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# Is there too much laboratory testing ?

by Brenda Leese

DISCUSSION PAPER 79

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## The Author

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Abstract

There is evidence that the numbers of diagnostic tests performed in hospital laboratories could be reduced without affecting outcomes to patients, and with significant concommitant reductions in costs. The concentration of testing in centralised laboratories located in larger hospitals, and the use of automated techniques, together with an increase in the types of tests available, have contributed to the large increase in test requests. This trend has been apparent for many years.

There has been little, if any, control of test requests. Moreover, the patterns of requests for laboratory tests differ between physicians, which suggests that some tests are unnecessary. The methods which have been used to modify clinical behaviour fall into six categories: education, feedback, participation, peer review, financial incentives and administrative changes. It is concluded that no single method is effective and a combination of methods may be necessary depending on the situation. Whatever methods are adopted, they must be sustained and interest maintained to achieve lasting success. A procedure is outlined for introducing test request reductions in hospitals.

It is shown that increasing use of desk top analysers in general practice and hospital wards will have only a small impact on the numbers of tests requested. The NHS Review, which incorporates costing procedures for diagnostic tests, may cause a reduction in hospital test requests once their costs are known. Determining costs will itself be an expensive and time consuming operation, but an inevitable product of information technology investments (eg, The Resource Management Initiative) already financed by government.

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## 1 INTRODUCTION

There is evidence that much of the laboratory testing performed in the UK and elsewhere is unnecessary, and that the cost of tests to the NHS could be reduced without harming patients. This situation has come about for several reasons. Firstly, the ease with which tests are available using automated methods in centralised laboratories has contributed to the large increase in test requests over recent years, together with an increase in the type of tests offered by the laboratories. Secondly, doctors requesting tests generally have little incentive to be economical: the costs of their decisions fall on people other than themselves. Thirdly, there has been little, if any, control of test requesting, and patterns vary considerably from one physician to another.

The present situation with regard to levels of laboratory testing, and the methods which have been developed in the UK and elsewhere to contain the growth of tests, are discussed in this paper. An attempt is made to identify the options available for test containment in the UK in the light of recent developments such as near-patient testing using small scale analysers such as the Reflotron (Leese and Hutton, 1989), and the requirements of the NHS Review (Department of Health, 1989).

## 2 ARE LABORATORY TESTS OVERUSED?

One of the problems associated with centralised facilities is that they tend to generate large numbers of tests, many of which may contribute little to eventual patient outcomes although they may be helpful in other ways, such as reducing 'uncertainty'. It is known that, up to 1980, the annual growth rate in the UK of requests for radiology and pathology tests was 6% per year, and over the preceding

10 years the workload in these services had increased by 80% (Young, 1980). According to Fowkes (1985), requests for tests to hospital laboratories have increased by 10% per year over the past 25 years, but inpatient admissions have increased by less than 2% per year. Similar figures have been reported from the USA (Danzon et al, 1984), where concerns at the high total cost of procedures which are relatively inexpensive in themselves have also been expressed. Indeed, much of the research on the containment of laboratory testing has come from the USA (Eisenberg, 1986). Increases in laboratory test requesting could clearly not be sustained, and the tide now appears to be turning, with questions being asked about the increasing numbers of tests being requested, their usefulness in diagnosis, and above all, their costs. In addition, it is debatable whether these increases can be justified in terms of better patient outcomes (Young, 1988).

Indeed, Sandler (1984) found, in a study of emergency testing of acute medical admissions, that only 17% of results were abnormal, and of these, only 33% were helpful in treatment, and less than 30% helped in diagnosis. It was estimated that £42.5m could be saved nationally by reducing unnecessary tests. Earlier studies (Griner and Liptzin, 1971; Griner, 1972) in the USA also concluded that the unnecessary numbers of diagnostic services provided to patients had no corresponding improvement in outcomes. Although some studies were flawed since they did not have adequate controls, or used retrospective data, the overall indications remain valid, and highlight the need for careful control of test requesting.

The major criterion for deciding whether a test is necessary or not is whether it has any effect on patient management or outcomes (Young, 1988). One method of assessing this is by looking at the attention paid by physicians to the test results they have requested (Myers and Schroeder, 1981; Mitchell et al, 1982).

