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Are there toxic chemicals in people's bodies?

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Abstract

Did you know that some parts of the United States are contaminated with high levels of toxic chemicals? These sites are so dangerous that the government must clean them up. Glynn County, Georgia has many of these sites. We wanted to know if Glynn County residents had toxic chemicals in their bodies. Working with community members, we collected blood samples from one hundred people. We analyzed the samples for chemicals. Then we compared these levels to those found in the general population. We found that people in Glynn County had higher levels of some chemicals in their bodies. Older residents, Black people, and people who fish were more likely to have higher levels of these chemicals. So were people who worked at one of the sites or lived with someone who did.

Introduction

Toxicants are substances that are harmful to humans or other living things. Some toxicants are **persistent chemicals**. That means they remain in the environment for a long time. Factories that make these chemicals sometimes release the chemicals into the areas around them. So do businesses and farms that use the toxicants. What about the people who live in these areas? Residents may be at risk for significant health problems because of exposure to these chemicals.

Some locations in the United States are called Superfund sites. These locations have high levels of dangerous toxicants. The federal government has a special program for cleaning them up.

We focused our research on three Superfund sites in Glynn County (see Figure 1 on page 2).

- Toxaphene was a common **insecticide** used on cotton and was once made in Glynn county. Sites A and B have high levels of toxaphene, even though it is no longer made.

The first photo is an aerial view of the LCP Superfund site. It shows how close it is to the rivers and marshes. In the second photo, signs in Glynn County warn people about fishing in certain areas. **Images:** courtesy of the Glynn Environmental Coalition Archives and Emily Clarke

- Site C has the toxicants **mercury** and a type of Aroclor. **Aroclors** contain a mixture of chemicals called **polychlorinated biphenyls (PCBs)**. Site C is no longer an active industrial site.

These chemicals can cause a variety of health problems. Toxaphene and mercury can cause damage to the kidneys, and **nervous system**. PCBs can cause cancer and damage to many body systems, including the nervous system, **immune system**, and **reproductive system**.

The people living in Glynn County wanted to know, "Are these toxicants in our bodies?" So, we conducted a study to find out. We checked if the levels of these chemicals were higher in the residents' blood than in the general population.

