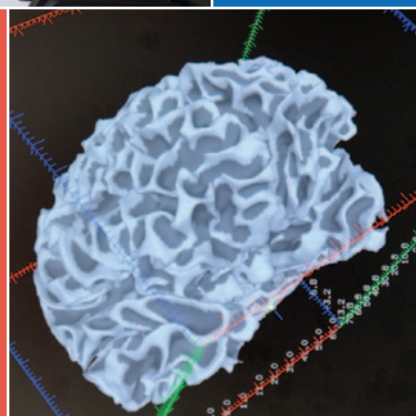
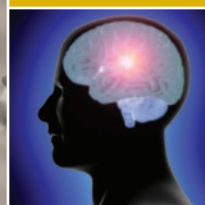
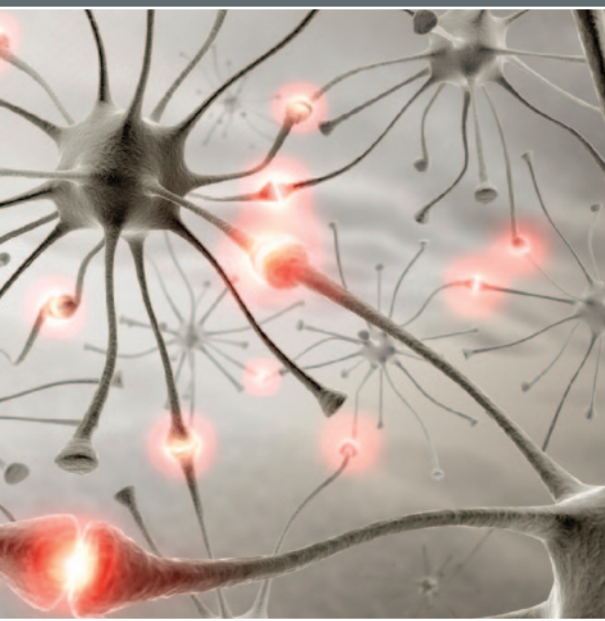


# Neuroimaging and Mental Illness: A Window Into the Brain

Frequently asked questions about brain scans

## NIMH

NATIONAL INSTITUTE OF MENTAL HEALTH



U.S. Department of Health  
and Human Services  
National Institutes of Health



**B**rain imaging scans, also called neuroimaging scans, are being used more and more to help detect and diagnose a number of medical disorders and illnesses. Currently, the main use of brain scans for mental disorders is in research studies to learn more about the disorders. Brain scans alone cannot be used to diagnose a mental disorder, such as autism, anxiety, depression, schizophrenia, or bipolar disorder.

In some cases, a brain scan might be used to rule out other medical illnesses, such as a tumor, that could cause symptoms similar to a mental disorder, such as depression. Other types of tests are needed for a mental illness to be properly diagnosed. Scientists are studying differences in the brains of people with and without a mental illness to learn more about these disorders. However, at this time relying on brain scans alone cannot accurately diagnose a mental illness or tell you your risk of getting a mental illness in the future.

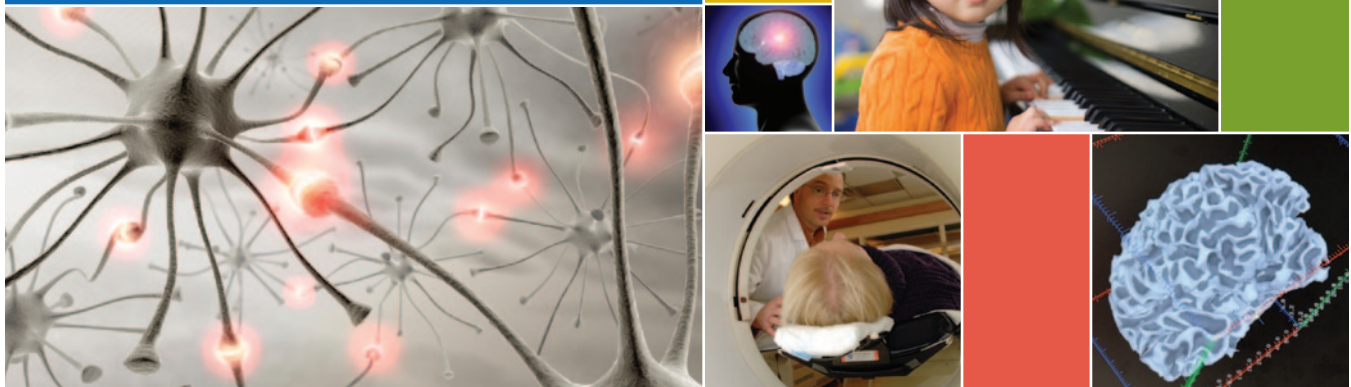
Some types of brain scans pose health risks due to the radiation they use to create a picture of the brain. Because of these risks, brain scans should not be used if you don't need them. In addition, these scans are very expensive, and unless your doctor prescribes such a test, they may not be fully covered by health insurance.

