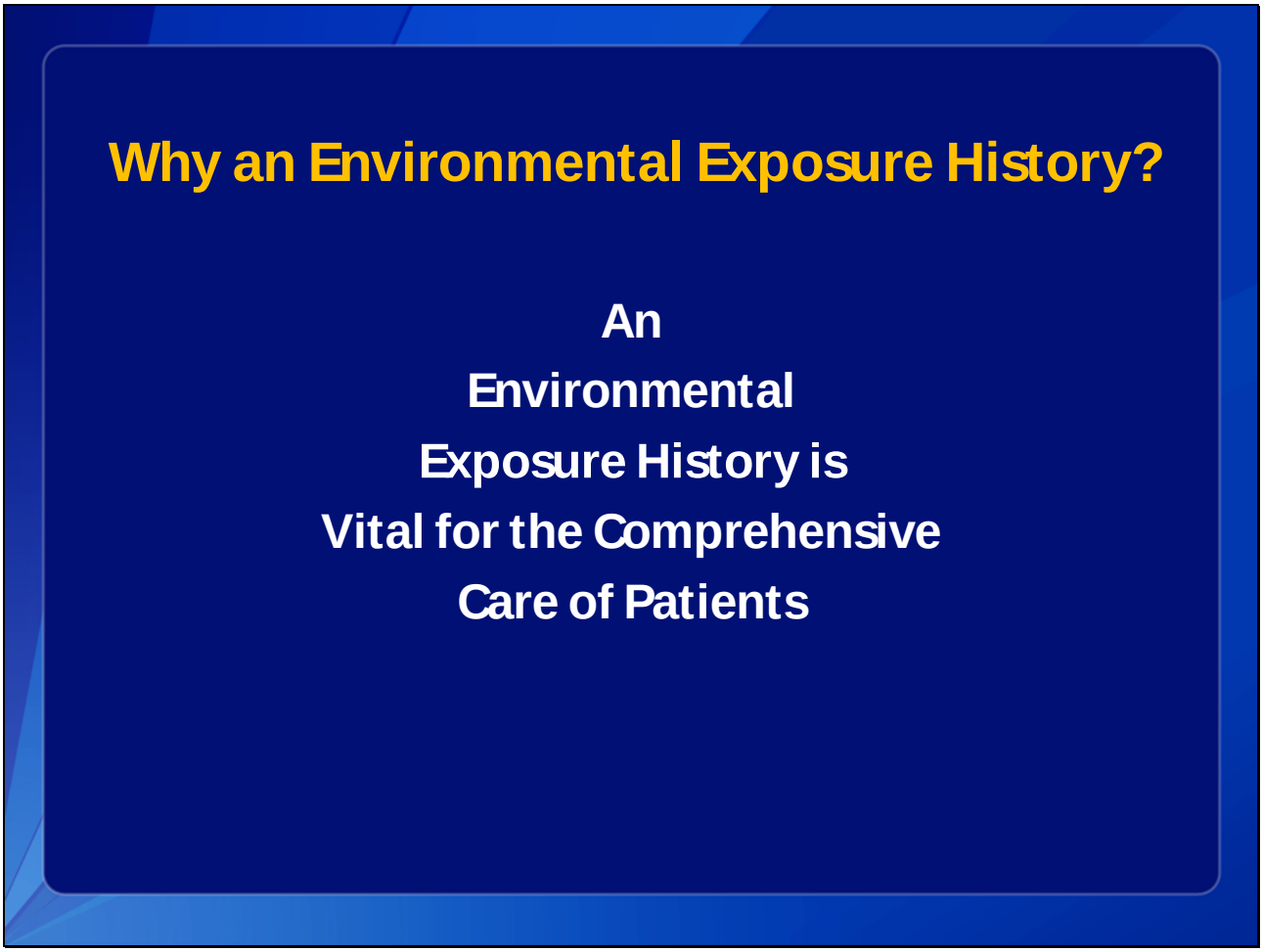
When all five parts are present, it is a completed exposure pathway.

Slide 10



LEFT→ Exposure Evaluation
On the BOTTOM →The Targeted Dose Evaluation
On the RIGHT →The Health Effects Evaluation

Slide 11



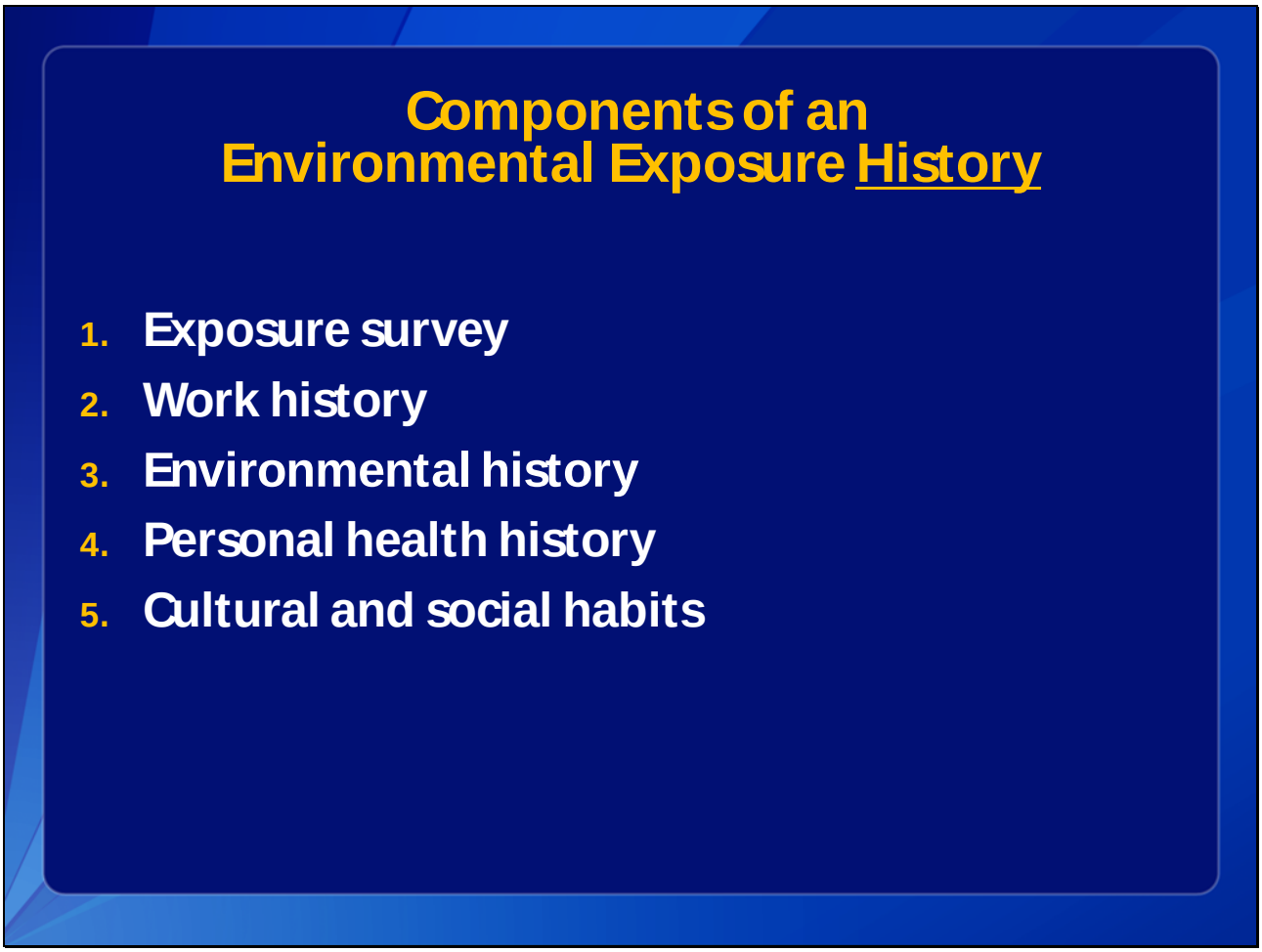
If you are going to take into account the contribution of environmental factors to your patient's problem, you need to consider environmental factors in your differential diagnosis.

