

Researchers are exposing troubling consequences of air pollution



Breathing clean air is important for everyone's health, but some communities face more risks than others

The air we breathe can sometimes contain tiny particles called [particulate matter](#) (PM). These particles come in different shapes and sizes and are made up of hundreds of different chemicals. Some are very small, smaller than 2.5 micrometers. They are referred to as PM_{2.5}. You can't see these particles, but you *can* inhale them.

As a group, PM_{2.5} is responsible for most pollution-related health problems in the United States. But not all PM_{2.5} are created equal. Some are particularly toxic, and where you live can make a big difference in the quality of the air around you.

NIH-funded research has turned up some important findings about air quality's effects on different communities.

Pollution and racial segregation

Many communities face an unfair burden by poor air quality, with communities of color often facing the highest exposure to PM_{2.5}. This disparity is linked to racial residential segregation, where people of different races live in separate areas often due to social, economic, or discriminatory factors. When these areas are exposed to more pollution, it can increase health risks for the people who live there.

A 2022 study wanted to understand how the most toxic components of PM_{2.5} are distributed across different communities. They found that the air in [racially segregated, predominantly Black counties](#) not only had higher levels of PM_{2.5}, they also had higher concentrations of toxic metals compared to air in racially integrated

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FAST FACT

Nearly **90% of people** living in urban areas around the world are affected by air pollution.

SOURCE: NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

communities. The highest levels of these toxic metals were mostly those generated by humans (for example, from industrial activities, waste burning, and car exhaust).

Exposure to certain toxic metals can lead to cancer. It can also damage the brain and nervous system. This means many communities of color are breathing air that's not just polluted, but loaded with harmful chemicals, too.

There is hope: For one, cleaner fuel regulations can go a long way toward improving air quality. This can reduce disparities in pollution and improve health for communities most at risk.

Air pollutants and asthma attacks in urban youth

Asthma is a chronic lung condition that creates inflammation of the airways. It can cause coughing, wheezing, or shortness of breath and make breathing difficult. Severe asthma attacks may require emergency room visits or hospitalizations. Triggers include:

- Environmental allergens (such as pollen, dust mites, and pet dander)
- Viral infections (such as cold, flu, and COVID-19)
- Poor air quality

Kids in lower-income, urban neighborhoods are more likely to experience frequent asthma attacks. A study discovered a link between [outdoor air pollution and asthma attacks](#) in children and teenagers living in those areas.

For this study, researchers followed more than 200 children and teenagers in nine cities across the United States. They found a connection between nonviral asthma attacks (attacks that are not caused by respiratory viruses) and moderate levels of two air pollutants: [ozone](#) and fine PM. These pollutants are often highest in areas with heavy traffic and industrial activity.

Researchers also saw that those children had changes in the genes that play a part in airway inflammation and linked those changes to higher levels of air pollution. This could reveal how pollution affects the body and may lead to attacks.

This study is one of the first to connect specific air pollutants to nonviral asthma attacks. It highlights why clean air is so important for human health.



Kids in lower-income, urban neighborhoods are more likely to experience frequent asthma attacks.

A concerning link between pollution and dementia risk

A recent study found a connection between [air pollution and the risk of developing dementia](#) as we age.

Researchers at the University of Michigan compared information about air quality to health data from more than 28,000 adults ages 50 and older across the United States. They found a troubling link between long-term exposure to PM_{2.5} and increased risk of dementia.

People who developed dementia were more likely to live in areas with higher levels of air pollution.

They were also more likely to be non-White and of lower socioeconomic status. People exposed to air pollution from farming and open fires were most at risk. These findings suggest that reducing air pollution, particularly from these sources, could reduce the chances of developing dementia later in life. ■

The data in this study were collected as part of the [Health and Retirement Study](#), which follows older adults' health over time.



People living in communities where the air is more polluted can face increased health risks.

What are the health costs of air pollution, and what can we do about it?