Studies on the retrospective audit of medical records have shown that both normal and abnormal laboratory tests are often ignored (Griner and Liptzin, 1971; Dixon and Laszlo, 1974), implying that the tests were not needed anyway.

Klatt et al (1982) showed how the cost of a relatively inexpensive test performed inappropriately can become very expensive in terms of cost per useful test performed. Creatine kinase was available only as part of a 19-test panel and the cost of the test was $0.64. However, it was found that none of 252 patients having the test within 24 hours of admission had their diagnosis changed, and of the 600 creatine kinases done every day as part of the panel, only 40 were clinically necessary, so that the true cost of a useful creatine kinase test increased to $9.60.

An important factor in the analysis of laboratory test ordering, which is frequently overlooked, is that test requests, may differ significantly from test results, because laboratory staff may modify requests in the light of their own knowledge of previously performed tests on particular patients. Since most studies of laboratory testing consider requests only, there may be a considerable discrepancy between this figure and those for tests actually performed, which may lead to distortion of the true volume of tests actually carried out (Cavill, 1988; Finn et al, 1988). In addition, the equipment available in the laboratory often makes it easier to perform a battery of tests rather than being selective. Broughton and Worthington (1989) assessed the tests actually performed for a specified request, and found considerable variation. For example, a liver function test request elicited 17 different test combinations in 19 laboratories, implying that unrequested (and possibly unwanted) tests are frequently added. They concluded that laboratory staff as well as clinicians must therefore bear some of the responsibility for unnecessary tests.

In the USA, billings for laboratory tests have accounted for up to 25% of patient costs, but in the UK, less than 4% of total hospital expenditure in 1985 was on laboratory tests (DHSS, 1985). However, this UK figure represents a clearly defined and possibly reducible expense. Many US laboratories overcharge for high volume, low cost tests in order to subsidise high cost tests and ensure a profit (Griner and Glaser, 1982). This is not currently a problem in the UK, although it may become one as a result of the NHS Review (Department of Health, 1989).

There is also ample evidence that doctors have little awareness of the cost of tests (Skipper et al, 1976; Nagurney et al, 1979; Kelly, 1978; Robertson, 1980; Schroeder et al, 1973), and in any case, physicians concern themselves more with the clinical effects of the test and not with its cost (Berner et al, 1985).

There is, however, mounting evidence that overuse of laboratory tests is occurring in the UK, as well as in the USA and elsewhere. Both usefulness and cost must be considered. If a test will not help in patient management, then it is unnecessary and can be excluded without affecting the patient, thereby reducing costs. On the other hand, concern about costs must not lead to the abandonment of necessary tests, which help in patient management. However, there may be a hierarchy of usefulness, so that a test might (a) increase knowledge of the patient's condition (b) help in establishing a diagnosis (c) change patient management and (d) affect outcomes. The evidence for the overuse of laboratory tests is primarily based on increasing costs, lack of effect on patient outcomes, and the low use made by doctors of the test results.

## 3 WHY USE LABORATORY TESTS?

What are the objectives of requests for laboratory tests? There are various

reasons for which tests may be requested, and these have been summarised by Griner and Glaser (1982).

## 3.1 Tests for screening purposes

The aim of screening is to identify the presence of disease in its early stages, with the hope of successful intervention. Intervention might take the form of simple advice, eg, dietary advice for patients with high cholesterol levels, or treatment might be initiated eg, for diabetics.

However, screening can also do more harm than good by creating unnecessary anxiety in a patient. Therefore, the more acceptable screening tests are those which have fewer false positive and false negative results. A more efficient approach than mass screening might be to screen only for diseases which can be treated or have a high prevalence, or screening those at most risk from disease, perhaps because of their lifestyle or family history. Such a policy has recently been suggested for cholesterol screening in the UK (Standing Medical Advisory Committee, 1990).

## 3.2 Tests to aid diagnosis

Another reason for requesting tests is to aid in diagnosis, either to supplement history taking, or sometimes as a substitute for those doctors who do not appreciate the importance of history taking.