More often than not the etiologic diagnosis of an environmental illness cannot be made with certainty. You need to use your clinical judgment.

Although most clinicians regularly ask about the use of cigarettes and alcohol, and some even ask about other matters such as seat belt use, they don't usually ask much about the patient's environment.
Current or past exposures, either in a workplace or another environmental setting may be important for your patient. Hobbies are also potentially important and patients are rarely asked about them.

There are several good reasons for asking about such exposures:
First, it helps to establish a good doctor-patient relationship. While most patients feel somewhat intimidated when interacting with a doctor, asking about details that the patient knows better than you do helps the patient feel more comfortable in the relationship. Patients know more about their own jobs and related exposures, as well as hobbies, living near hazardous facilities, and related matters.
Doctors can educate themselves about workplaces by talking with their patients.
Secondly, information about these issues may help clinicians reach a diagnosis more quickly. Exposure to pesticides in a family garden or working in a shipyard decades earlier may help the doctor determine something about subtle neurologic changes or the new onset of noncardiac chest discomfort.

Slide 12

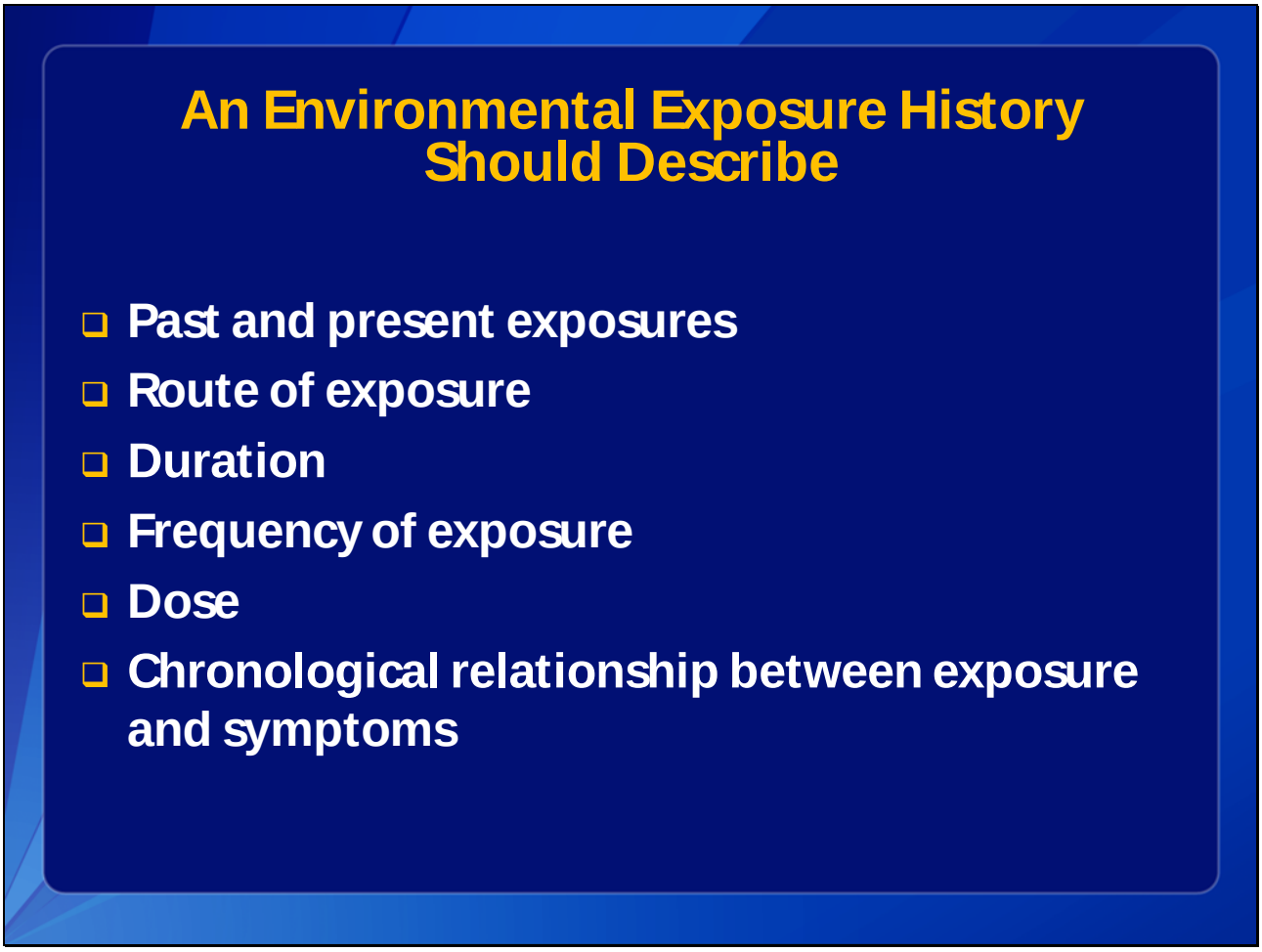


Taking an environmental exposure history should be considered a *process,* not a checklist. It is impossible to include all exposure possibilities.

You can abbreviate, expand, or focus an exposure history depending on the signs and symptoms of the patient. How much of the form you use depends on the clinical situation.

To start, we will work our way through an exposure history form.
A copy of the exposure history developed by ATSDR and NIOSH is included on the Environmental Odors Website. This is only one of several varieties that can be found in various textbooks, but is a good starting point for beginning an assessment of a patient's current and past potential exposure to hazardous chemicals.