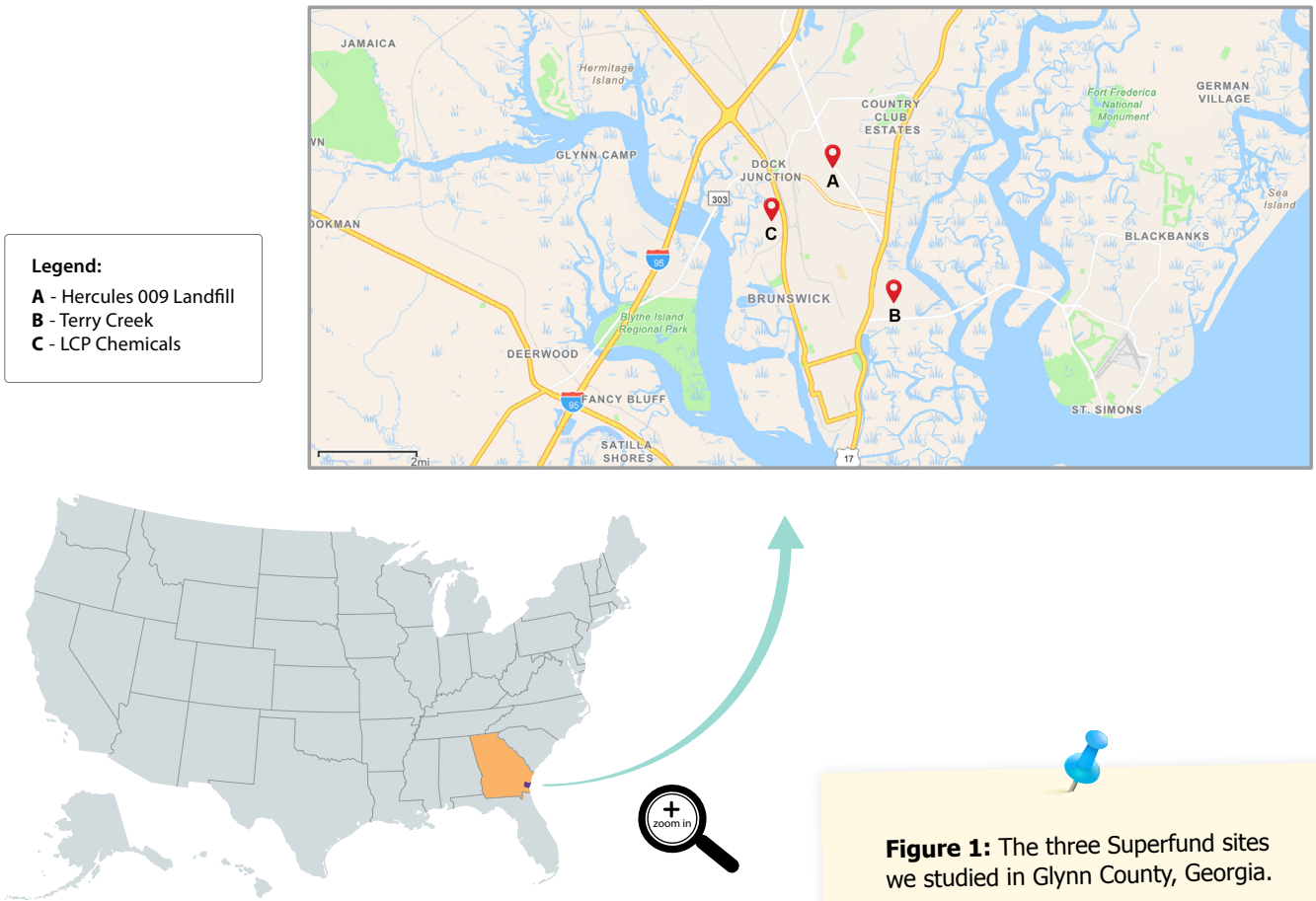

Figure 1: The three Superfund sites we studied in Glynn County, Georgia.

Methods

We conducted a study of 100 Glynn County residents in 2023. Everyone in the study was 18 years or older and had lived in Glynn County for 10 or more years. We studied the group as a whole, then focused on specific groups:

- People who lived in neighborhoods near one of the Superfund sites.
- People who worked at one of the sites or lived with someone who worked there.
- People who participated in fishing activities.
- Older people
- Black people

The residents answered questions about themselves and how they interacted with the sites. Each person also provided blood samples. We tested the blood for mercury, seven types of PCBs, and two types of toxaphene. Three of the PCBs we tested are main components of the Aroclor that Site C used. Then, we compared the levels we measured in Glynn County residents to levels in the general population.

Results

We found that the mercury levels of the Glynn County residents were about the same as the general population. Residents had higher levels of both types of toxaphene. We did not find evidence that any specific group of people was at a greater risk of exposure.

Residents also had higher average levels of the three PCBs in the Aroclor mixture (see Figure 2). The average level of PCB 206 was almost three times higher than the average in the general population.

- We did not find a relationship between location and toxicant levels. People living closer to the sites did not always have higher levels.
- Participants who worked at Site C, or lived with someone who worked there, were more likely to have high levels of the Aroclor PCBs than residents who did not.
- Two PCBs from the Aroclor mixture were common in people who fished.
- Older participants and Black participants were more likely to have higher PCB levels.

Which Aroclor PCB had the greatest difference in blood levels between Glynn County residents and the general population? Which had the smallest?