Inefficient testing is a problem in hospitals. This might arise because doctors may have difficulty in keeping up with technology, which provides increasing types of tests, and so may have difficulty in interpreting the results. This might

lead to unnecessary tests being requested. This problem could be overcome by providing data about the meaning of test results, not just as a "normal range" but in relation to different diseases, so that the appropriate tests can be requested initially. There is also, however, the possibility that a test result will help to explain unusual symptoms in a patient.

General practitioners are likely to request tests to exclude disease rather than to confirm it. This could be the only explanation for the finding that the frequency with which gallstones are identified among patients receiving cholecystograms only slightly exceeds the prevalence of gallstones in the general population (Bartrum et al, 1977).

### 3.3 Tests in patient treatment

Once a diagnosis has been made, laboratory tests are frequently used to monitor the progress of the disease or the treatment. The problem lies in defining the frequency of such testing, which has been shown to be particularly high in teaching hospitals (Myers and Schroeder, 1981). Testing after a diagnosis has been confirmed may also be useful in determining the prognosis of the disease. Reassurance for the physician that the treatment has been effective is also an important factor.

### 3.4 Tests to generate income

In countries where private medicine is the norm, there may be a temptation to request tests for which a payment is received from the patient, whether the test is necessary or not, and charges could be inflated. This could also arise where the hospital gets more income if more tests are carried out, for example, outpatient

testing in Canada. Other possibilities include tests ordered for medico-legal reasons. These are not currently problems in the UK. However, the impact of the recommendations of the NHS Review (Department of Health, 1989), in the context of diagnostic testing is discussed in Section 5.

### 3.5 Summary

The evidence shows that laboratory tests are useful in defined situations where they can help specifically in screening, diagnosis or treatment. However, there are other negative aspects, as well as overuse of tests. the problem of false positive and false negative results is very real: the former possibly leading to unnecessary intervention and treatment for the patient, and the latter giving false reassurance to the physician. Care should also be taken to ensure that test results do not obscure the value of history taking as a diagnostic tool.

## 4 METHODS OF MODIFYING CLINICAL BEHAVIOUR

How can the growth in the volume of tests be limited? If tests do not aid in patient management, they are an unnecessary cost to the health service and should be reduced. Numerous strategies have been reported to eliminate the inappropriate use of tests (Griner and Glaser, 1982; Young, 1988). The aim has been to promote selectivity in the ordering of tests, and the better education of physicians about the cost of tests. Such strategies, to be discussed below, are (1) education (2) feedback (3) participation (4) peer review (5) financial incentives (6) administrative changes.

Cost containment exercises have failed to affect the overall cost of tests because of the large indirect cost element involved, hence the need to try out the

strategies listed above.

Education programmes have had mixed success, but those using personalised instruction techniques have been the most effective (Eisenberg and Williams, 1981). Several peer review and feedback programmes have shown reductions in costs, at least in the short term, as have administrative interventions. Penalties and direct rewards have been less successful, possibly because of their inappropriateness or because they were poorly targeted. Eisenberg and Williams (1981) suggested that alterations in the reimbursement system in the USA could offer financial incentives to doctors who practice in a cost effective manner. Such methods have been used in the UK (Wickings and Coles, 1985), but with the advent of GP budgets and self-governing hospitals (Department of Health, 1989) methods of cost containment have been brought to the fore. For example, GPs who are fund holders will be allowed to keep a proportion of their unspent budget allocation for use in their practices.

As early as 1977, 34% of medical schools had cost containment programmes for medical students (Hudson and Braslow, 1979). Both Eisenberg and Williams (1981), and Grossman (1983) have reviewed cost-containment strategies in the USA, as have Fraser and Woodford (1987). A variety of approaches have been used, but discussion has been limited by the lack of available data on cost effectiveness.

Test ordering patterns often depend on two factors (1) the personal characteristics of the doctors concerned (Schroeder et al, 1973; Eisenberg and Nicklin, 1981; Hardwick et al, 1975; Ornstein et al, 1988) with little relationship to quality of care (Daniels and Schroeder, 1977; Schroeder et al, 1974), and (2) on age, with older doctors ordering fewer tests (Eisenberg and Nicklin, 1981; Lave and Leinhardt, 1976; Fleg et al, 1989) possibly because when they trained, fewer tests were available anyway, or by being older, they have more clinical experience

and are less likely to need the reassurance of a test result.