Have you ever noticed the hazy smog that hangs over cities or the lingering smell of exhaust fumes from traffic? These are just a few noticeable signs of air pollution, a threat that can have a significant effect on our health and well-being.

What is air pollution?

Air pollution is caused when harmful substances are released into the atmosphere. These pollutants can come from both natural and human-made sources. Natural sources include dust, pollen, volcanoes, and wildfires. Human-generated sources include emissions from vehicles, power plants, factories, agriculture, and burning of wood and other fuels.

Where is the air polluted?

Air pollution can occur anywhere, but certain conditions can make it worse. According to the [Environmental Protection Agency \(EPA\)](#), air pollution levels tend to be highest in urban and industrial areas and near busy roads.

While we typically think of air pollution as only an outdoor problem, it's important to know that indoor air can also be polluted. Indoor air pollution comes from sources such as cooking stoves, fireplaces, and air conditioners. Even household pets can contribute to indoor air pollution when they shed allergens from their skin or hair.

How can polluted air make you sick?

Breathing in polluted air can contribute to health issues, especially in the respiratory system.

In the short term, breathing polluted air can irritate your eyes, nose, and throat. It can cause you to cough, wheeze, or have trouble breathing. It can also make certain health conditions and their symptoms worse.

Over time, exposure to air pollution can even create more severe health problems. These include:

- Respiratory diseases, including asthma and chronic obstructive pulmonary disease (COPD)
- Heart disease and stroke
- Cancer, particularly lung cancer

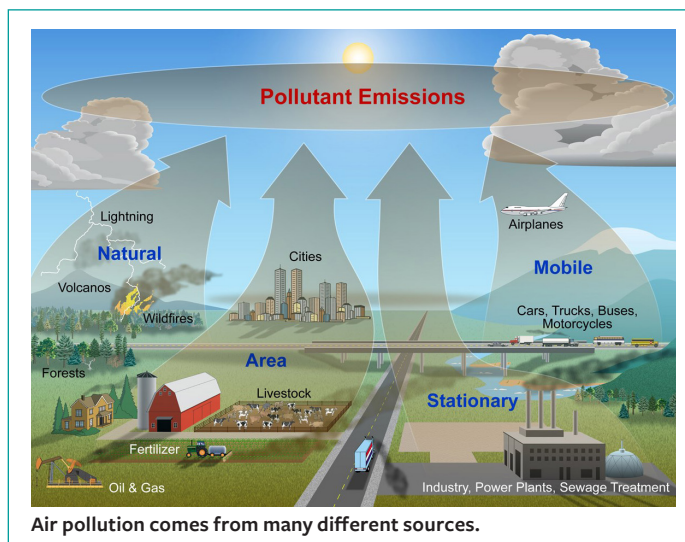
Researchers studying air pollution continue to learn more about air pollution's many health effects every day.



FAST FACT

Each year, indoor and outdoor air pollution combined are responsible for **6.7 million deaths** worldwide.

SOURCE: [WORLD HEALTH ORGANIZATION](#)



Who is at risk?

While air pollution affects people of all ages and backgrounds, certain groups are more vulnerable to its harmful effects.

They include:

- **Children.** Their developing lungs are more susceptible to damage from pollutants.
- **Older adults.** They are more likely to have preexisting health conditions that can get worse due to air pollution.
- **People with asthma and other respiratory problems.** Their airways are more sensitive to pollutants, which can trigger symptoms.
- **People living in more polluted areas.** Those living in urban and industrial areas with high pollution levels are more likely to experience harmful health effects.

How can you protect yourself from air pollution?

Even though it's impossible to avoid polluted air completely, you can take steps to protect yourself from its harmful effects.

