

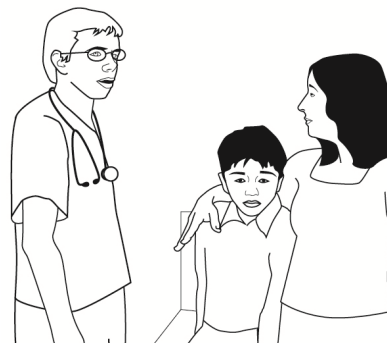
# Lead: An Element of Danger

## Part I: What's Wrong with Santiago?

**Patient: Santiago Cruz**

**Age: 5 years**

Santiago's mother is worried because he has become irritable and is not eating well. He is having problems with learning and behavior in school. His teacher reports that he is inattentive and overly active.



Santiago's mother wonders if he is sick or if his problems might be related to family stress. Because of her divorce three years ago, she needed to move with her three children into an old apartment building that was built in 1945. She also needed to get a job, and she started working for a company that remodels old homes.

The doctor suspects that Santiago might be suffering from lead poisoning. He has drawn a sample of Santiago's blood. He would like you to test Santiago's blood lead level.

1. Dip one end of the Lead Test Paper into the sample of Santiago's blood for approximately 2 seconds.
2. Immediately compare the color of the Lead Test Paper with the **Blood Lead Concentration Color Chart**.
3. What is the concentration of lead in Santiago's blood?  
 \_\_\_\_\_  $\mu\text{g}$  lead/dL (micrograms of lead per deciliter of blood)
4. Is the concentration of lead in Santiago's blood safe or dangerous? \_\_\_\_\_
5. According to the information in the table, **Effects of Lead on Children's Health**, what kinds of problems may result from Santiago's lead level?  
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## Part 2: Health Effects of Lead

Lead is a highly toxic metal that causes many health problems. It can disrupt the development and function of every system of the body. Lead is particularly dangerous because it interferes with oxygen and calcium transport within the body and disrupts nerve communication in the brain.

1. State two ways that lead may interfere with the development and function of body systems.

- \_\_\_\_\_
- \_\_\_\_\_

Lead enters your body when you eat things that contain lead or breathe in dust that contains lead. Once lead enters the body, a small amount remains in the bloodstream but most of it is stored in bones, kidneys, and the brain. Lead stays in the body for a long time. A person can be poisoned through high exposure to lead during a short period of time or through accumulation of lead from low exposure over a long period of time.

2. Explain how exposure to low levels of lead over a long period of time may result in high levels of lead in the body.

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Because Santiago's blood lead level was high, the doctor ordered blood lead tests on other members of Santiago's family. Here are results of the blood lead tests for Santiago's family.

Family Members	Age (years)	Blood Lead Level ( $\mu\text{g}/\text{dL}$ )
Santiago	5	15
Santiago's Mother	30	30
Santiago's Brother - Mateo	3	30
Santiago's Brother - Luis	10	15

3. Do the blood lead levels for Santiago's family put them at risk for health problems?

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4. Describe two ways that lead could have entered the bodies of people in Santiago's family.

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- \_\_\_\_\_

Blood lead levels will gradually decrease without treatment if the source of lead exposure is removed. A medical treatment called chelation therapy is used only if lead levels are extremely high (above 45  $\mu\text{g}/\text{dL}$ ). In chelation therapy, a chemical is injected into the patient's bloodstream. The chemical binds to lead and removes the lead from the patient's body. Chelation therapy is not used to treat lower lead levels because it has limited effectiveness and can have harmful side effects.

5. Is there a treatment that doctors would recommend for removing lead from the bodies of Santiago's family members? Explain your answer.

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Children under the age of 6 years old are most at risk for the harmful effects of lead. Young children ingest more contaminated dust or dirt because they crawl and play on the ground and put their hands or toys in their mouths. This lead exposure comes at a time when children's bodies are building their vital organs and skeletal and nervous system structures. Lead is particularly toxic to children's developing nervous systems.