## 4.1 Education

Education methods have included discussions, workshops, seminars, case reviews, newsletters and other mechanisms. However, such programmes have been shown to have only a temporary effect (Eisenberg, 1977; Young, 1980; Rhyne and Gehlbach, 1979; Marton et al, 1985). Fowkes et al (1986) reported a reduction in tests requested over 10 weeks, but warned that sustained reductions over a long period of time would require continued vigilance. Most studies have only had short follow up periods, for example, Davidoff et al (1989) reported that physicians educated about diagnostic tests ordered fewer tests than those educated only on cost containment, and the reduction in tests ordered was sustained for 4 months after the study had finished.

However, Griner (1979), in a seven year study, showed a continued reduction in the use of some tests which led to the hospital showing lower rates of increase in hospital tests than elsewhere in the USA. This study used seminars, the showing of patient bills to doctors, and administrative changes, to achieve a decline in clinical tests per patient from 34.5 in 1970 to 26.6 in 1977, showing that with sustained effort and organisation, it is possible to maintain initial success rates.

Most studies using education as a means of reducing the numbers of tests requested have been successful whilst the study has been in progress but in most cases the level of testing has returned to its original level soon after the study was ended, or, if sustained success was reported, the follow up periods were short.

## 4.2 Feedback

Feedback involves giving doctors information on the costs and types of their tests ordered, sometimes in conjunction with those requested by other doctors, so that comparisons can be made.

Some studies have shown that feedback information on the cost and ordering patterns of tests can be effective in reducing test requests (Bowers and Franklin, 1977; Wennburg et al, 1977; Grimm et al, 1975; Craig et al, 1978; Counts, 1977; Goldberg and Abbot, 1974; Freeman, 1976; Karas, 1980; Henderson et al, 1979). Such feedback methods have included sending doctors copies of bills received by their patients; sending doctors lists of their use of tests compared with others, and management reviews of test use (Eisenberg and Williams, 1981; Young, 1988).

Tierney et al (1990) developed a computer programme which showed one group of physicians the charges for tests ordered and for the control group only the type of tests ordered. Those physicians receiving cost information ordered 14% fewer tests with 13% lower costs than did the control group, but the effect did not persist after the study was completed.

Reduction in tests ordered was found to be due to a decrease in test numbers rather than substitution of cheaper tests (Cummings et al, 1982).

The use of feedback of their own and other doctors' test usage, either alone or combined with a manual detailing the costs of tests, was effective in reducing numbers of tests ordered and persisted for a 3 month follow up period (Marton et al, 1985). The provision by the Prescription Pricing Authority, of PACT (Prescribing, Analyses and Cost) information to GPs in the UK, which breaks down

the costs of their prescribing and compares these with the FHSA (Family Health Services Authority) average, hopes to achieve the same end, but it is as yet too early to draw conclusions.

Another approach is to provide doctors with information about their ordering patterns along with those of other doctors, but allowing each doctor to identify his/her own ordering patterns only (Schroeder et al, 1973), perhaps combined with an educational programme (Gortmaker et al, 1988). The latter study found that essential tests were still requested to the same extent, and Schroeder et al found that the decrease in test ordering was greatest amongst high cost physicians, although Grivell et al (1981) found that such ranking was not effective.

Computer programmes have been used (Tierney et al, 1988). Providing doctors with information on the probability that the test they had ordered would be positive for the abnormalities being tested for, was effective in reducing test requests.