- **Stay informed.** Check your local air quality index (AQI) regularly. EPA's AQI tool at [AirNow.gov](#) provides current air quality conditions in your area.
- **Reduce outdoor exposure.** Limit outdoor activities when air pollution levels are high. Try to stay indoors as much as possible. If you need to go outside, plan to do so in the early morning or late evening when levels are typically lower.
- **Avoid polluted areas.** Stay away from busy roads and highways, especially during rush hour.
- **Improve indoor air quality.** Ventilate your home, use air purifiers, and choose low-emission cleaning products. Don't burn candles, incense, or wood indoors, and open your windows when you're cooking.
- **Don't smoke.** Smoking contributes to air pollution and increases your overall risk of health problems. ■

Hotter days put human health at risk

Climate change and rising temperatures can affect your body in many ways



People living in major cities are likely to experience higher temperatures due to the urban heat island effect.

Extrême heat and unpredictable weather patterns are big news around the world. But did you know that climate change is not just a concern for scientists? It's also worrying doctors.

Warmer global temperatures cause many environmental changes. These include droughts, increased risk of wildfires, more extreme temperatures, warmer oceans, and stronger storms. These changes can contribute to water-borne illnesses, infectious diseases spread by animals—especially insects such as ticks and mosquitoes—and food contamination. Wildfires

release carbon dioxide from trees, and the smoke causes air pollution. Extreme heat can also damage your body.

These climate threats add up over time, which can change human health long-term. Our bodies may struggle more with multiple conditions, and it can also take a toll on our mental health.

Outside temperature affects body temperature

Humans evolved to adjust to their surrounding temperature to stay alive. Sweating is how the body naturally cools itself. But sometimes sweating isn't enough on especially hot or humid days. The temperature of the Earth is rising, and when they remain high, it's harder for your body to [regulate itself](#). [Hyperthermia](#) is when your body stays too hot and can't cool itself down. Hyperthermia can take the form of different heat-related [illnesses](#), including:

- **Heat cramps.** These are muscle cramps, usually in the legs or stomach, caused by loss of salt from sweating. If you start having heat cramps, it's important to drink lots of fluids, especially those with [electrolytes](#). Also find a cooler space.
- **Heat exhaustion.** Symptoms include heavy sweating, cold and clammy skin, nausea, and vomiting.
- **Heat stroke.** This is when your body temperature exceeds 104 degrees Fahrenheit (40 degrees Celsius). Heat stroke can be life-threatening.



FAST FACT

From **2008** to **2019**, the average number of cardiovascular-related deaths linked to extreme heat in the United States each year was about **1,651**. That number is expected to grow to **4,320** deaths per year by **2065** due to rising temperatures.

SOURCE: NATIONAL HEART, LUNG, AND BLOOD INSTITUTE



Infants and children are among the most at risk for heat-related illness because they are less able to regulate their body temperature.

Who is most at risk for heat-related illness?

Groups most at risk because they are less able to regulate their body temperature include:

- Infants and children
- Pregnant people
- Older adults
- People who are overweight
- People taking certain medications

People with disabilities or mobility issues may not be able to get to a cooler place if needed. People who work or exercise outside are vulnerable to high heat.

Extreme heat can make chronic diseases worse, including cardiovascular (heart), respiratory (lungs), and cerebrovascular (brain and blood vessels) illnesses. It could also affect diabetes-related conditions, [asthma](#), and [chronic obstructive pulmonary disease \(COPD\)](#).

People with lower incomes may not be able to afford home air conditioning or be able to weatherproof their homes to control temperatures. Those living in major cities are also affected by the urban [heat island effect](#). Human-made surfaces like roads or building walls absorb and reemit the sun's heat. This causes surrounding air temperatures to rise.

And some factors—chronic disease, lower incomes, and urban heat islands—are even higher for people of color than for non-Hispanic White people. These groups are more likely to live in environmentally hazardous places due to housing and racial discrimination. Scientists predict that the health risks [will be greatest](#) for Black adults and people ages 65 and older.