### What Brain Scans Can Do

- Show damage to brain tissue, the skull, or blood vessels in the brain
- Be used with other medical tests to help doctors find the right diagnosis for mood and behavioral problems
- Help researchers study healthy brain development, effects of mental illnesses or effects of mental health treatments on the brain.

### What Brain Scans Cannot Do

- Diagnose mental illness when used by themselves
- Predict risk of getting a mental illness
- Determine which medications work best.



**Q. Can a brain scan tell me what mental disorders I have or might get?**

**A.** No scientific studies to date have shown that a brain scan by itself can be used for diagnosing a mental illness or to learn about a person's risk for disease. Researchers use brain scans to study brain development in healthy people and people with illnesses, disease progression, and the effects of medications or other treatments on the brain.

In practice, when used with other types of medical tests and done by an experienced doctor, brain scans can be used to confirm a diagnosis of a small number of disorders, such as brain tumors, where there is obvious damage in the brain. Brain scans are not usually the first test a doctor would do to

diagnose changes in mood and behavior. Other medical tests a doctor may use include behavioral and cognitive tests or a medical interview.

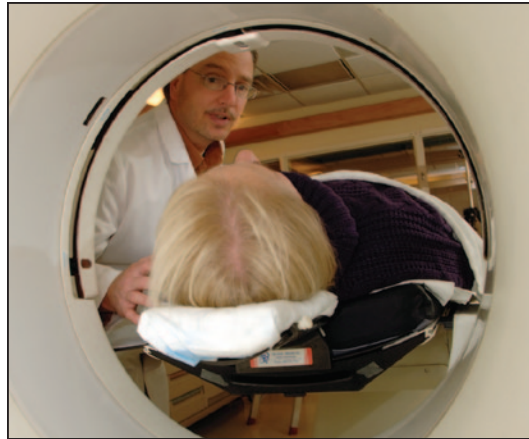
**Q. Should I have a brain imaging scan?**

**A.** When used with other medical tests, they can provide useful information about:

- Brain tumors, infections, and other brain diseases
- Bleeding, blood clots, or other signs of stroke
- Skull fractures or brain damage from head injuries
- Diseases or disorders affecting the skull or blood vessels in the brain.



Researcher analyzes fMRI brain images.



Patient enters PET scan machine.

### Q. What types of brain scans, or neuroimaging tests, are there?

- A.** There are two main types of neuroimaging tests: structural and functional.
- **Structural** imaging creates a “snapshot” of the brain’s structure, including bone, tissue, blood vessels, tumors, infection, damage, or bleeding such as from a stroke.
  - **Functional** imaging reveals the brain’s ever-changing activity and chemistry by measuring the rate of blood flow, chemical activity, and electrical impulses in the brain during specific tasks.

### Q. Are there risks associated with brain scans?

- A.** Brain scans are relatively safe and do not cause any pain. However, risks include exposure to magnetic fields and radiation. Safety measures are used to limit these risks such as using the lowest possible radiation or magnetic level to do the scan.

Children and teens may be more sensitive to these risks. If your child needs a brain scan, ask if there are special precautions you can take or whether a different type of brain scan can be used. Ask the doctor doing the scan if the machine’s settings have been adjusted for a child.

Women who are pregnant or breastfeeding should also talk with their doctor about how to prepare for any type of brain scan. While most types of scans pose little risk to the developing fetus, the doctor may make different recommendations to accommodate pregnancy.

Sometimes a contrast agent may be used in structural MRIs (not in FRMIs) to make the image better. These contrast agents are not radioactive but in rare cases can cause kidney problems and are not generally recommended for people with a history of kidney disease or taking some medications that effect kidney function.

Another possible risk is claustrophobia, or a fear of small spaces. Many brain scanning machines look like large tubes or giant “donuts” that are open on both ends. The machines can be very loud while scanning



Patient in MEG scanner.

takes place. Some people feel scared or nervous when inside the machines. Sometimes, an injury or other medical condition can make it uncomfortable or painful for a person to hold a certain position.

It is important to stay still in order to get a clear picture. Tell your doctor if you are afraid of being inside the brain scanning machine or think you cannot stay still for any other reason. The doctor can give you a sedative to help you lie still, or may suggest a different type of test entirely.

Talk with your doctor to make sure you understand the possible risks and benefits before deciding to get a brain scan. In general, a person should not need more than one of the same type of brain scan. If a doctor recommends a brain scan that you've already done in the past, ask if you really need to get the test repeated.

## **Q. What can research using brain imaging technologies tell us about disease risk?**

**A.** As they continue to learn more about how the healthy brain develops and which processes may contribute to specific diseases, scientists are building a more complete picture of how to detect which people are at risk of common diseases.

This research also is helping to reveal biological pathways that guide thoughts and emotions, and how experiences, medications, or environmental substances affect the brain. Scientists can use this information to design better screening and prevention for specific disorders, and improve on the delivery and effectiveness of mental health treatments.