Wickings (1977) noted that individual incentives were often more effective than institutional incentives. His own study gave ward teams their own budgets and allowed them to use savings made to purchase items not previously funded. The teams were given a monthly financial and statistical report, and had regular review meetings. A control group received no data. Expenditure was reduced by 9.5% in the experimental group, but also by 4.8% in the control group. The latter result was unexplained but could have been caused by the movement of nurses and other staff between teams, resulting in the promotion of cost-consciousness. Wickings gave no indication of whether the experiment was continued or extended, or whether the effect persisted. This study shows the difficulty experienced in demonstrating that the effects observed were due to the experimental procedure

adopted. Wickings (1983) also noted that doctors supported schemes which allowed them to redeploy the money saved, within their own team. Another UK study showed a reduction in the number of routine pathology tests requested, among others, when clinicians were responsible for their own budgets (Gibberd, 1982). This type of clinical budgeting has formed the basis for resource management initiatives in the UK (Lamb and David, 1985).

Most of these studies have been effective during the study period but have had too short a follow up period, or none at all. Those which had a follow up period showed that the effect of the intervention diminished with time and that continued vigilance is necessary. There has been, as yet, no long term study balancing the costs of implementing the cost containment exercise, against the savings when fewer tests are ordered.

The high overhead costs in many hospital laboratories mean that it is not certain that the savings would be worthwhile, at least in the short term; but in the long term, there could be fewer autoanalysers. Doubts were expressed in 1981 by Eisenberg and Williams. More research is needed on whether cost containment exercises have any effect on the quality of patient care, and which methods are the most effective. There is also the need for such studies to be undertaken in a variety of settings, since responses may differ. The most appropriate people should be targeted with feedback information (Mitchell and Fowkes, 1985). Feedback has tended to be most effective when junior staff are reviewed by their seniors (Martin et al, 1980), and least effective either when feedback is carried out by junior staff (Eisenberg, 1977), or when tests were ordered by junior staff, but feedback was to senior staff (Grivell et al, 1981). Another factor is that although clinicians might be willing to consider costs when ordering tests, so many tests are considered essential regardless of cost, that savings could be minimal (Hoey et al,

1982).

## 4.3 Participation in Cost Containment Strategies

Theoretically, involvement of the doctors in the whole cost-containment strategy should be more effective than any of the previously discussed strategies. Such methods are known as "contingency theory" - "neither physicians nor other professionals would be expected to respond favourably to forced change with which they did not agree" (Eisenberg et al, 1977).

Stoelwinder and Clayton (1978) found such methods to be effective and Cohen et al (1982) also commented that feedback would only be effective with clinicians well motivated to act on the information given. Novich et al (1985) reported that the most commonly requested clinical tests could be reduced by requiring clinicians to justify their test requests. Fowkes et al (1986) obtained an immediate reduction in the average number of haematology test requests per week from 74 to 27 (64% less) and biochemistry tests from 158 to 58 (64%) by using clinical guidelines and a weekly review of medical records to encourage a more discriminating use of laboratory tests. The decrease was mainly due to a reduction in the number of repeat requests. Fraser et al (1985) suggested guidelines for clinical chemists to enable effective communication of the results of laboratory tests.

Participation is similar to feedback but depends on the initial inclusion of clinicians in the study, and also requires their involvement at all stages, not just at the end. Studies have been effective, but again, continued vigilance is necessary.

## 4.4 Peer Review

Peer review requires discussion about test choice and costs with other physicians and inevitably involves some elements of education, feedback and participation. For example, successful methods have been reported in which senior staff have conducted individual discussions in cost containment with junior staff (Lyle et al, 1979; Martin et al, 1980; Klein et al, 1980). Martin et al observed that a large reduction in frequently ordered low cost tests produced much larger savings than any reduction in the number of less frequently ordered high cost tests. Everett et al (1983) conducted a randomised controlled trial, firstly to compare the effect of cost education, cost audit and a combination of the two, after an initial observation period, and secondly to compare a group subjected to faculty chart review (ie, discussion of tests requested with one of the researchers) with a control group. Faculty chart review was found to be the most effective method of reducing the number of laboratory tests performed by junior staff, but the effect was small. Such methods would be applicable to the UK, but adequate controls must be used to show effectiveness. For example, in the study by Griner (1979) it was not possible to separate the effects of the three types of education, and in the study of Martin et al, all doctors in both the study and the control group attended an initial discussion on cost containment (Grossman, 1983).