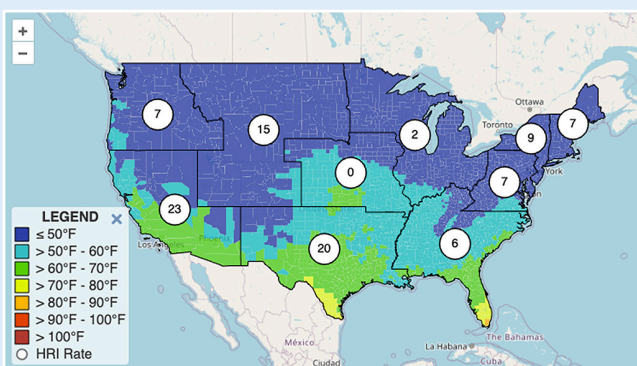
What can you do to stay safe?

Stay as cool as possible! Remember to:

- **Drink plenty of hydrating fluids.** Water and sports drinks that replace salts and minerals are best for staying hydrated. Avoid caffeine, alcohol, and beverages with lots of sugar.
- **Schedule exercise or outdoor activities when temperatures are lower.** Aim for the early morning and evening.
- **Get into an air-conditioned space.** This can be at home, in the homes of friends and family, or in public places. Community centers, shopping malls, movie theaters, and libraries are some options. Local officials may also designate public spaces as cooling centers during emergencies.
- **Dress for heat.** Wear breathable clothes with lighter colors and moisture-wicking fabric.

If you have heat [edema](#) (swelling in your ankles and feet because you're feeling hot or sunburned), try elevating your legs. If that doesn't work quickly, check with a health professional. ■

See how extreme heat is affecting rates of illness and emergency room visits by using the [CDC Heat and Health Tracker tool](#).



Too loud and too bright!

Noise and light pollution's effects on your health

Noise pollution

Every day you are surrounded by sounds from your environment, including the TV, radio, appliances, and traffic. [Noise pollution](#) is unwanted or bothersome sound. In some cases, noise pollution can be loud enough to damage the ear and contribute to hearing loss. Noise pollution can also disrupt sleep and contribute to chronic stress. These issues have been associated with health conditions like high blood pressure, heart disease, and diabetes.



Common sources of noise pollution include:



Sound is measured in units called decibels (dB). Sounds at or below 70 dB are usually safe and won't harm your hearing. However, sounds can be harmful if they are too loud for even a short time. Occasional loud noises are okay, but it's important to give your ears time to recover in quiet.

More than 30 million Americans are regularly exposed to hazardous levels of sound.

DID YOU KNOW?

Noise-canceling headphones and earbuds used to block background noises while listening to music can still be harmful. Some can reach a volume up to 105 dB, which can permanently damage hearing.

SOURCE: [NATIONAL INSTITUTES OF HEALTH](#)

Average sound levels (in dB)



A typical conversation: 65–80



Motorcycle: 80–110



Washing machine or dishwasher: 45–65



Sirens: 110–129



Fireworks: 140–160



Gas-powered lawn mowers and leaf blowers: 80–100

SOURCE: NATIONAL INSTITUTE ON DEAFNESS AND OTHER COMMUNICATION DISORDERS

Ways to protect your hearing

To reduce your risk of hearing damage from noise:

- Move away from the noise.
- Wear hearing protectors (such as earplugs or earmuffs).
- Lower the volume (including when wearing headphones).

Check out [It's a Noisy Planet](#) from the National Institute on Deafness and Other Communication Disorders to learn more about noise-induced hearing loss.



Light pollution

Artificial light from electronic devices, homes, streetlights, vehicles, and buildings creates light pollution. This can cause problems for people and animals.

Exposure to [artificial light](#) at night affects your body’s melatonin production. Melatonin is a hormone that signals it’s time to go to sleep. [Poor sleep](#) can affect your focus, judgment, memory, and other bodily processes.



Vehicle traffic is a common source of both noise and light pollution and is something people are regularly exposed to.



Bright electric lights can also affect birds that migrate at night. These birds can become confused and may fly into buildings, communication towers, and other structures. The [U.S. Fish and Wildlife Service](#) estimates that nearly 7 million birds die each year from colliding with communication towers at night.

Ways to reduce artificial light at night



Keep your room dark for at least 9 to 10 hours a night.



Install room-darkening shades on your windows.