Slide 13

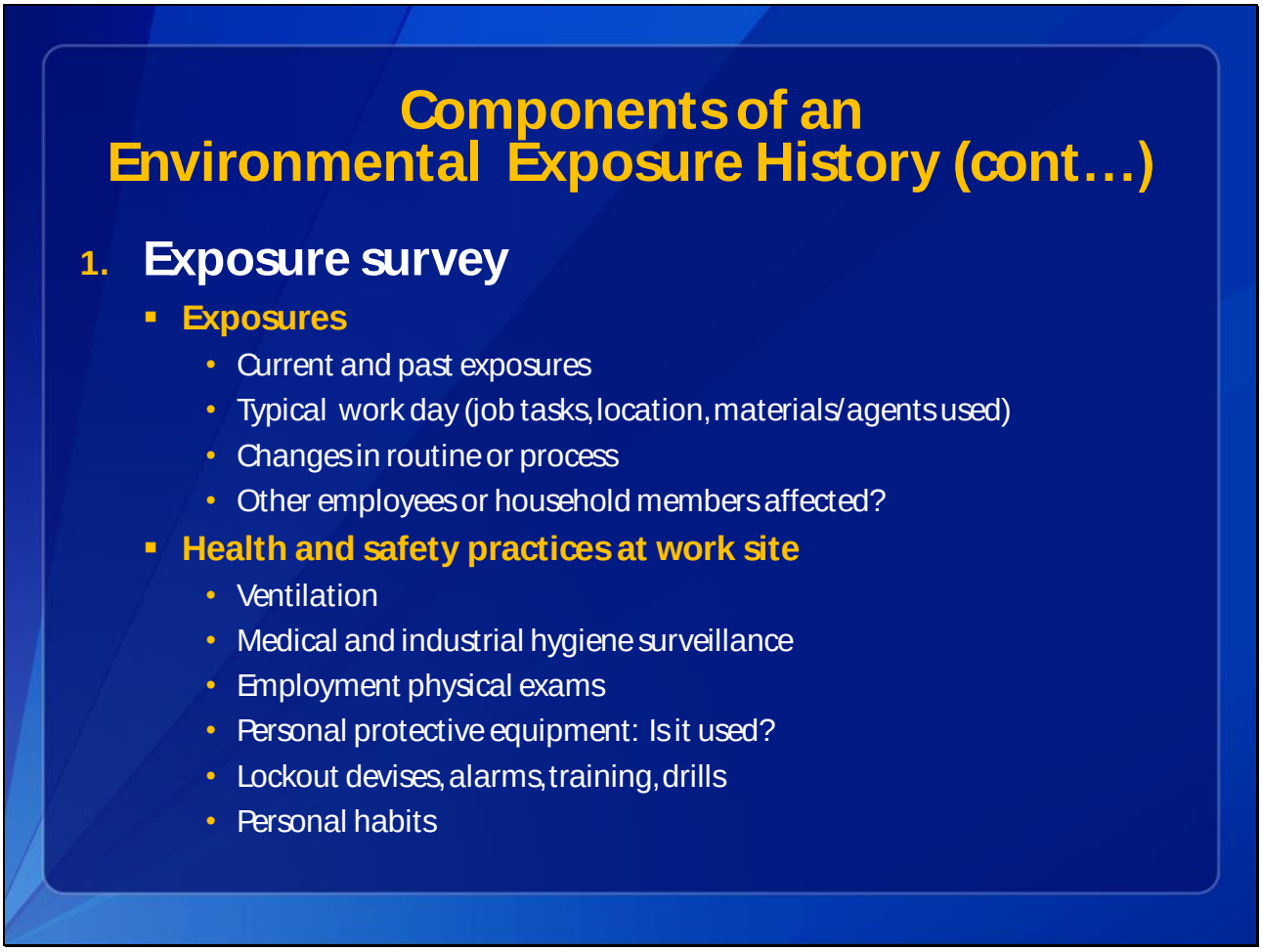


Onset:
Do symptoms occur only in certain locations?
Do other individuals complain of similar problems?

Remember: There are chemicals that have different toxic effect based on the *route of exposure,* for example

Ingesting a small amount of mercury has no clinical consequences. If *the same amount* is spilled on the carpet and *volatizes when* the room temperature goes up or when you vacuum, that mercury inhalation has deleterious consequences to the nervous system.

Slide 14



A TYPICAL WORK DAY:
Includes a review of categories of hazards that the person might be exposed to -what the person works with and is exposed to: Metals, dust, fibers, fumes, chemicals, biologic hazards, radiation, noise vibration…
The clinician can then go on and ask about specific types of exposures.

•Dusts that can produce pneumoconiosis such as *coal dust, silica or talc.*

•Fumes from welding:
-short-term → *metal fume fever:* Monday morning fever[2] Workers breathe in fumes from chemicals such as zinc oxide (ZnO) or magnesium oxide (MgO), which are themselves created by heating or welding certain metals, particularly galvanized steel.[1]
-longer term fume production → *smelting* → *exposure to arsenic*, a carcinogen, can occur, or manganese fumes can lead to a Parkinson-like picture.

•Fibers of interest would be:
-*cotton dust*, which can lead to *byssinosis,*
-*asbestos fibers* leading to *asbestosis* or several forms of cancer.

Is the ventilation appropriate? Are the ventilation systems regularly checked and/or repaired if damaged?

Many workers are subjected to *noise* at work. In addition to personal habits such as the use of firearms and motorcycles, work-related noise induced hearing loss is a major problem in this country. Excessive vibration from diverse tools from jackhammers to hand tools can give rise to Raynaud's-like symptoms or carpal tunnel problems as well.

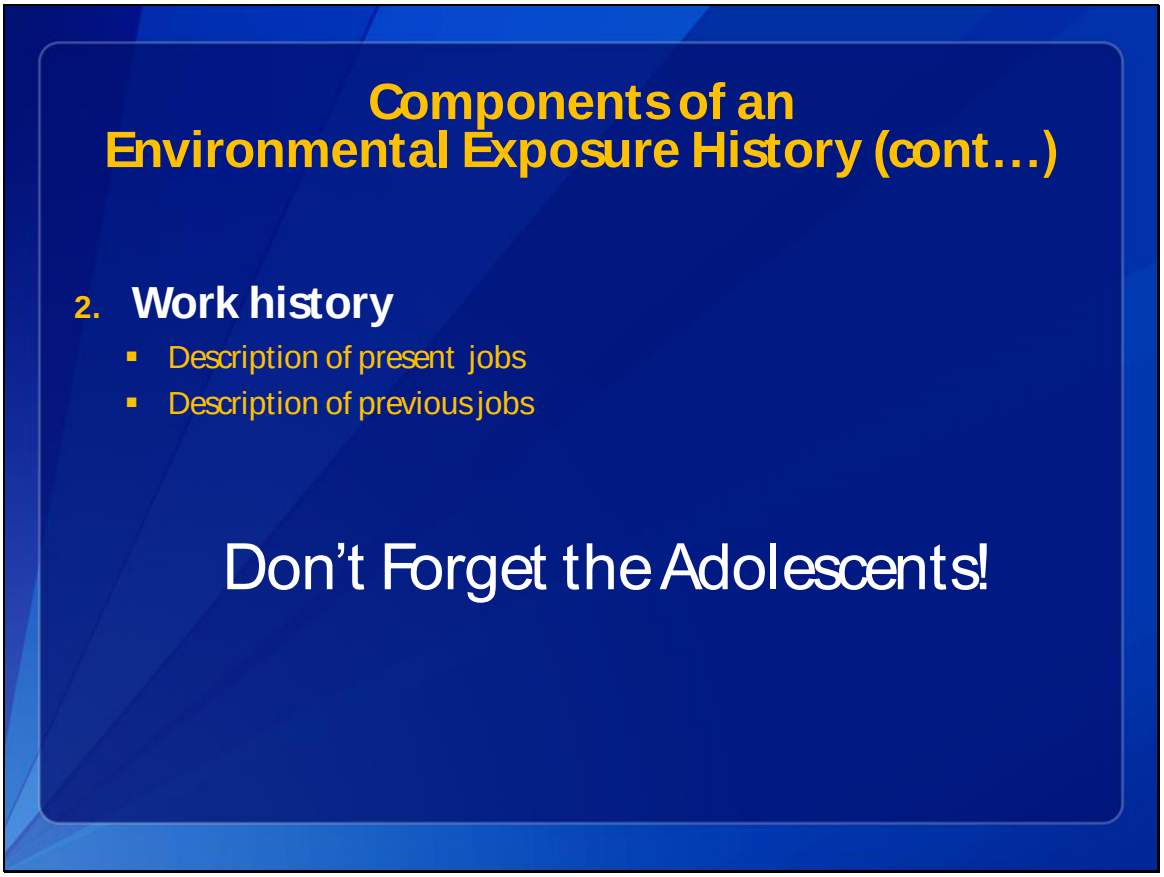
Use of protective equipment gives the clinician some basic insight as to the potential hazards at a workplace:
-The use of hardhats, steel-toed shoes, gloves, or respirators speaks to the potential for harm at a worksite and may well lead to more detailed questioning about specific hazards.