However, Robertson (1980) found no improvement in knowledge about the costs of hospital tests by doctors even after an intensive educational programme, although Greenland et al (1979) showed that tests were used more selectively by the more knowledgeable doctors. Another strategy used in the USA, is to target influential doctors or opinion leaders.

Peer review, education, feedback, and to a lesser extent, participation, have

been the subject of numerous studies in both the UK and the USA, and all point to reductions in test use which can be achieved, provided the initial impetus is maintained. It is likely that a combination of some, or all, of these methods would be required to achieve and maintain reductions in test requests.

## 4.5 Financial Incentives

The effectiveness of financial rewards or penalties is debatable. There has been little research in this area (Young, 1988). Lohr et al, (1980) found that feedback reduced the use of injectable drugs by 60%, but denying payment for inappropriate injections decreased use by only a further 15%, although there were no control groups in this study. Jones et al (1974) found some savings when financial rewards for good prescribing behaviour were used, but Martin et al (1980) found that financial incentives to reduce test requests had little effect, possibly because they were of little value to the participants. The HMO (Health Maintenance Organisation) system, where a set fee is paid for all medical care over a defined time period, might be effective in influencing physician behaviour, but whether quality of care is affected needs further study (Hillman et al, 1989). In the UK, the strategy of "clinical budgeting" is emerging and will be developed greatly as a result of the White Paper. Wickings (1977) reported that allowing clinicians to use the notional savings gained from a reduction in laboratory tests was an attractive option for the clinicians. However, a trial of clinical budgeting conducted by the DHSS (1985) showed that savings would be small because of the smaller contribution of direct costs to the total test cost. As Tarbit (1986) noted earlier, a 20% reduction in test numbers resulted in a cost saving of only 3.8%. These observations have led to the suggestion in a Lancet editorial (1986), that clinicians should be given two figures; the total cost of the test, and the costs which are redeployable.

It is possible that financial incentives could be effective in reducing costs, but such incentives would have to be large enough to be worthwhile to the physician. Allowing GP budget holders to use some of their income saved elsewhere in the practice makes sense in principle, but needs careful evaluation to ensure that patient care is not jeopardised.

## 4.6 Administrative Changes

All of the methods for reducing test requests described so far have involved the cooperation and involvement of those people making the requests. An alternative approach, which has been extensively researched, is to impose administrative changes which control or direct physician test choices. Such methods would be immediately applicable in the UK, and could be used to control, not only laboratory tests, but also other hospital services such as admissions (Wickizer et al, 1989).

Dixon and Laszlo (1974) showed that test use became more selective and tests were reduced by 25% when junior doctors were limited to eight tests per day. A similar study was carried out by Gray and Marion (1973). The importance of ensuring that patient care does not suffer was emphasised in these studies. Other administrative changes have included limiting the availability of certain drugs or requiring prior approval before certain tests can be carried out. Different clinical settings will require different strategies. Hubbell et al (1988) found that the battery of tests done when a patient was admitted to hospital had little effect on patient care, with only 0.5% of tests leading to changes in patient treatment. Korvin et al (1975) found that routine admission biochemistry tests carried out on 1000 patients led to no benefit in terms of new diagnoses.

Another approach is to have clearly defined protocols for test ordering. Wong et al (1983) found that test requests fell when the requesting forms were changed from a list to a problem oriented form. Wong and Lincoln (1983) have suggested that protocols may generate unnecessary tests because they apply to the average patient, and should be discontinued when shown to be of no proven value (Connelly and Steele, 1980). Bull et al (1986) proposed that the ranking of tests in order of usefulness would be effective, but Charpak et al (1988) warned that assessment of usefulness may vary with the individual. However, although Lehmann et al (1988) found that a redesigned requisition slip reduced the total number of tests performed by more than 50%, there was a 39% increase in the number of samples taken for analysis, and they warned that attempts to reduce physician use of the laboratory may produce cost savings in one area, which may be negated by cost increases elsewhere.

A further problem (Valenstein et al, 1988), is that a patient is likely to be seen by a number of different physicians during a hospital stay, many of whom may well order a battery of tests, even though these have already been performed for other physicians, so leading to significant over requesting.