Protecting children from exposure to lead is important to their lifelong health. Even very low levels of lead in blood have been shown to decrease children's:

- Intelligence
- Ability to pay attention
- Academic achievement

Unfortunately, most children do not show obvious symptoms of lead poisoning. When there are symptoms (ranging from irritability to stomach upset), these may not be immediately recognizable as lead-related. Therefore, without blood screening, the majority of lead poisoning cases go undiagnosed.

6. Which family member is most at risk from high lead concentrations? Explain why.

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7. List at least two ways in which the children in Santiago's family could be affected by high levels of lead.

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8. Explain why it is difficult to diagnose lead poisoning without testing blood lead levels.

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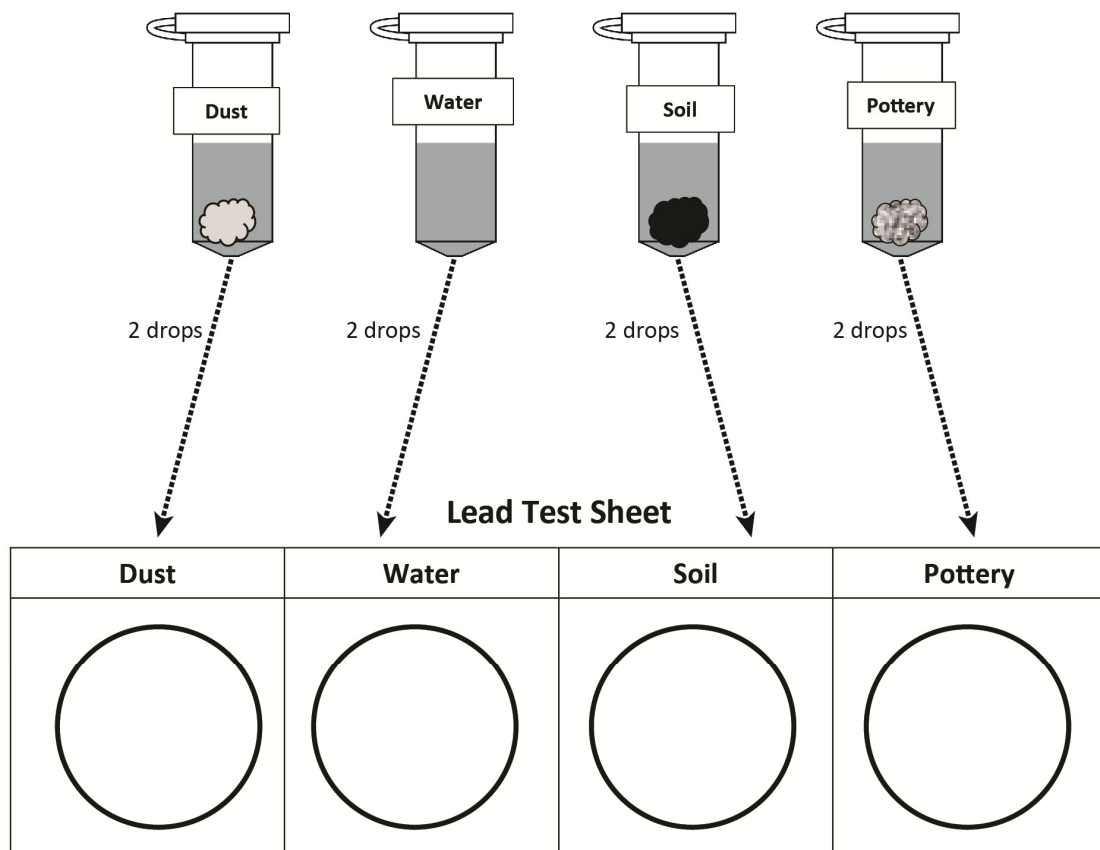
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### Part 3: Preventing Lead Exposure

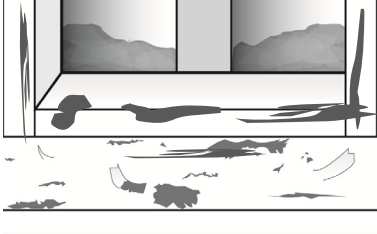



Because the effects of lead exposure cannot be corrected, it is important to prevent lead exposure to children before they are harmed. Lead hazards in a child's environment must be identified so that they can be controlled or removed safely.