Asking other workers with the same pattern of illness may be helpful to your patient. Hazards at a worksite may be affecting many. By learning of this, it may become easier to pinpoint the problem or to at least be assured that some type of common exposure has led to the health problems.

-Detailed questioning may elicit information about a specific product or activity that gives rise to health concerns. Knowing if the symptoms get better, or worsen, at home or at work can help pinpoint the nature of the difficulty.

Personal habits→ smokes?, eats in work area?, washes hands with solvents? showers before going home? wears the same shoes he works with to go home, etc.?
If others in the patient's household seem to be having the same difficulty, it may be helpful in trying to determine the cause.

Slide 15



DESCRIPTION OF PREVIOUS JOBS.
Chronologic listing including short-term, seasonal and part-time employment and military service → Include the title and description of what they do, and substances they are exposed to. There are substances with a considerable long latent period between exposure and onset of disease: for example, asbestos.

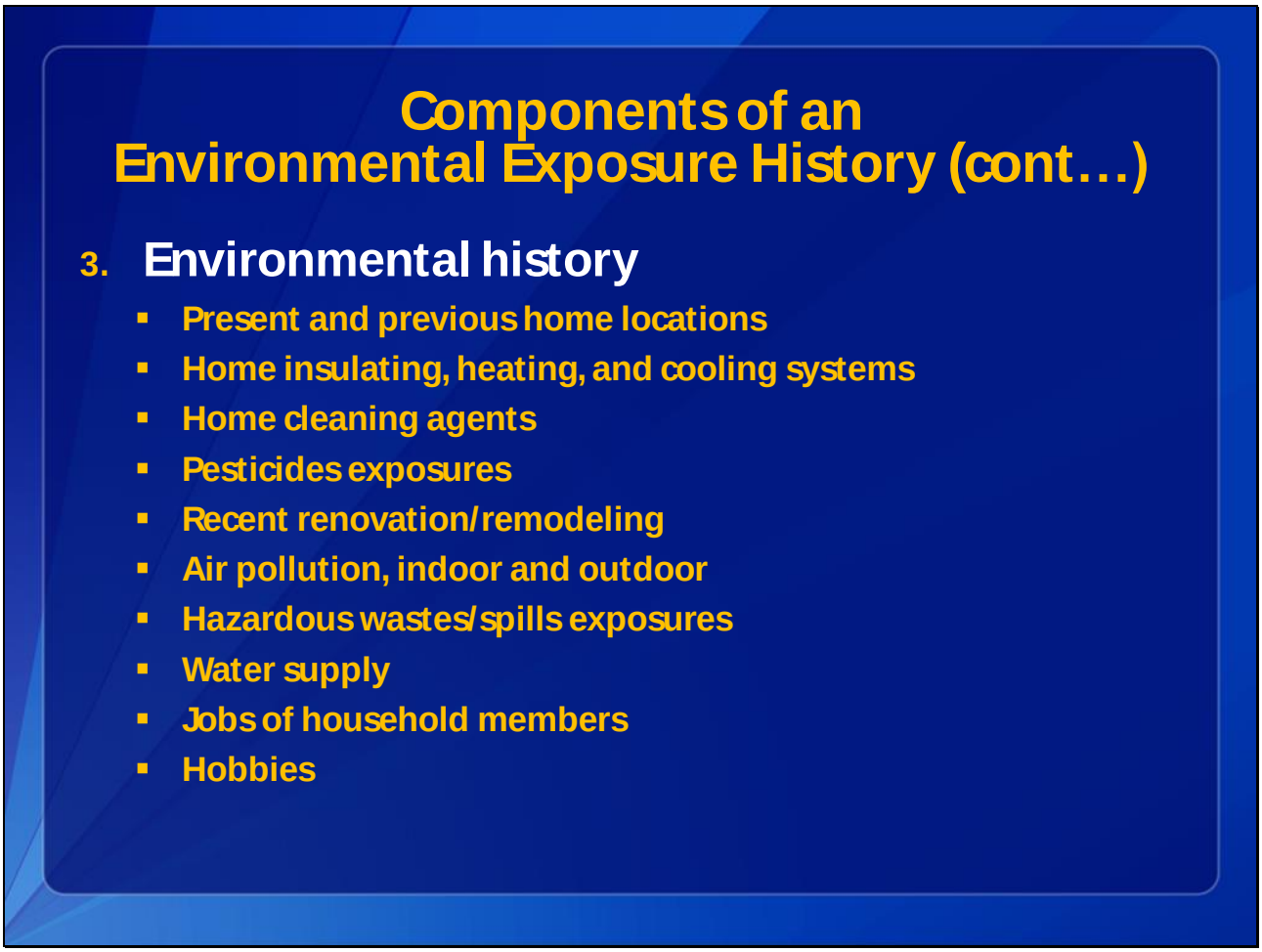
Ask about current or most recent past employment. Depending on the type of work done, each patient may then have a profile of possible exposures that give clues to the clinician. After establishing the most recent employment, it is prudent to develop a full job history, including both regular employment as well as second jobs, summer employment, and service in the military. All of these may hold clues relevant to the patient's condition, especially for diseases like cancer which may take many decades to manifest. Many carcinogens exert their potential after two or more decades, and the length of exposure might have been quite short, such as exposure to asbestos during a summer construction job or service in a shipyard in lieu of military service.

Biologic agents are significant in agriculture, food processing, and other settings as well. Patients may develop allergic symptoms of the skin from handling produce, as is seen in some grocery store clerks or asthmatic symptoms among farmers from handling moldy hay. There are several good reasons for asking about such exposures. Patients know more about their own jobs and related exposures, as well as hobbies, living near hazardous facilities, and related matters. Doctors can educate themselves about workplaces by talking with their patients. The information about these issues may help the clinician reach a diagnosis more quickly.

Lastly, with information about significant workplace exposures, the doctor can advise the patient about any possible relationship between such exposures, a disease they have developed, and assistance they may be entitled to. Such assistance may be related to their care or even for salary replacement should they no longer

be able to work. Do not forget the adolescents when asking about household member's temporary/summer jobs. Adolescents take unnecessary risk and are often forgotten by managers and supervisors with regard to associated health risks in the job place.