Such methods would be applicable in the UK on a much wider scale than the local initiatives currently being undertaken. The "limited list" is an attempt to curb costs and unnecessary prescribing by allowing only the prescribing of generic (cheaper) drugs for certain drug groups. With the increasing emphasis on costs in the NHS as a result of the White Paper recommendations (Department of Health, 1989), it is likely that methods such as those discussed above will be much more widely used.

There are numerous pitfalls to be avoided in the design of requisition slips for laboratory tests. Each hospital laboratory and speciality would need to assess their basic test requirements, and all users be involved in their design. This is particularly so where patients are routinely tested on admission. All physicians should be informed of tests previously carried out so that unnecessary duplication can be avoided. Above all, patient care must not be compromised.

## 4.7 Main Lessons from the Literature

In general, no single method for reducing test requests is effective in all situations, and a combination of appropriate methods will be necessary, depending on the situation. In the short run, a decrease in laboratory tests will bring about only small reductions in costs, but in the long term it might be possible to reduce the indirect costs which make up the major part of test costs, without damaging the quality of care. In addition, more information on cost effectiveness and the actual costs of tests is required. In conclusion, controlled trials of different strategies appropriate to different situations are required, particularly in the UK. The redesigning of request forms would appear to be a fruitful course of action, particularly for GPs and side wards and clinics, where near patient testing might be appropriate. Further long term studies in UK hospitals in a variety of settings, would help to provide more information on strategies for cost containment which would best suit different situations. Such studies have become much more relevant as a result of the White Paper. The basic problem is that tests are not perceived as opportunity costs by the consultant requesting them, or to the ward or GP budgets. The best rationing device may be for the cost of tests to come directly from the budget of the individual making the request. This is particularly relevant to GPs as budget holders, and to hospitals who wish to attract contracts for services from GPs and elsewhere, and need to compete on costs. However,

successful cost containment in hospital laboratories will be dependent on cooperation between physicians requesting the tests and the laboratory staff carrying out the tests (Wong, 1985). For if clinicians do not take the ordering of tests as a serious responsibility, then freedom to choose their own tests could be severely restricted (Bean and De Cresce, 1989).

## 5 RECENT DEVELOPMENTS

### 5.1 Desk top analysers

Desk top analysers have recently been vigorously marketed in the UK, and allow the analysis of a limited number of blood constituents at the patient bedside or GP surgery (Leese and Hutton, 1990).

What effect is the development and availability of desk top analysers likely to have on the numbers and costs of diagnostic tests carried out? It must be emphasised that near-patient testing using desk top analysers has limited application in hospitals and in general practice, partly because of the small number of test types available, so requests to centralised laboratories will continue to be the major route for the foreseeable future. However, in the USA, at least 20% of all laboratory tests are performed in the doctor's office (Broughton, 1990).

The situations in which near-patient testing is likely to assume importance include intensive care units, special care baby units, casualty, and accident and emergency departments, ie areas where emergency testing is likely to be needed. Other areas of potential use include out-patient clinics such as diabetic and antenatal, and in general practice.

In these situations, the most frequently requested tests - haemoglobin, glucose and cholesterol, are available on desk top analysers. With the back up which will be necessary from the main hospital laboratory in monitoring and standardising, as well as maintaining the equipment, there is unlikely to be any significant reduction in the level of diagnostic testing. However, it is possible that, if doctors do their own tests, they will think carefully whether the test is really necessary before carrying it out. This would be especially true if the tests were a cost to the physician's own budget. Alternatively, a doctor having his or her own test facility, may be more likely to carry out a test, knowing that the result will be available immediately.

It is probably true that centralised testing encourages a lack of constraint on test ordering. The test result may take several days to be returned to the patient notes, by which time the relevance has been lost, and when the patient is seen again, the test may need repeating. However, it is likely that the NHS Review will improve reporting times. Desk top analysers may play a part in this situation and help to reduce unnecessary tests. Hopefully, the clinician will judge the importance of the test results in relation to the overall management of the patient at that time, and may avoid further tests. Marks (1985) considered that the higher costs of near-patient testing might be offset by a reduction in unnecessary tests. Greater selectivity of tests on the part of doctors is certainly a possibility, though there is little available evidence for this assertion. However, certainly in the USA health care system, a greater throughput of patients is possible if desk top analysers are used, obviating the need for repeat attendances, and this situation could apply in general practice in the UK if desk top analyser usage were to become more widespread.

