

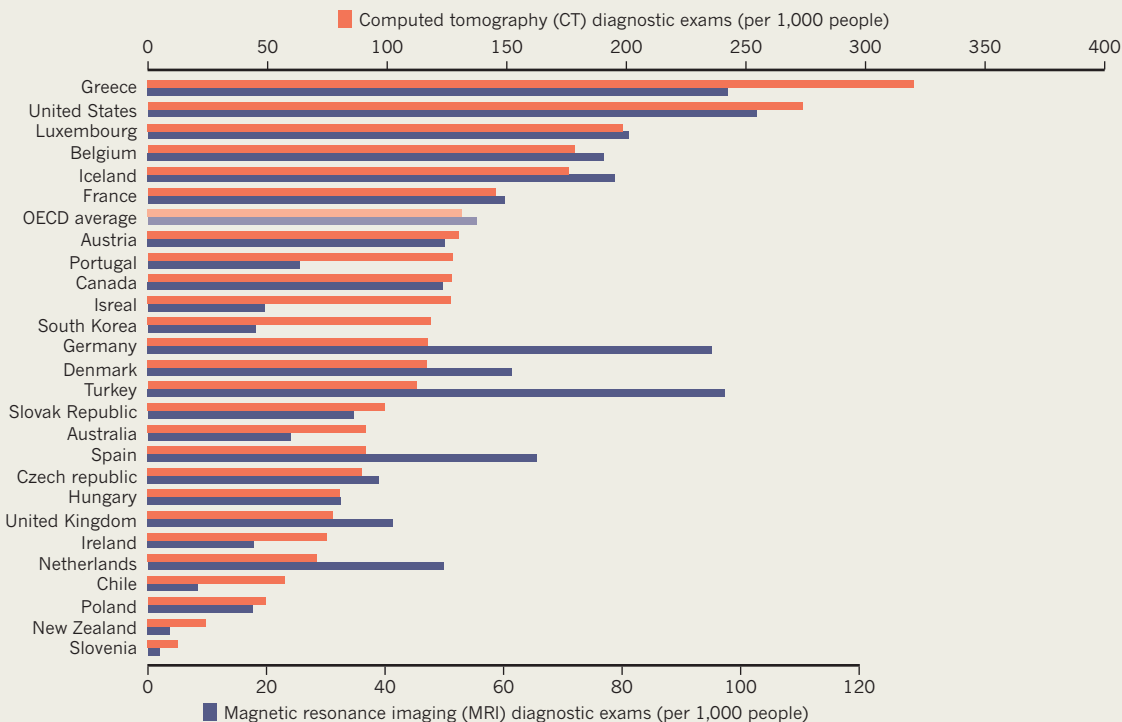
# ENHANCED MEDICAL VISION

The ability to look inside the human body without using a scalpel has revolutionized how we diagnose and treat illness and injury. By **Brian Owens**.

## UNEVEN DISTRIBUTION

The number of scans per 1,000 people varies widely around the world. In some cases, such as New Zealand, the number may be underestimated because the data only include procedures paid for with public funds.

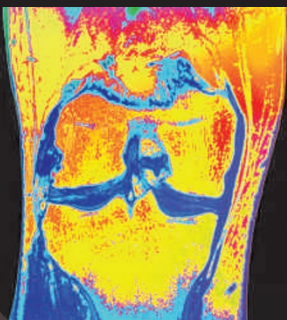
Greece tops the list in number of CT scans because it has a large number of scanners, with the vast majority based in private clinics, and there are no official guidelines governing their use.



## TYPES OF SCANS

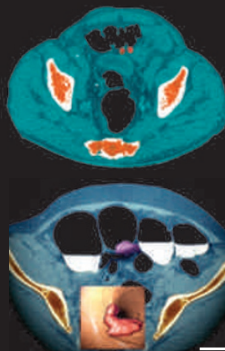
### MRI

Magnetic resonance imaging is used to examine soft tissue such as joint ligaments, muscles, and the brain. It uses powerful magnetic fields to manipulate the spin of protons in the tissue to provide information about how they are arranged.



### CT

Computed tomography uses computers to process X-rays and create images of slices of the body. These cross-sections can be assembled into larger 3D images to detect tumours, bone damage, and potential hemorrhages, as in this scan of colonic diverticular disease.