Slide 16



Hazards exist also in the home.
Asking about when a home was built gets to the issue of possible contamination from materials that may no longer be used but were widely used in the past. This would include the use of leaded paint before the late 1970s, putting children in such households at risk for lead poisoning. Houses built many decades ago may also be heavily contaminated with friable asbestos that may have been used for insulation, as fire protection around furnaces, in floor tile, or in roofing materials, giving rise to asbestosis and mesothelioma.
Living near industrial facilities where asbestos products were made, or where it was extensively used, can give rise to what has been called, neighborhood cases of asbestos disease, especially the cancers associated with asbestos.

Ventilation system maintenance is another important factor here.
The use of chemicals inside the home may lead to health problems. The use of bug sprays or other insecticides, either from outside services or used by the patient or a family member, can lead to difficulties.
Household chemicals carry several risks. This may be direct risk such as lye or bleach, or from the combination of chemicals that may give rise to such hazards as phosgene (Phosgene is a major industrial chemical used to make plastics and pesticides). At room temperature (70°F), phosgene is a poisonous gas. Phosgene is used in industry to produce many other chemicals such as pesticides. Phosgene can be formed when chlorinated hydrocarbon compounds are exposed to high temperatures. Pesticides can also have harmful effects, such as triggering asthma.

The presence of a pet may help alert a clinician to the role of animal dander among other triggers of asthma for many people.

Indoor air pollutants can come from several sources. A common problem is environmental tobacco smoke, it is particularly deleterious on children, giving rise to ear infections and triggering asthmatic attacks.

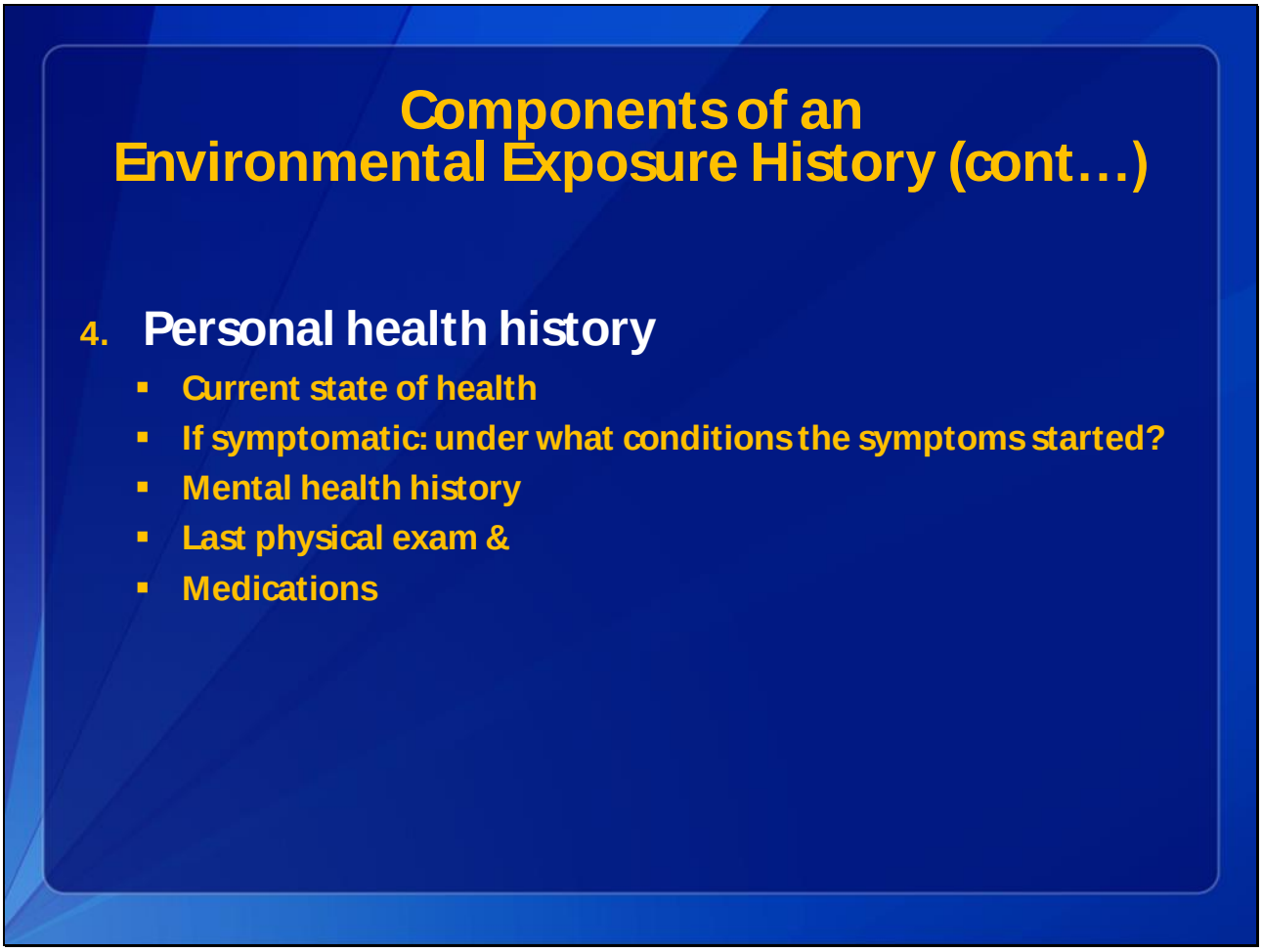
Use of wood burning stoves can also increase indoor air pollutants, as can the use of space heaters or the kitchen stove when used for heating rather than cooking. Fumes from *malfunctioning* wood or gas stoves: Gas, oil, kerosene, or wood, improperly vented fireplaces, produce nitrogen dioxide that can irritate the lungs and precipitating asthma symptoms. Kerosene heaters are the primary indoor source of acid aerosols. Other indoor air pollutants can build up with the installation of new carpeting, shelving or furniture with the offgassing of formaldehyde or other chemicals used to make these products. Also, the use of household pesticides or chemicals may add to the burden of indoor air contaminants.

House trailers are also a major source of indoor air pollutants given off from the foam used for insulation. Potential toxins can enter the homes through the air, homegrown vegetables, or contaminated water. The use of lead water pipes, in some communities means other contaminants can enter through the water supply, especially if a home uses well water rather than municipal or commercial water supplies. Commercially supplied water must be regularly tested, and reports sent to customers, in contrast to well water where no requirements for testing exist. Even commercial water supplies are tested for a limited number of items, but not regularly for many other items of potential concern, like radionuclides.

Hobbies (painting, photography, sculpting, welding, woodworking, restoring cars, shooting firearms, making stained glass, making ceramics, and gardening). Asking about family hobbies is also relevant, from jewel polishing, to soldering, to bird raising, and many other possibilities that can give rise to symptoms among those who live in such an environment.