You will conduct tests to identify the sources of lead contamination that are poisoning Santiago and his family.

1. Your lab kit contains four tubes containing samples collected from the family's home environment (dust, water, soil, and pottery). A laboratory technician has already added Lead Test Solution to the samples in each of the tubes.
2. Use the appropriately labeled dropper to transfer 2 drops of the liquid from the tubes to the appropriate circles on the plastic **Lead Test Sheet** in your kit.



- Dip one lead test swab into each liquid sample on the **Lead Test Sheet**. Gently twist the swab so that it comes in contact with the liquid. Use a new lead test swab for testing each sample!
- If the lead test swab turns red or pink, it indicates that the sample contains lead.
- Record the results of the lead tests in the table below.

	<b>Sample Tested</b>	<b>Is lead present? Yes or No</b>
	<p style="text-align: center;">DUST</p> <p>Paint dust from the window sill in the family's apartment</p>	
	<p style="text-align: center;">WATER</p> <p>Tap water from the family's apartment</p>	
	<p style="text-align: center;">SOIL</p> <p>Soil from the playground where the children play</p>	
	<p style="text-align: center;">POTTERY</p> <p>Chips from pottery dishes the family uses for meals</p>	

- Based on the results of the lead tests, what are the sources of lead exposure for Santiago's family?

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How can you tell if a house contains lead? In some areas, the local municipality, housing or health department may test homes for lead. You can also hire a professional to do a lead assessment, but this can cost over \$500. Lead test kits are available in many hardware stores, but it is easy to miss lead dust when using these kits.

All buildings constructed before 1978 are likely to contain some lead-based paint. This paint can peel and crack to create lead contaminated dust on surfaces inside the buildings and in the lead contaminated soil outside the buildings. Even if old lead paint has been painted over with new non-lead paint, small chips and friction (especially on windows, doors, and floors) can result in lead-contaminated household dust and soil. Vegetable gardens planted in lead contaminated soil may result in foods that contain lead, and gardeners can be exposed if they do not thoroughly wash their hands after working in soil. It is safest to assume that a house built before 1978 has lead, and you should take actions to control peeling and chipping paint, dust, and bare soil.

Other things in addition to house paint may contain lead. Older furniture, cribs, and toys may be painted with lead-based paint. Plumbing in older houses may contain lead that can contaminate drinking water. Some other countries do not test products to be certain that they are lead free. Therefore, you should avoid using imported items such as folk medicines, candies, toys, jewelry, containers, cookware, or tableware that are not shown to be lead free. Some hobbies (such as making stained glass), lead sinkers, fishing lures, and bullets can be sources of lead exposure. Jobs that involve lead such as painting, construction or remodeling, and mechanics may expose workers to lead dust, and these types of workers may bring the dust home to their families.

9. List at least four possible sources of lead (in addition to household dust, soil, and pottery) that may be affecting Santiago's family.

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- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Once sources of lead have been identified, it is important to take actions to prevent children’s lead exposure before they are harmed. Make sure a child does not have access to peeling paint or chewable surfaces painted with lead-based paint. Children and pregnant women should not be present in housing built before 1978 that is undergoing renovation. Children and pregnant women should not participate in activities that disturb old paint or in cleaning up paint debris after work is completed. All contractors working on renovating pre-1978 housing should be trained in lead safe work practices to keep from creating and spreading lead dust. Until water from a pre-1978 home is tested and shown to be lead free, use only cold water from the tap for drinking, cooking, and making baby formula.

It is also very important to use good cleaning techniques to prevent children’s exposure to lead. Frequently wash children’s hands and toys because these may be contaminated with household dust or with exterior soil. Because household dust is a major source of lead, you should wet-mop floors and wet-wipe horizontal surfaces (like counter tops) every 2-3 weeks. Use mops and cleaning cloths that have been moistened with detergent water. Window sills and window wells can contain high levels of leaded dust, so they should be kept clean. Take off shoes when entering the house to prevent bringing lead-contaminated soil in from outside. Prevent children from playing in bare soil, which may be contaminated with lead.

10. The Santiago family lives in an apartment building that was constructed in 1945. List at least five actions that Santiago’s mother could take to reduce the family’s exposure to lead.

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