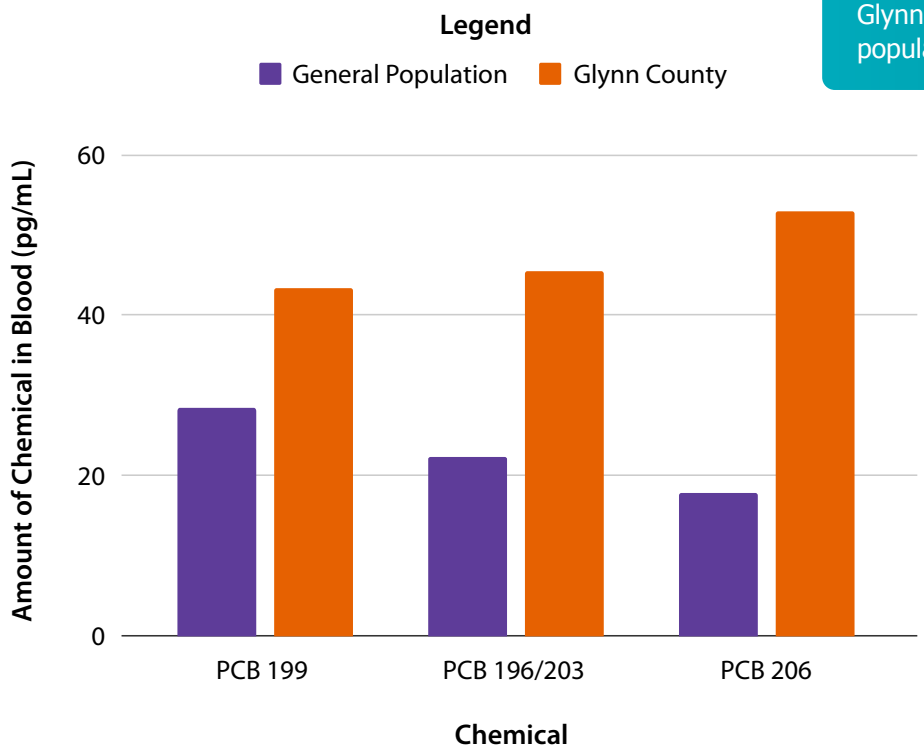

Figure 2: The levels of three Aroclor PCBs in the blood of Glynn County residents compared to the general population. The levels are in picograms per milliliter (pg/mL)

Discussion

Study participants in Glynn County had higher levels of toxaphene and some PCBs than the general population. Many PCBs tested had levels similar to the general population. The 3 PCBs with higher levels were the ones from the specific Aroclor mixture that polluted Site C.

So why did residents have higher levels of these chemicals in their blood? People can breathe chemicals in or swallow them in food or water. Chemicals can also pass through the skin. These chemicals **bioaccumulate**, meaning that organisms store them in their bodies. Bioaccumulation can

lead to **biomagnification**, meaning stored chemicals get passed up the food chain. Organisms at the bottom of the food chain store the toxicants in their bodies. When a predator eats them, the chemicals then get stored in the predator's body. Top predators eat a lot of prey. So, organisms at the top of the food chain (including humans!) often have the highest levels of chemicals.

Our study offers hints about why some residents have higher levels of these chemicals. Some residents fish locally and many eat what they catch. Fish and other marine organisms bioaccumulate chemicals, including toxaphene and PCBs. These toxicants are persistent, so people who live in the area longer have more exposure to the chemicals. Over time, the chemicals build up in their bodies.

For people who worked at Site C, the high toxicant levels most likely came from their job. Their family members or other people who lived with them may also have been exposed because of these jobs. This could happen if people came home with the chemicals on their clothes or used the chemicals in their homes.

Conclusion

Simple actions can help you avoid exposure to toxicants. Follow local seafood consumption guidelines. They tell you if you should limit or avoid eating certain types of fish at different locations. Try to avoid using chemical pesticides on lawns and gardens. It is also important to get rid of toxic household chemicals properly. Do not throw them in the trash or pour them down storm drains! Instead, take them to a collection site in your community. Working together, communities can reduce exposure to toxicants.

Glossary of Key Terms

Aroclors - a group of substances that contain a mixture of polychlorinated biphenyls (PCBs). They are used in building materials and electrical equipment.

Bioaccumulation - a process in which chemicals collect inside the bodies of organisms (like animals and people).

Biomagnification - the process of the amount of chemicals inside an organism increasing as you move up the food chain.

Immune system - the body system that protects the body against disease.

Insecticide - a chemical or mixture of chemicals used to kill or repel insects. Toxaphene is an insecticide. The US government banned toxaphene because it is a toxic and persistent chemical.

Mercury - a heavy metal that is a silvery liquid at room temperature. Mercury is a toxicant that can negatively affect the nervous system, kidneys, and skin.

Nervous system - the body system which includes the nerves, brain, and spinal cord. It helps the different parts of the body communicate.

Persistent chemicals - chemicals that take a long time to break down in the environment, so they remain in the environment for long periods of time.

Polychlorinated biphenyls (PCBs) - a group of human-made chemicals that are made up of carbon, hydrogen, and chlorine atoms. The government banned their use because they are toxic and persistent chemicals. Chemicals with different combinations of PCBs are sometimes called Aroclors.

Reproductive system - the body system that contains the organs and structures needed to support reproduction.

Toxicants - substances that are harmful to humans or other organisms. Examples include pesticides, PCBs, and heavy metals.

Check your understanding

1. Why are the people of Glynn County worried about toxicants?

2. Why did older people have higher levels of toxaphene and PCBs?

3. Draw a diagram to illustrate biomagnification in a marine food chain. Imagine that phytoplankton absorb 1 molecule of PCB into their bodies and that every zooplankton eats 2 phytoplankton a day. Every day, small fish eat 4 zooplankton, large fish eat 3 smaller fish, and a marine bird eats 4 large fish. For each organism in the food chain, label how many molecules of PCBs it would have after 1 day of exposure. Then explain what happens to the PCB levels as you move up this food chain.

4. Research a list of common household materials that are considered toxic or hazardous. Summarize the purpose of these chemicals. Then identify any that you might have at your home.

5. With a partner, develop a plan to help educate people about Superfund sites and the proper disposal of toxicants.

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