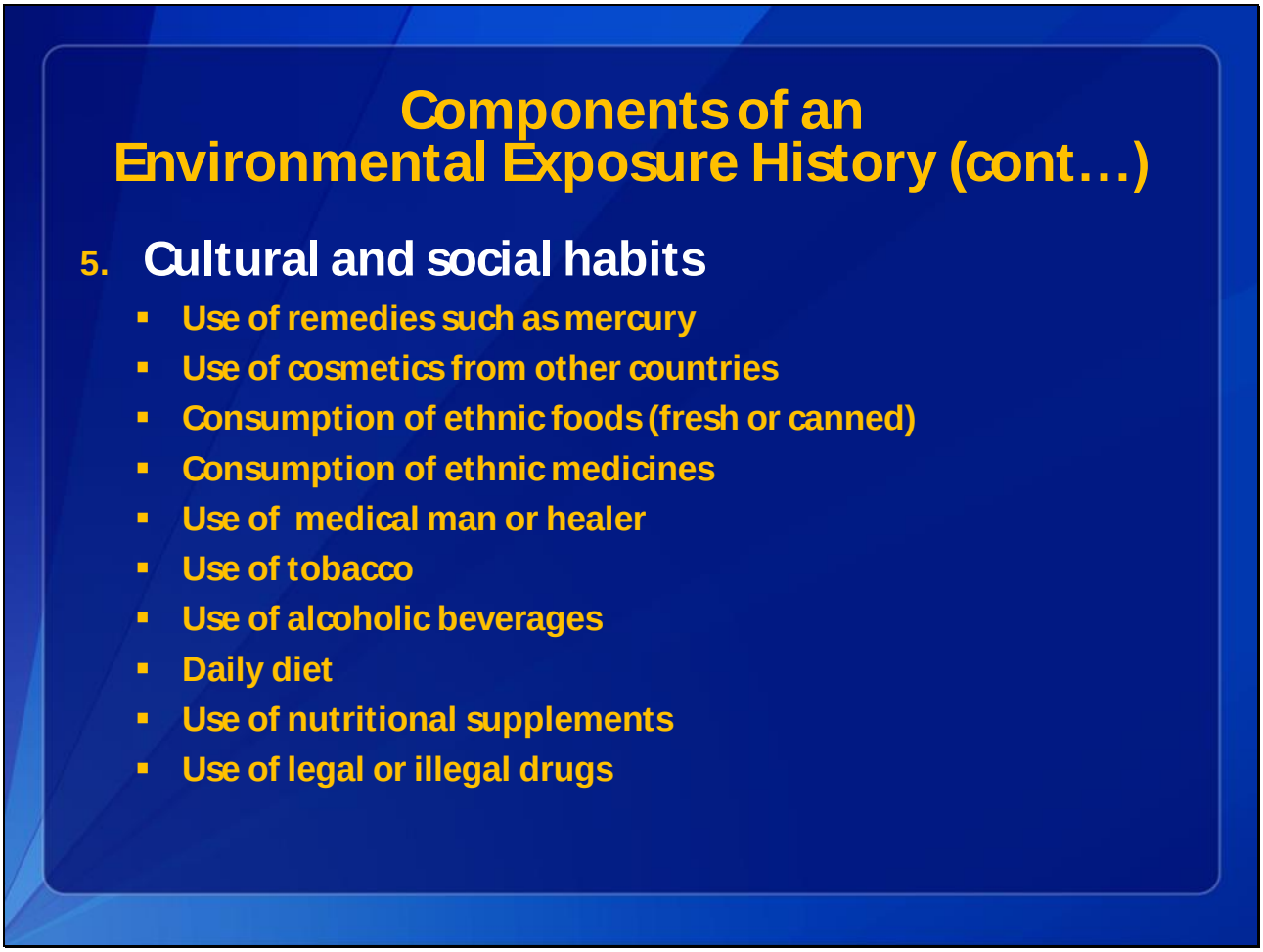
Take home contaminants.

Slide 17



Is there a change in medical condition at work/away from work?

Slide 18



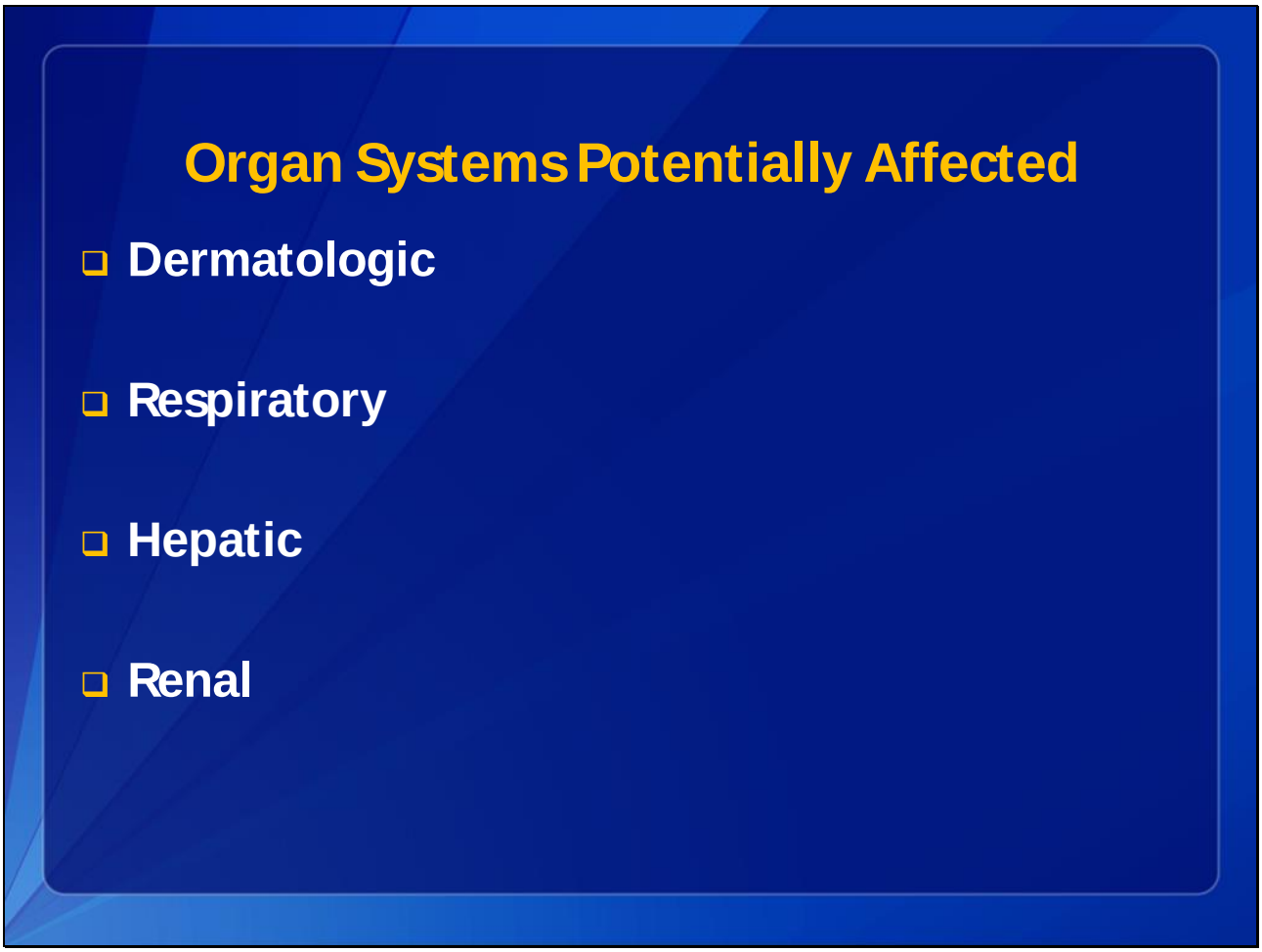
5. Cultural and social history:
Includes folk remedies that may contain hazardous substances.

