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Radiation Risks Prompt Push to Curb CT Scans

By LAURA LANDRO



For millions of patients, a CT scan can mean the difference between life and death, detecting a brain tumor, blood clot or burst appendix in seconds.

But federal regulators, radiology groups and hospitals are launching efforts to scale back use of the scans, also called CAT scans, amid growing evidence that they are exposing millions of patients to radiation that may elevate the risk of cancer in the future. A third or more of scans may be unnecessary or repetitive, studies show, and in scans that are medically appropriate, radiation doses could be dramatically reduced without hurting the quality of images.

Helping Doctors Make Informed Decisions About CT Scans

New clinical decision support tools help doctors decide whether or not a CT scan is necessary based on medical evidence. Nuance Health Care, for example, licensed a program developed by Massachusetts General Hospital to create RadPort, which contains more than 15,000 continuously updated rules based on guidelines from the American College of Radiology and others. Appropriateness is ranked on a scale of one to nine, giving doctors green, yellow and red lights accordingly as well as alternate procedures to consider. Here are two examples of how the program works, using fictional patients and doctors.

For a 63-year old female with blood in the stool, diarrhea, fever and jaundice, a CT scan of the abdomen and pelvis is rated as appropriate.

A screenshot of the RadPort clinical decision support tool interface. At the top, it shows patient information: "Patient: [redacted], 63 Y, F, 163 (173), MRN: 4394294 (University), Physicians: [redacted] (Massachusetts General Hospital)". Below this, it displays a color-coded appropriateness scale from 1 (green) to 9 (red). The current rating is 4 (yellow), labeled "Marginal 4-6". To the right, there are checkboxes for "Indicated 7-9", "Marginal 4-6", and "Low 1-3". Under "Indicated 7-9", there are three options: "Abdomen/Pelvis CT Scan" (checked), "Abdomen/Pelvis MRI", and "Abdomen/Pelvis Angiography". To the right of these options are checkboxes for "CT Scan", "MRI", and "Angiography". At the bottom, there are links for "View Indications" and "Change Exam".

Nuance Healthcare

Combining special X-ray equipment with sophisticated computers, CT—for computed tomography—produces vivid cross-sectional pictures of organs, bone, soft tissue and blood vessels with far greater clarity and detail than regular X-ray exams—but at 50 to 500 times the radiation dose. The number of CT scans in the U.S. has skyrocketed to about 70 million a year from just three million annually in 1980. A study in the Archives of Internal Medicine estimated that 29,000 future cancers could be related to CT scans performed in the U.S. in 2007 alone.

The Food and Drug Administration recently announced a broad initiative to reduce unnecessary radiation exposure from all medical imaging, and is developing new safety requirements for manufacturers of CT devices. It also said it will support "informed clinical decision making" programs that prompt doctors to think twice before ordering a scan whose risk may outweigh its benefit.

"If a CT scan is medically warranted, the benefit is going to completely outweigh the risk," says David Brenner, director of Columbia University's Center for Radiological Research in New York. Too often scans are ordered because they are quick and easy, because a doctor fears a lawsuit from a missed diagnosis, or owns a scanner and directly benefits from its use, he says. Moreover, "patients may put the pressure on to get a CT scan," Dr. Brenner says.

For a 62-year-old male with chest pain, persistent cough fatigue and night sweats, a CT scan is also appropriate



Nuance Healthcare

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Dr. Brenner co-authored a study in the *New England Journal of Medicine* in 2007 estimating that 20 million adults and one million children are being irradiated unnecessarily and up to 2% of all cancers in the U.S. at present may be caused by radiation from CT scans, based on data extrapolated from atomic bomb survivors in Japan.

The American College of Radiology says equating the CT scans and atomic exposure is faulty, and that there is still no direct evidence linking CT scan radiation to cancer.

"Someone who comes in with a stroke could die today, but if they are worried about a cancer 30 years from now they may refuse a life-saving scan," says James Thrall, chairman of the American College of Radiology's Board of Chancellors and chief radiologist at Massachusetts General Hospital in Boston.

That said, Dr. Thrall says patients should ask doctors whether a scan is necessary, what the risks and benefits are, and whether there is an alternative test that doesn't use radiation such as ultrasound, which relies on sound waves, or magnetic resonance imaging, which uses powerful magnets and radio-frequency waves. The College is working on a national registry to track the radiation dose that patients receive from CT scans nationwide, which will allow facilities to compare their rates to others.

Exposure Levels

Here are typical doses, in millirems, of radiation an average patient would receive in various medical procedures

Exam	Effective Dose (mrem)
Dental X-ray	2
Chest X-ray	10
Mammogram	70
CT spine	600
CT pelvis scan (multiple exposures)	1,000
Angioplasty	750, 5,700

Source: American College of Radiology

Experts say that the best way to reduce the use of CT scans is to encourage doctors to follow guidelines developed by the American College of Radiology and others. Massachusetts General Hospital incorporated thousands of the guidelines into a program that requires doctors to enter information about a patient in the hospital's electronic medical records system before ordering a scan. If the need is questionable or another test might be more appropriate, doctors will get a yellow light. If a scan isn't recommended, it comes up red. A study of the program's use from 2004 to 2009 found that the rate of growth in outpatient scans fell to 1% a year from 12%, even though outpatient visits grew at a compound annual rate of nearly 5% over the same period.