Turn off the lights and electronic devices in the bedroom when you are sleeping. Avoid watching television, using your phone, or working on the computer right before you shut your eyes.



If you get up in middle of the night to use the bathroom, for example, use a dim red nightlight instead of the regular room light. Red light suppresses melatonin production less than other wavelengths.



Do not take melatonin tablets unless directed by your health care provider. Melatonin can disrupt your circadian rhythm further. ■

ADHD across the lifespan: What it looks like in children and teens

The neurodevelopmental condition poses unique challenges at each stage of life

[Attention-deficit/hyperactivity disorder](#) (ADHD) affects the brain's ability to focus and control impulses and is one of the most common mental disorders that children experience. It can also continue into adulthood.

Early signs and symptoms

ADHD shows up first in childhood, sometimes as early as age 3. It's not unusual for children to be energetic, act impulsively, and have trouble focusing from time to time. But for children with ADHD, these behaviors are *persistent* and can be disruptive to both the child and those around them.

The most common symptoms of childhood ADHD are hyperactivity, impulsivity, and inattention. These symptoms can show up in different ways—for example, not all children with ADHD appear hyperactive. ADHD may also look different in one setting compared to another (such as at home versus at school).

Children with ADHD may:

- Have trouble paying attention to details, following directions, or staying focused on tasks
- Be easily distracted by their own thoughts or by things happening around them
- Seem fidgety or restless or struggle to engage in quiet activities
- Act impulsively—for example, by interrupting others often
- Hyperfocus on activities that are interesting or meaningful to them (often to the point of being unable to shift focus to something else)

These symptoms can affect a child's relationships with their families and with other children. They can also affect a child's performance in school and their overall well-being.



ADHD affects children, teenagers, and adults.



FAST FACT

ADHD symptoms can first appear in children **as young as age 3** and continue into adulthood. To be diagnosed with ADHD, adolescents and adults must have experienced symptoms before age 12.

SOURCE: [NATIONAL INSTITUTE OF MENTAL HEALTH](#)

Navigating ADHD in the teenage years

As children with ADHD enter adolescence, their symptoms can change. Pressure at school, relationships with peers, increasing responsibilities, and hormonal changes can all influence ADHD in new ways.

Challenges with paying attention, impulsivity, and executive functioning in teenagers can result in:

- Poor time management and organizational skills
- Difficulty prioritizing tasks and completing assignments on time
- Trouble managing emotions and dealing with frustration
- Risky or impulsive behaviors (such as substance use or unprotected sex)

Like in childhood, ADHD can affect teenagers' social relationships, self-esteem, and performance in school. Teenagers with ADHD may also experience mental health issues such as depression and anxiety.

Learn more about [ADHD in children and teens](#).

Supporting young people with ADHD

The right treatment, support, and coping strategies can help young people with ADHD at each stage of their development.

Building a strong foundation

Here are some ways parents, teachers, and other caregivers can help young people navigate ADHD from childhood through adolescence.

- **Structure and routine.** Children with ADHD thrive on predictability. Set a consistent schedule and stick to it as much as possible. This provides a sense of stability and helps them stay on track.
- **Clear communication.** Use clear, simple, direct language to explain rules and expectations.
- **Coping strategies.** Teach them skills for managing emotions, staying organized, and reducing stress. Help them break overwhelming tasks into smaller, more manageable steps.

- **Positive reinforcement.** Instead of criticizing “bad” behaviors, focus on positive and productive ones. Reinforcing these actions with praise and rewards will help children replace negative or unhelpful behaviors with more positive ones.
- **School support.** Individualized training and support that build organizational, social, and behavioral skills can help young people with ADHD survive—and thrive—at school. So can accommodations such as extra time on tests or assignments. Talk to your child’s school about what options are available.
- **Seek professional help.** Mental health professionals offer therapy, education, and support to help young people manage ADHD. They can also help parents of children with ADHD learn about the disorder, develop new skills, and connect with other parents in similar situations.