- *Mercury*→ "Santería"
- *Litargirio*→ lead monoxide a peach-colored powder that is used as *antiperspirant/deodorant* and a *folk remedy* in Hispanic communities
- *Greta and Azarcón:* Traditional Mexican remedies employed to treat "empacho." Greta can contain approximately 99% lead oxide.
- *Tamarind Candy:* We have found elevated contents of lead in two types of wrappers of tamarind candy, leaching lead.
- Abnormal eating practices: Sometimes pregnant women eat *nonfood items* during pregnancy. Cause of congenital lead poisoning in a child.

  Pica: A craving for something not normally regarded as nutritive such as clay, or eating dirt, or chewing lead glazed Mexican pottery during pregnancy can produce increased lead levels in the mother and congenital lead poisoning in the fetus.

It is important to ask about the use of smoking products, alcohol, and medications either for their direct effects, such as trigger of asthma in children of smokers, or for indirect effects of the interaction of alcohol and chemicals on the bone marrow or liver (benzene).

Slide 19



In environmental medicine, some organ systems are more likely to be affected than others. The most commonly affected organs include the skin and the respiratory system, but many others can be affected as well including the central nervous system, the liver, the kidneys, and hematopoetic system.

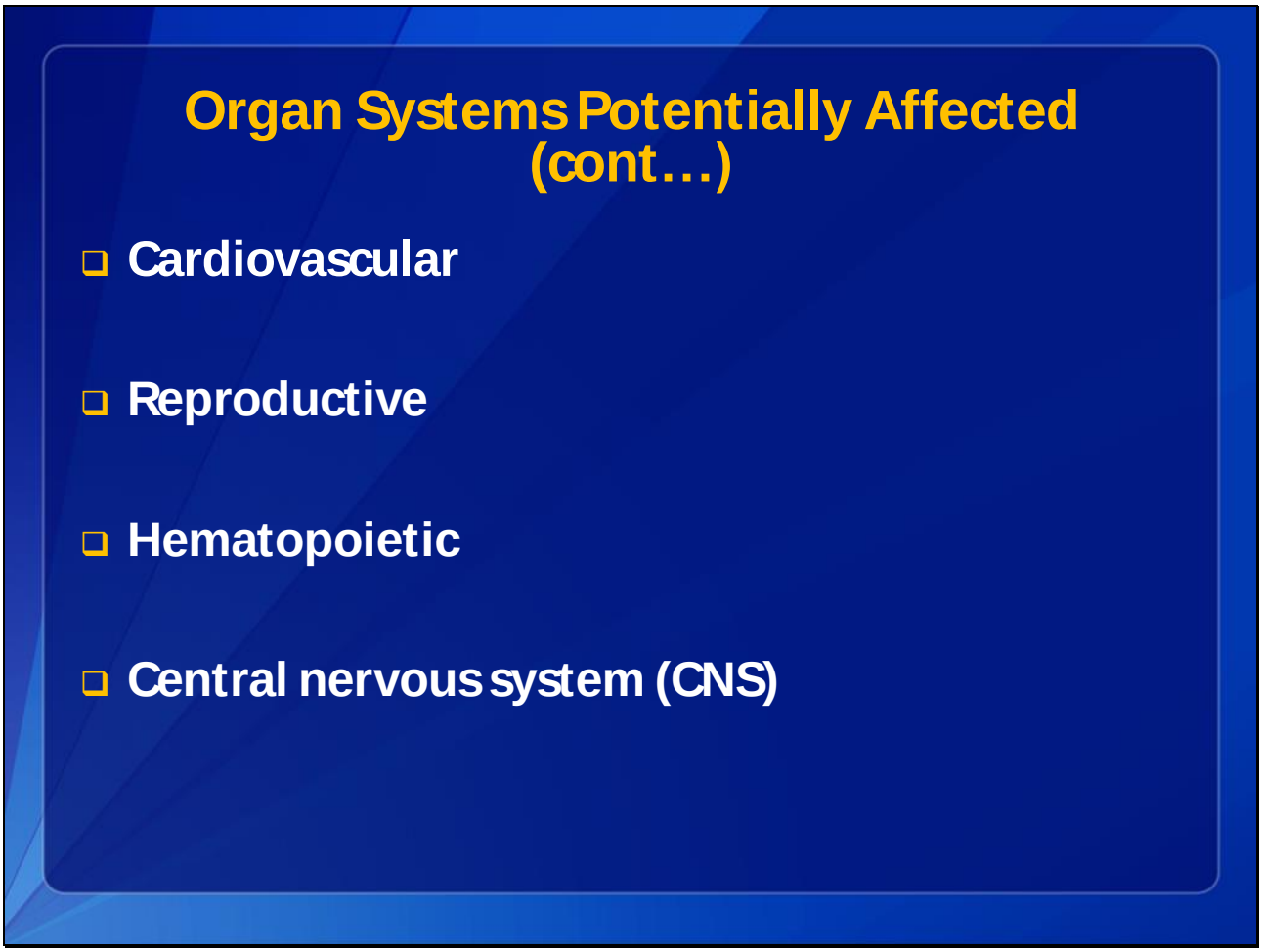
-The skin: Irritant and allergic contact dermatitis account for 90% of occupational skin disorders. Dermatitis, eczema, and even skin cancers may be related to various exposures: polychlorinatedbyphenyls (PCB), dioxins (chloracne), heavy metals (nickel, arsenic, mercury…)

-The lungs: Major route of entry and also a target organ itself. Among the more common are asthma, both in adults and children, pneumoconiosis such as black lung, silicosis, and asbestosis, and various causes of lung cancer including arsenic, carbon-derived materials and radiation.

-The liver: Affected by solvents (such as acetone, ethylene glycol, toluene, and xylene among others) and other materials, often metabolized in the liver. Alcohol use may act synergistically in causing medical problems.

-The kidneys: Many new cases of renal diseases of unknown etiology are diagnosed annually. The kidneys can be affected by heavy metals and organic solvents, giving rise to diverse diseases such as hypertension caused by lead, or renal failure. Solvents can cause kidney failure leading to dialysis, as is seen in among histology technicians, for example.