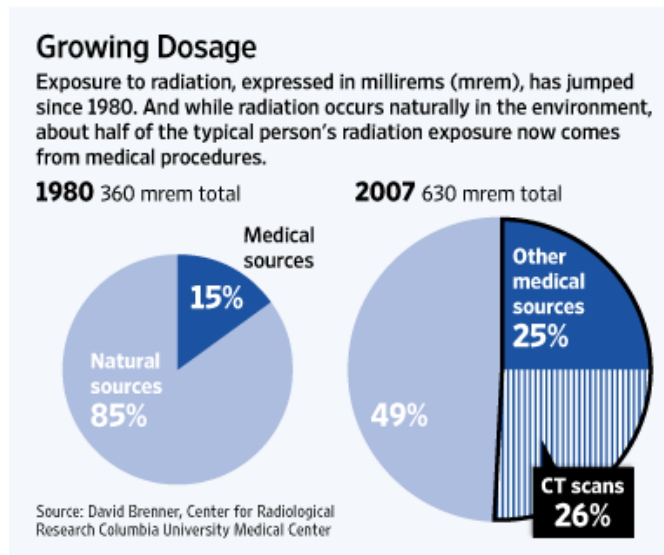
"We will allow a doctor's clinical judgment and instinct to override the system but if they are overriding it consistently, we will let them know we are watching and have a conversation about why," says Jeffrey Weilburg, the hospital's director of clinical psychology. Mass General licensed the program to Nuance Healthcare, which provides software for health plans and hospitals.

Six medical groups and five health plans in Minnesota completed a two-year pilot test of the system in 2007. The number of CT scans was reduced to 385,660 from a projected 416,974 for the year, saving insurers nearly \$18 million. Typically, costs for a CT procedure range from \$600 to more than \$3,000.

Barry Bershow, vice president of quality at Fairview Health Services in Minneapolis, says many CT scans are ordered for patients with sinus infections, but the guidelines indicate a scan isn't appropriate if a patient has a headache with no nasal discharge or a fever of less than 10 days' duration. In the pilot, Dr. Bershow says, insurance companies agreed that if doctors got a yellow or red alert and decided the scan was necessary anyway, they would "trust them to do the right thing in their clinical judgment" as long as they went through the program.

Although there is no evidence on how many scans are too many, hospitals are also acting to reduce the number of scans patients receive over time, especially younger patients and those who have repeat problems such as kidney stones. When Rachel Johnson suffered her second kidney-stone attack at 17 last summer, her mother Robin took

her to the same emergency room near their home in Dacula, Ga., where Rachel had received a CT scan to diagnose the first attack. Ms. Johnson, an ultrasound technician, was prepared to voice her concerns about the possibility of additional radiation from a second scan, but says that before she had a chance, the doctor said he was foregoing a scan for the same reasons. "Doctors usually want to run so many tests so I was pleasantly surprised," she says.



Southern New Hampshire Medical Center developed a Patient Protection Program that sends letters to doctors when their patients under 40 have had between five and 10 scans, and sends them directly to patients who have had more than 10 scans. While one CT scan has a minimal risk for any patient, "the damage from radiation is thought to be additive over time," says Steven Birnbaum, a radiologist affiliated with the center and developer of the program. In 2008, 15% of scans were canceled and 15% switched to an MRI or ultrasound as a result of the program.

Health-care providers are also taking steps to lower the radiation dose in tests that are deemed necessary by changing the speed of the scan or the intensity of the radiation.

Using scans on cadavers, for example, researchers at Loma Linda University Medical Center reported in December that they were able to reduce radiation exposure by 95% and still detect kidney stones.

Of particular concern, some researchers say, is coronary angiography, which scans the heart at levels up to 1,000 times of a normal chest X-ray to diagnose coronary artery disease. The Archives of Internal Medicine study on radiation risk estimated that one in 270 women who underwent CT coronary angiography at age 40 and one in 600 men will develop cancer from that CT scan. A study published last week in the journal *Radiology* found that the radiation dose can be reduced by 91% using a volume scanning technique— which takes a picture of the heart in one piece as opposed to traditional scanning over intervals of time—without reducing the quality of the image markedly.

Montefiore Medical Center in the Bronx, N.Y., meanwhile, reduced the number of CT pulmonary angiography scans and radiation dose delivered to emergency room patients with a suspected blood clot in the lungs by routing some of those with a normal chest X-ray to an older technology known as a ventilation perfusion, or V/Q scan. A V/Q scan evaluates air flow and blood supply to the lungs. Radiation from a CT scan is five times greater than a V/Q scan; the dose is 20 to 40 times greater to the female breast says Linda Haramati, lead author of the study. "We found we can decrease radiation exposure without compromising patient care," she says.

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