Navigating the teenage years

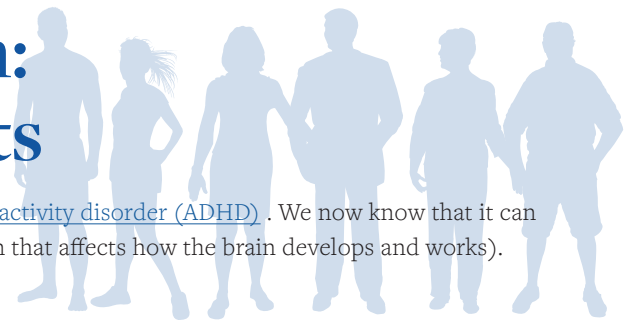
Puberty can exacerbate ADHD symptoms, making it harder for teenagers to stay focused, remember things, and manage their emotions. Be patient and understanding and let them know you’re there to help. Encourage them to develop coping mechanisms and explore different activities to discover their strengths.

Parents, teachers, peers, and families can use these additional strategies to support and empower teenagers who are dealing with ADHD.

- **Enable self-advocacy.** Help them identify when they need support and learn how to ask for help. This will empower them to navigate future challenges confidently and independently.
- **Encourage positive relationships with peers.** Encourage them to participate in activities where they can meet new people and make friends. Supportive friends can help teenagers with ADHD feel more connected and less isolated.
- **Discover strengths.** Provide lots of opportunities for teens with ADHD to explore different activities and interests. Help them discover their unique talents and build confidence in their abilities.
- **Seek professional help.** As with younger children, therapists and other mental health professionals can help teenagers with ADHD develop effective skills to manage their symptoms now and as they grow older.

At any age, the ADHD journey starts with getting the right diagnosis. But it doesn’t stop there! [Learn more about ADHD](#) and how to support people of all ages who have it. ■

ADHD across the lifespan: What it looks like in adults



For a long time, people thought only children could have [attention-deficit/hyperactivity disorder \(ADHD\)](#). We now know that it can continue into adulthood. ADHD is a neurodevelopmental condition (a condition that affects how the brain develops and works). ADHD is often diagnosed in childhood, but it can continue into adulthood.

Living with ADHD as an adult

ADHD does not magically disappear when you grow up. Even with treatment, many people with ADHD continue to have symptoms in adulthood—though those symptoms may look and feel a little different.

For many adults with ADHD, losing the structure and support they had at home and in school when they were younger can make it harder to manage symptoms later in life. The responsibilities and challenges of adulthood can also trigger new symptoms and make existing ones worse.

Symptoms and patterns

Adults with ADHD may struggle with daily tasks, relationships, and work. These challenges can lead to feelings of frustration and underachievement. They may struggle to manage their time, stay on top of their finances, meet deadlines, and maintain stable home and social lives. This can look like:

- Always losing important items (such as keys, wallets, and phones)
- Struggling to listen closely, follow instructions, or pay attention to details
- Forgetting appointments, not returning calls, or neglecting to pay bills
- Fidgeting or feeling restless and being unable to sit still for a long time
- Interrupting others or answering someone’s question before they’ve finished asking it

Find more information about [ADHD in adults](#).

Managing symptoms

If you have ADHD, these strategies and tools can help you manage your symptoms.

- **Prioritize physical and mental health.** Taking care of physical and mental health is important for everyone and especially for people with ADHD. Getting enough sleep, eating healthy foods, and exercising regularly can help reduce your stress, improve your mood, and better manage your symptoms.
- **Establish structure and routine.** A regular routine can help adults with ADHD stay on track and manage their time more effectively. Set specific times for daily activities such as waking up, eating meals, working, exercising, and going to bed.
- **Tackle “time blindness.”** ADHD affects how people perceive and manage time, which can make it tough to estimate how long tasks will take and stick to schedules. While calendars and planners are helpful for some people, they can also be tricky for ADHD brains. Try setting frequent, attention-grabbing timers with sounds or colorful visuals, or experiment with reminder apps and alarms to stay on top of deadlines. The key is to find a tool that grabs your attention and keeps you on track.