Slide 20

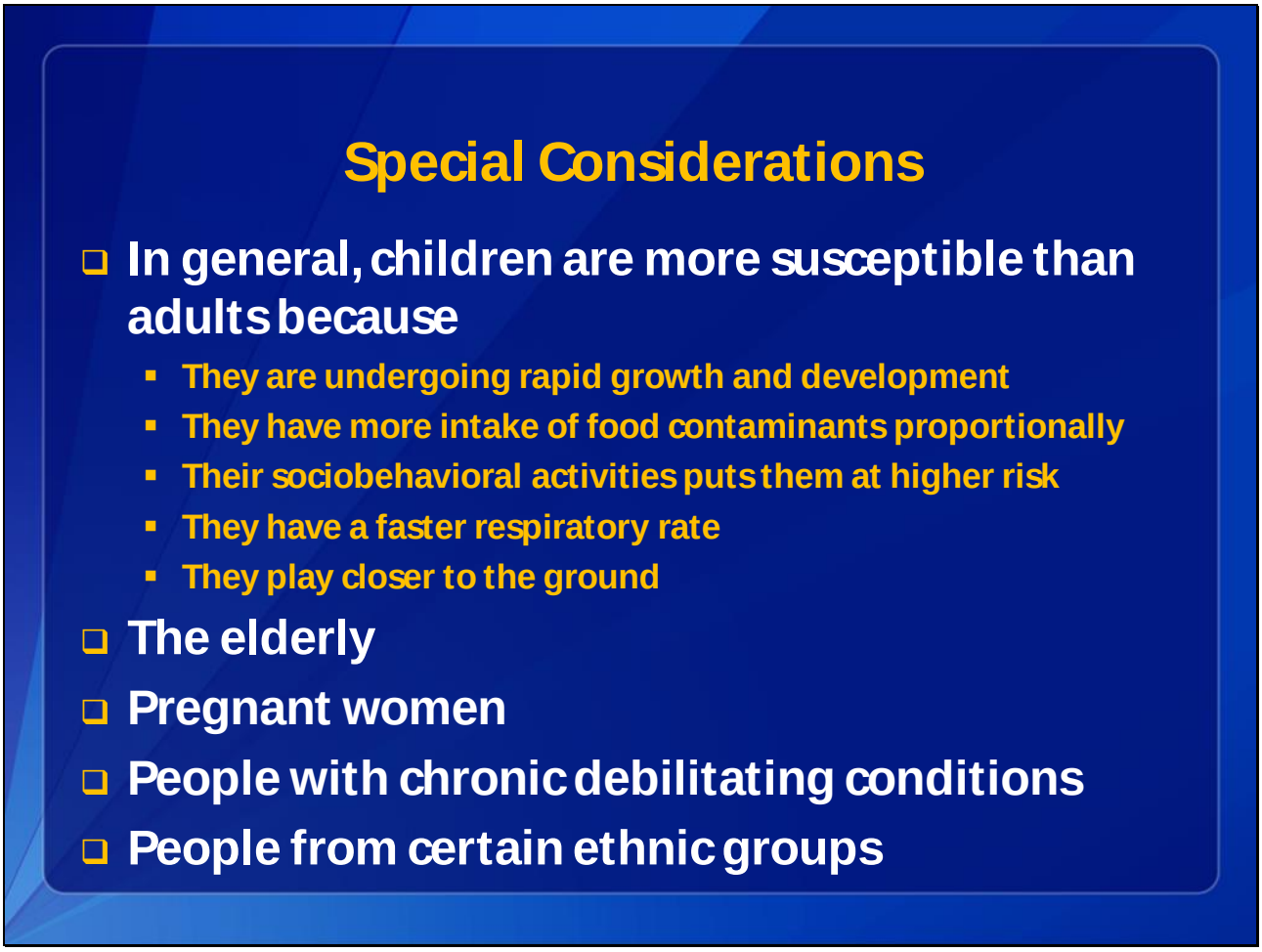


-The heart can be affected by carbon disulfide → premature atherosclerosis, or by air pollutants, which give rise to myocardial infarct. Carbon monoxide, tobacco smoke, physical stress, Nitrates, methylene-chloride can also affect the heart.

-Reproductive: Lead, Methyl mercury, carbon monoxide, Ethylene oxide.

-The Hematopoetic system: The blood forming organs can be affected by solvents, such as benzene leading to leukemia, or the same condition arising from exposure to radiation. Benzene exposure can also give rise to myelofibrosis, lymphomas, and multiple myeloma.
With regard to chemicals, many thousands are beyond the scope of knowledge of most clinicians, but a few key ones should be appreciated. For example, if there is evidence of benzene exposure, one may be more concerned about the hematopoetic system, or platinum salts giving rise to allergic phenomena, solvents causing problems in the liver or kidneys, or many others. Prior radiation exposure from such settings as mining, ore processing or in healthcare facilities, put individuals at risk for such problems as lung cancer or leukemia.
ARSENIC: Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenic (CCA) is used to make pressure-treated lumber but not for residential use in the U.S.; it is still used in industrial applications. Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.-Benzene,-Nitrates, Radiation
CNS: Many neurotoxicants, from lead to methanol (visual impairment).

Slide 21



-Compared to adults, children's rapidly developing nervous and immune systems are especially vulnerable to environmental hazards →They eat more fruits and vegetables for their size - all of which enhance exposure to toxicants.
-Behaviorally, children exhibit high levels of *hand-to-mouth intake* and some may have pica. Children spend an increased percentage of time near the ground, and most chemical fumes are heavier than air and they stay closer to the floor. Also, when an accidental mercury and/or arsenic spill happens, the chemical remains immersed in the carpet fibers and can volatize when the room temperature raises, or when you vacuum.
Several factors increase the susceptibility of young children to environmental hazards.
Once exposed to hazardous contaminants, children are much more likely to express toxic effects. For example, relative to their smaller size, children's respiratory rate, absorption rate, and metabolic rates are higher than adults. Furthermore, rapid bone development in young children enhances the potential for chemical interference in bone metabolism. More commonly, however, fetuses, infants, and children are less able to detoxify chemicals and thus are more vulnerable to them.
<u>There are exceptions:</u> They are unable, for example, to metabolize some toxicants to their active form, e.g. acetaminophen poisoning in the mother, spares the fetus because the fetus' immature liver prevents the active metabolite of acetaminophen from harming it.
Aminophyllin: Adults are more sensitive than small children to the cardiac effects of aminophyllin.
The elderly→ Chronic health conditions, multiple medications, inability to ambulate on their own, decreasing sense of Olfaction not making them aware of offensive environmental odors such as Hydrogen sulfide, putting them at risk for higher exposures etc.
Pregnant women→ Heavy metal poisoning such as lead poisoning, methyl mercury in fish…


How Can We Protect Our Patients?
Treatment is not a replacement for environmental modifications
Avoid exposures!!

Slide 23

Links & Resources

1. ATSDR, Case Studies in Environmental Medicine: Taking an Exposure History, Course: WB 1109 http://www.atsdr.cdc.gov/csem/csem.html
2. ATSDR Taking a Pediatric Exposure History: http://www.atsdr.cdc.gov/csem/pediatric_history/docs/pediatric_history.pdf
3. Environmental Health and Medicine Education: http://www.atsdr.cdc.gov/emes/health_professionals/grem.html
4. ATSDR Toxicological Profiles: http://www.atsdr.cdc.gov/toxprofiles/index.asp
5. Clinical Environmental Health and Toxic Exposures. Second Edition. Sullivan, Jr. JB., Krieger, GR., Editors. Lippincott Williams & Wilkins. 2001.
6. Occupational & Environmental Medicine, Fourth Edition, La Dou, J. Lange Series. 2007.
7. Pediatric Environmental Health, Second Edition, American Academy of Pediatrics, Committee on Environmental Health 2003.
8. TOXNET Toxicology Data Base: http://toxnet.nlm.nih.gov/
9. IRIS (Integrate Risk Information System): www.iris.epa.gov

Slide 24

Main CDC at 1600 Clifton Rd., Atlanta., GA., 30333

Slide 25

For more information, please contact Agency for Toxic Substances and Disease Registry

4770 Buford Hwy, NE Chamblee, GA 30341

Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

Visit: www.atsdr.cdc.gov | Contact CDC at: 1-800-CDC-INFO or www.cdc.gov/info

Agency for Toxic Substances and Disease Registry

Division of Community Health Investigations (DCHI)