

need are pragmatic lifestyle interventions that can delay the onset of diabetes. We need to decide whether we want to spend more on drugs for prevention rather than on lifestyle measures and public health strategies to reduce the burden of chronic disease.

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X ray imaging goes digital

Digital imaging brings benefits but also demands changes in ways of working

Digital x ray imaging has brought obvious benefits to health care, but, as with all new technologies, it both requires and leads to changes in behaviour and processes, some obvious and some less so. The issues include cost and productivity, the need to acquire new skills, radiation doses, overuse, and image quality. Moreover, some of the ethical and legal issues surrounding teleradiology remain unclear.¹

Physicians have long been accustomed to viewing and interpreting images on film. Film is now being replaced with digital images in the same way as film cameras are being replaced with digital cameras. Digital x ray imaging does away with film processing, and the images can be viewed just minutes after exposure via computer networks, to be seen by many people at once, in many different places. So what are the issues surrounding the transition to digital imaging?

The initial cost of buying digital systems has dropped substantially during the past two decades, but such systems are still more expensive than a conventional system. Conventional film images can be viewed anywhere, just by holding up the film to light, whereas monitors with network connections and software capabilities are needed to view digital images. The high cost of implementation has clearly impeded the adoption of digital systems, though some cost analyses have shown that the high cost can be justified in a high volume setting.^{2,3} The increase in the overall speed of service, from the request for an examination to reporting, may also justify the high cost. One comparison of the operating and investment costs of conventional and digital systems found that the average total cost of digital technology was 20% lower than that of a conventional system.³ Several studies have shown that the transition to filmless technologies offers potential for improved workflow and increased productivity.^{2,w1}

New technology requires new skills. Physicians must become familiar with viewing images on a display screen. For many years, even radiologists found digital

images not as acceptable as film for interpretation.⁴ Today, high resolution displays have greatly aided interpretation of digital images.

It was once thought that digital systems would reduce radiation doses. They can facilitate dose monitoring by recording factors that have direct bearing on radiation exposure to patients, such as x ray tube voltage and tube current. Any technical errors can be promptly rectified, thus further reducing risk to the patient. Although some studies have shown dose reductions,^{5,w2} there is a tendency towards increased doses.⁶ The reasons include the fact that overexposure can go undetected, unlike with film, where the image turns dark, but more important factors are a tendency to take more images than necessary and at a higher image quality (and hence radiation dose) than necessary.

One study showed that some centres with digital systems used an average of 68 exposures per examination in upper gastrointestinal fluoroscopic examinations, compared with 16 exposures in other centres with conventional systems.⁷ In several US hospitals the number of examinations per inpatient day increased by 82% after transition to digital systems and the number of examinations per outpatient visit increased by 21%, while the number of examinations per visit nationally decreased by 19%.⁸ It is easy to delete digital images, and repeat exposures normally go undetected.

Different imaging tasks require different levels of image quality. For example, the follow-up examination for a fracture does not require the same image quality as that required for its diagnosis.^{8,w3} A lower quality image may look slightly less clear but still be good enough for diagnosis. The image quality routinely used in digital imaging is often greater than that required for diagnosis, so how does a physician know if it is higher than necessary? This is a question of training.



Extra references w1-w4 are on bmj.com

Studies using simulated images have shown that it is possible to reduce radiation doses by half or more by having slightly less clear images, without affecting the detection of simulated pathologies.⁹ w4 Organisations such as the International Commission on Radiological Protection and the International Atomic Energy Agency recommend that quality assurance programmes should be implemented,¹⁰ as do the UK regulations.¹¹

One big advance of digital technology is, of course, that it enables the electronic transfer of images to any location. This timely production and transmission of images gives physicians greater access to them during consultations.¹² The option of remote interpretation of images has the potential to ease the burden on hard pressed radiology departments. Images taken in short staffed departments at night can be reported by remote fully staffed departments in the day.¹

Despite the obvious benefits of digital x ray imaging, there is lack of clarity about related ethicolegal issues. Whether the current law relates to telemedicine in the same way that it does to other medical specialties remains controversial.¹ Telemedicine raises licensure questions, such as whether teleradiologists practising medicine in another country need a license for that place. This is complicated by individual hospitals having different standards for accreditation.

In the UK, practice guidelines on legal issues relating specifically to telemedicine or teleradiology are lacking. The next step is to develop and implement guidelines to safeguard both patients and professionals. Until such guidelines exist, practitioners should be

mindful of their position regarding issues such as duty of care, liability, and confidentiality.

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Preoperative staging for rectal cancer

Magnetic resonance imaging can accurately predict the success of surgical resection

Colorectal cancer is the second most common cause of death from malignant disease in the United Kingdom, with about 20 000 deaths each year. Around one million new cases (9% of all cancers) are diagnosed each year worldwide (CANCER*Mondial*; www-dep.iarc.fr). As the UK population ages the incidence is predicted to rise.¹ At present the only realistic prospect of cure is complete surgical resection of the primary tumour. The restricted anatomical space in the pelvis makes this technically easier to achieve for cancers of the colon than the rectum. Consequently, local recurrence rates after surgery for rectal cancer have been as high as 50%. Local recurrence is a devastating complication as it is invariably fatal even without disseminated disease. Local recurrence can be reduced by two methods—surgical technique and radiotherapy. Currently, radiotherapy is given to most patients even though only a subgroup will benefit. There is increasing interest in the use of preoperative staging to target high risk patients who will benefit most from radiotherapy. A study in this week's *BMJ* shows the value of magnetic resonance imaging in the preoperative staging of rectal cancer.²

Local recurrence rates can be reduced to less than 5% if the surgeon removes the rectum en bloc with the mesorectum using precise anatomical dissection (total mesorectal excision).³ Crucially, the surgeon must ensure that the circumferential resection margin is clear of tumour because a positive margin predicts a high risk of local recurrence.⁴ The quality of this surgery, which is technically demanding, can be determined by pathological examination of the integrity of the mesorectum in resected specimens. In Sweden, the adoption of total mesorectal excision by surgeons who had attended a training programme reduced the local recurrence rate after surgery for rectal cancer from 20% to 8% and increased survival.⁵

Randomised trials have shown that preoperative radiotherapy reduces local recurrence and is superior to postoperative treatment.^{6,7} The Swedish rectal cancer study showed that “short course” preoperative radiotherapy reduced local recurrence and improved survival, but this study was subsequently criticised because total mesorectal excision was not used.⁸ In a later Dutch trial all patients had total mesorectal excision and were randomised to preoperative radiotherapy or surgery alone.⁹ As expected with high quality

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