- **Seek professional help.** Working with a trained professional can help people who are struggling to manage their ADHD symptoms. These professionals can help with your specific needs and challenges, including developing strategies to address them.
- **Reach out to others.** Connecting with friends, family, or colleagues can help people with ADHD find support, advice, and a sense of community. There are also many ADHD support groups and online forums.

The first and most important step is getting an accurate diagnosis. The next is finding the best treatment and support. [Learn more about ADHD.](#) ■



ADHD can affect people of all ages, including adults.

ADHD support toolkit

Tips and resources for understanding, encouraging, and empowering people of all ages on their ADHD journey.

If someone in your life has attention-deficit/hyperactivity disorder (ADHD), here are some ways you can offer your support.



Do

- **Educate yourself.** NIH has resources where you can [learn about ADHD](#) and better understand its symptoms, causes, and challenges.
- **Offer practical help.** There are many practical ways to help someone with ADHD, such as giving them a hand with tasks like cleaning and organizing or simply being present and engaged while they work. This technique, known as “body doubling,” can give individuals with ADHD a sense of accountability and motivation, helping them stay focused and on track.
- **Be patient and understanding.** ADHD can be frustrating both for those who have it and for the people in their lives. Be patient, flexible, and empathetic.
- **Encourage breaks.** Help prevent burnout by encouraging time for short breaks during tasks that require sustained attention.



Don't

- **Blame or criticize.** It's important to remember that people with ADHD are dealing with a neurodevelopmental condition. This means their brain works differently than others, and they may struggle with certain tasks or behaviors and use different strategies to succeed.
- **Make assumptions.** Instead of assuming that you know what someone with ADHD is going through, learn about their individual challenges by listening to them and asking questions. Everyone experiences this condition differently and uses different strategies to manage it.
- **Try to “fix” them.** The best thing you can do is be there for those with ADHD by offering support and encouraging them to learn how to manage their symptoms.

Diving deeper

Knowledge is power. The more you understand ADHD and its unique challenges, the better you can support those who have it. ADHD is a lifelong journey, and your understanding and acceptance can make a world of difference. [Learn more about ADHD](#), how it changes across the lifespan and how it's treated. ■



Buttons & bows pasta

Prep time: 5 minutes
Cook time: 20 minutes

INGREDIENTS

- 2 cups dry whole-wheat bowtie pasta (farfalle) (8 ounces)
- 1 tablespoon olive oil
- 1 teaspoon garlic, minced (about 1 clove)
- 1 bag (16 ounces) frozen peas and carrots
- 2 cups low-sodium chicken broth
- 2 tablespoons cornstarch
- 1 tablespoon fresh parsley, rinsed, dried, and chopped (or 1 teaspoon dried)
- 1 medium lemon, rinsed, for 1 teaspoon zest (use a grater to take a thin layer of skin off the lemon)
- 1/4 teaspoon ground black pepper



DIRECTIONS

1. In a 4-quart saucepan, bring 3 quarts of water to a boil over high heat.
2. Add pasta, and cook according to package directions. Drain.
3. Meanwhile, heat olive oil and garlic over medium heat in a large sauté pan. Cook until soft, but not browned.
4. Add peas and carrots. Cook gently until the vegetables are heated through.
5. In a bowl, combine chicken broth and cornstarch. Mix well. Add to pan with vegetables, and bring to a boil. Simmer gently for 1 minute.
6. Add parsley, pasta, lemon zest, and pepper. Toss gently, and cook until the pasta is hot.
7. Serve 2 cups of pasta and vegetables per portion.

Yield 4 servings, **Serving Size** 2 cups pasta and vegetables, **Calories** 329, **Total Fat** 6 g, **Saturated Fat** 1 g, **Cholesterol** 0 mg, **Sodium** 127 mg, **Total Fiber** 9 g, **Protein** 13 g, **Carbohydrates** 59 g, **Potassium** 331 mg

WHO WE ARE

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