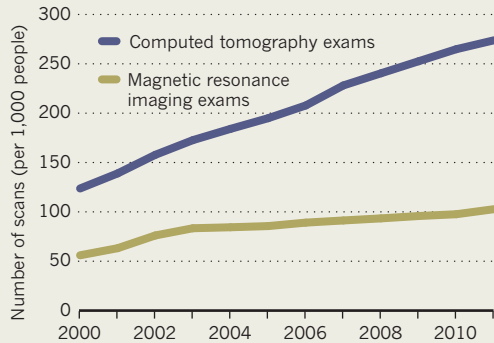
### ULTRASOUND

Sound pressure waves with a frequency beyond human hearing can be used to image soft tissues in the body, most commonly a developing foetus.



## RISE OF THE MACHINES

There has been a dramatic rise in the number of CT and MRI scans over the past decade in the United States.

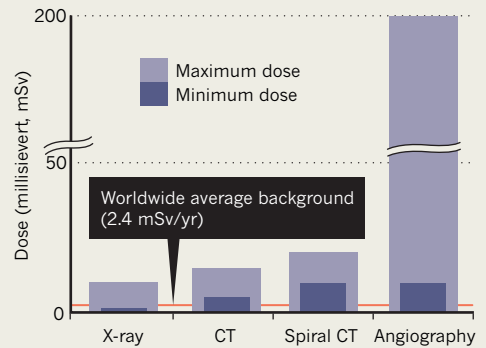


# 100,000

The most powerful clinical MRI machines have a magnetic field of 3 Tesla, about 100,000 times stronger than the Earth's natural magnetic field

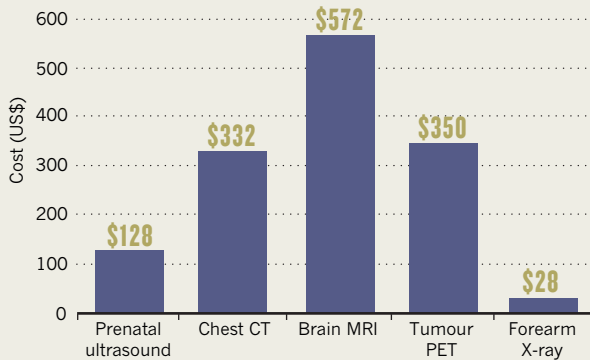
## RISKY BUSINESS

Some imaging procedures can expose patients to high levels of radiation, so the number and timing of scans must be carefully controlled over their lifetime.



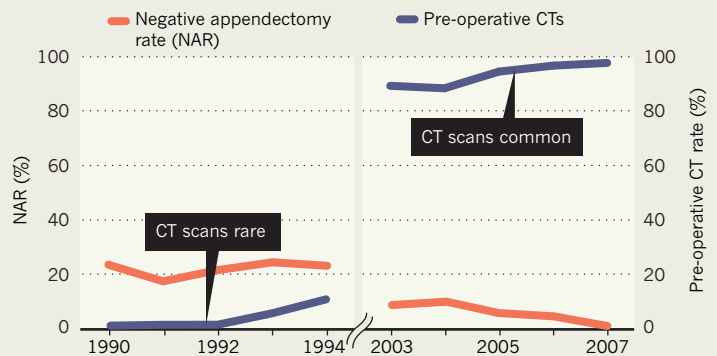
## OUT OF POCKET

The cost of a single diagnostic scan can be steep, but can save money in the long run by eliminating the need for expensive surgery (see 'Positive feedback', right).



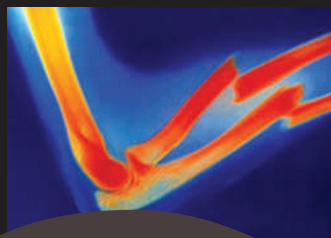
## POSITIVE FEEDBACK

As the use of pre-operative CT to diagnose appendicitis has increased, the number of false positives – and therefore unnecessary surgeries – has dropped to almost none.



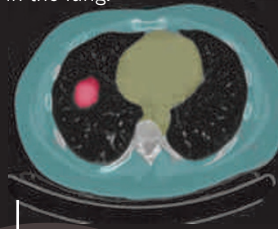
## X-RAY

The oldest and still most common form of medical imaging is used to examine the lungs and hard tissues such as bones.



## PET

Positron emission tomography detects the gamma rays produced by a radioactive tracer introduced into the body that is specific to the tissue of interest. It is used extensively in cancer diagnosis, to locate tumours such as this one in the lung.



## fMRI

A research technique that is beginning to find clinical uses, functional magnetic resonance imaging measures brain activity by detecting associated changes in blood flow.