Technician checks MRI machine.

### Risk from magnetic fields:\*

- Magnetic resonance imaging (MRI)
- Functional magnetic resonance imaging (fMRI)
- Magnetic resonance spectroscopy (MRS)

These scans use strong magnets to develop pictures of the brain. This means that a person must remove all jewelry, piercings, and clothing with metal before entering the scanning machine.

Medication patches, such as nicotine patches or ones that release hormones, sometimes contain metal in the sticky backing, which can burn the skin if worn during an MRI. If you use such patches, talk to your doctor about if and when you should remove them.

It's important to tell your doctor if you have any metal in your body, such as metal braces or metal fillings in your teeth, embedded bullets, shrapnel, or implanted medical devices – pacemakers, aneurysm clips, medication pumps, metal plates, screws, or pins.

If located close to the head, they may distort the scanned image. Sometimes, the strong magnetic field causes these objects to move, which can cause an injury. If you're not sure about your risk, check with the doctor before getting this type of brain scan.

\* Magnetoencephalography (MEG) scanning does not carry these risks because it does not use magnets.

### Risk from radiation:

- Computed tomography (CT) or computed axial tomography (CAT)
- Positron emission tomography (PET)
- Single positron emission computed tomography (SPECT)

These scans expose people to low levels of radiation. For example, the amount of radiation from one CT scan of the head is about the same as the amount that the average person receives from natural sources of radiation over eight months.<sup>1</sup> Natural sources of radiation include naturally occurring radioactive materials and cosmic rays such as emitted by the sun.

Also, some people may be allergic to the chemicals, called contrast dyes or tracers, used to make sure brain structures show up in these types of scans. In some cases, these chemicals are radioactive but lose their potency fairly quickly.

If you have ever had a bad reaction to a contrast dye or tracer, tell the doctor before you get the scan. In general, children should not have PET or SPECT scans.

<sup>1</sup>Computed Tomography (CT) – Head. <http://www.radiologyinfo.org/en/info.cfm?pg=headct>. Accessed on June 18, 2008.

For more detailed descriptions of the different types of brain scans and other tests used to diagnose brain disorders, see the booklet “Neurological Diagnostic Tests and Procedures,” distributed by the National Institute on Neurological Disorders and Stroke (<http://www.ninds.nih.gov>).

## Reprints

NIMH publications are in the public domain and may be reproduced or copied without the permission from the National Institute of Mental Health. NIMH encourages you to reproduce them and use them in your efforts to improve public health. Citation of the National Institute of Mental Health as a source is appreciated. However, using government materials inappropriately can raise legal or ethical concerns, so we ask you to use these guidelines:

- NIMH does not endorse or recommend any commercial products, processes, or services, and publications may not be used for advertising or endorsement purposes.
- NIMH does not provide specific medical advice or treatment recommendations or referrals; these materials may not be used in a manner that has the appearance of such information.
- NIMH requests that non-Federal organizations not alter publications in a way that will jeopardize the integrity and “brand” when using publications.
- Addition of non-Federal Government logos and Web site links may not have the appearance of NIMH endorsement of any specific commercial products or services or medical treatments or services.
- Images used in publications are of models and are used for illustrative purposes only. Use of some images is restricted.

If you have questions regarding these guidelines and use of NIMH publications, please contact the NIMH Information Resource Center at 1-866-615-6464 or e-mail [nimhinfo@nih.gov](mailto:nimhinfo@nih.gov).

## For more information about mental illness and neuroimaging

Visit the National Library of Medicine’s MedlinePlus at <http://medlineplus.gov>

En Español, <http://medlineplus.gov/spanish>

For information on clinical trials:

NIMH supported clinical trials

<http://www.nimh.nih.gov/health/trials/index.shtml>

National Library of Medicine Clinical Trials Database <http://www.clinicaltrials.gov>

Clinical trials at NIMH in Bethesda, MD  
<http://patientinfo.nimh.nih.gov>

Information from NIMH is available in multiple formats. You can browse online, download documents in PDF, and order materials through the mail. Check the NIMH Web site at <http://www.nimh.nih.gov> for the latest information on this topic and to order publications. If you do not have Internet access, please contact the NIMH Information Resource Center at the numbers listed below.

### National Institute of Mental Health Science Writing, Press & Dissemination Branch

6001 Executive Boulevard  
Room 8184, MSC 9663  
Bethesda, MD 20892-9663  
Phone: 301-443-4513 or  
1-866-615-NIMH (6464) toll-free  
TTY: 1-866-415-8051 toll-free  
Fax: 301-443-4279  
E-mail: [nimhinfo@nih.gov](mailto:nimhinfo@nih.gov)  
Web site: <http://www.nimh.nih.gov>

*The photos in this publication are of models and are used for illustrative purposes only.*



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
National Institutes of Health  
National Institute of Mental Health

NIH Publication No. 10-7460

Revised 2010