

The price of diagnosis

It is becoming increasingly acceptable in today's medicine to put a price on life itself. The most obvious example in the UK is in the workings of the National Institute for Health and Clinical Excellence (NICE). For treatments to be approved for NHS use, they must pass two tests: they must be clinically effective, and they must be cost-effective, yielding benefits of one quality-adjusted life year (QALY) for £20 000, although this figure is often fudged upwards.

NICE is generally concerned with treatments but it also examines diagnostics; for example, coeliac disease is currently being reviewed, including the health economics of alternative diagnostic strategies. However, as diagnosis is usually cheap, clinicians rarely consider the costs. An exception to this general rule is in this month's journal, where Kernick *et al* offer diagnostic guidance for imaging of the brain in adult patients with headache.¹ The authors struggled with a shortage of both clinical and economic evidence but still generated logical advice. How does this advice perform in terms of economic and human cost?

In essence, the authors recommend imaging once the risk of a brain tumour is above 1%. They describe three clinical scenarios that they estimate to have at least that risk: a headache that awakens the sufferer, one accompanied by dizziness or lack of coordination, or headache rapidly increasing in frequency. Surprisingly, their calculations suggested that headache accompanied by abnormal neurological findings had a risk of an underlying tumour in the range of 0.3–0.5%, and so for these patients a policy of 'watchful waiting' is advised. Their estimates of risk were derived from secondary care likelihood ratios, combined with a primary care incidence. This was a necessity, as brain tumours are so rare that it is almost impossible to study their symptoms in primary care.² The selection process inherent in referral to secondary care will mean that patients in neurological clinics with neurological

signs are over-represented in relation to the number of brain tumours. Clearly, some abnormal neurological signs accompanying headache warrant referral – papilloedema for instance. The choice of a 1% threshold for investigation is relatively low when compared with other cancers. For anaemia and colorectal cancer, NICE guidance equates to recommending rapid investigation only when risk of a cancer has risen to 13% in men and 8% in women.^{3,4} This is a flagrant example; even so, few of the current recommendations in NICE guidance represent a risk below 3%.⁵

Imaging has two main benefits compared with watchful waiting: firstly, it expedites diagnosis of brain tumours (the true positives) so allows earlier treatment, which in turn may improve survival. Secondly, those with a normal scan (the true negatives) may be reassured. It is clear that the survival gains are small for the first group: few tumours are cured. Median survival with treatment ranges from 0.4 years in glioblastomas, to 5.6 years in low-grade astrocytomas.⁶ Cerebral metastases, which are more common than primary tumours, have a dismal prognosis, with a median of 4.1 months survival.^{7,8} Survival gains from treatment of brain tumours have been modelled in an economic analysis in children, who probably benefit more from early diagnosis than adults, as cerebellar tumours are very amenable to cure. Even at a prior probability of a tumour of 4%, the cost per QALY of imaging was \$114 000.⁹

Imaging for a brain tumour is highly unlikely to pass the NICE economic test when considering benefits for the true positives alone, unless a very high threshold level of risk is set. This should be no surprise. Testing of low-risk populations is always expensive, as the number of tests is so large in comparison with the number of cancers found. For instance, the annual cost of diagnosis of colorectal cancer has been estimated at £157 million in England, more than the costs of either primary treatment or

screening.¹⁰ This identifies around 30 000 colorectal cancers, equating to a rough figure of £5 000 per cancer identified: half of which will be cured.

Therefore, if Kernick *et al*'s threshold figure of a 1% for imaging is to be accepted, the benefits in the true negatives must be large or, put more simply, the reassurance from a normal brain scan must justify the cost. Trial evidence helps us here. A randomised trial of imaging against no imaging in headache had short lived clinical benefits, so the main trial outcome was negative.¹¹ However, in the following year patients who had been scanned used considerably less healthcare resources: £465 less (95% confidence interval = £1028 less cost to £108 more cost). These figures suggest that imaging of low risk populations may be cost-effective, although the main economic benefit comes from patients with negative scans, as opposed to those with positive scans. Such a financial benefit accrues to the NHS, not the patient, but we can assume the patient has experienced some clinical benefit, in that the likeliest explanation for reduced healthcare use is that the patient feels better. A policy of liberalised imaging may also translate into fewer attendances in primary care, and may reduce the number of complaints against doctors, although these should probably be regarded as fringe benefits. Perversely, complaints invariably come from those whose allegedly delayed scan identifies a tumour. This group actually gains little survival benefit (so may have lost little, if anything, from their delayed diagnosis).

However, the costs of imaging are not just financial: there are human costs too. The main problem is the risk of false-positives, whereby a scan is abnormal, but the abnormality is not a tumour. Often the abnormality is vague, and repeat scanning is required. Significant abnormalities are identified in 1.7–6.6% of healthy volunteers, with the chance of an abnormal result increasing with age.^{12,13} Many of these abnormalities pose real management problems, such as arterio-

venous malformations (found in 0.5%) or arachnoid cysts (in 1.7%).¹² It doesn't require advanced mathematics to see that a policy of scanning at a brain tumour risk of 1%, combined with a false-positive rate of up to 6.6% means that for every tumour identified, many chance findings will also be uncovered. Where is the reassurance in this? Perhaps it could be argued that these incidental findings are benefits of scanning, but unless these findings lead to treatment with clear benefit, this will be a hard argument to sustain.

There is also a societal cost too. If imaging of headache becomes the norm — and these guidelines clearly do not believe it should be so — we run the risk of shifting the threshold between what is part of normal life, and what is illness. A small shift in population behaviour could cause the demand for medical care for headache, and thus for scanning, to mushroom. It is not that illogical to extrapolate from 'all headaches must be scanned' to 'all headaches must be reported to the doctor.'

This leads to a final concern. If as clinicians we concentrate on only the life-threatening possibilities, the much more

common — and treatable — alternative causes of headache may be ignored. Paracetamol and triptans are more important in the primary care management of headache than brain scans.

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