It would be unfortunate if "bedside testing" became simply an "addition to"

the standard laboratory testing instead of a "substitute for", as this would not help in cost containment. When test usage and costs are measured in hospitals, care must be taken to include those tests performed at the bedside so that a proper estimate of tests and costs involved can be achieved.

The use of desk top analysers by GPs may reduce test requests to the centralised laboratory, but the overall impact is likely to be small (Leese and Hutton, 1989). Leese and Hutton presented data showing that only 12% of test requests to a centralised hospital laboratory were from GPs.

Home testing by patients such as diabetics using desk top analysers is already happening, and would have a small effect on hospital test requests (Walford et al, 1978). This has been shown to be valuable for motivated patients (Stubbs et al, 1980) and trials have been conducted (Webb et al, 1980).

Out of hours test requests may well benefit from the advent of desk top analysers. Such requests are often necessary for severely ill patients in intensive care units who need regular monitoring, and for patients brought into hospital as emergencies. According to Bernstein (1986), such "urgent" cases make up 40% of test workload. Lester (1986) favoured the introduction of equipment for clinicians to carry out their own tests in these circumstances, primarily as a cost cutting exercise, since call-out payments to technicians for out of hours work can be high in the UK. However, if clinicians had to perform their own tests at the bedside, they would be more likely to do only those which were absolutely essential, which might lead to some reduction in tests.

In summary, all of the factors mentioned above in relation to near-patient testing and the reduction in test requests, would probably have only a minimal

impact on the overall number of tests requested, and more research is needed in this area.

## 5.2 The NHS Review

Much of the evidence so far discussed in this paper suggests that too many diagnostic tests are requested, and various methods for reducing these numbers have been put forward. Within the UK National Health Service, there have, until now, been few incentives, in terms of costs, to reduce test requests. The recent NHS Review (Department of Health, 1989) however, has set out proposals by which general practices with a list of at least 11,000 patients, may choose to control their own budgets. They will be free to purchase certain requirements for their patients, such as defined surgical procedures, and also diagnostic tests, from their own budgets. In turn, hospitals will be required to cost diagnostic tests and decide what to charge for their services. The costing of tests by hospitals will not be easy, partly because there is no data base on which to build, and the assessment of overhead costs such as lighting, heating and buildings, will be difficult. It is therefore possible that if fund holding GPs have to buy diagnostic tests from the laboratory, and are aware of the costs involved, they will only request those tests considered essential, since they will be a charge to their budgets. Conversely, it is feared that test requests may be cut so severely that even those which are necessary will not be requested. On the other hand, a test ordered by the GP might prevent a more costly referral to a specialist. In a similar way, with the costing of laboratory tests, clinicians within the hospital can be made aware of costs, and may adjust their requesting pattern accordingly.

If budgeting becomes a reality, it will be possible to show whether awareness

of costs has an impact on test requests. In these circumstances, it is possible that some practices, (and hospital side wards), will decide to purchase desk top analysers to do many of their own tests. In the case of GPs, there is evidence that they would choose the cheapest option (Leese and Hutton, 1989).

## 6 DISCUSSION

Evidence has been presented that the numbers of laboratory tests carried out in the UK, as well as elsewhere, have been increasing at a greater rate than the throughput of patients, and therefore suggests that many tests are requested largely because they are available, and little attention is subsequently paid to the results. In addition, requesting rates differ considerably between doctors. There have been many attempts, mainly in the USA, to alter test requesting patterns, some with initial success, but many of which were unsustainable in the long term. Different situations appear to require different strategies, and interest has to be maintained or old habits are likely to return. It is doubtful whether the increased use of desk top analysers will have a significant effect on test requesting patterns, though some proposals set out in the NHS Review may increase awareness of costs and ultimately have some impact on test requests.

Finally, it is suggested that hospitals concerned about the increasing volume of laboratory tests requested should carry out a phased policy of assessment, as outlined below.

1 Monitor current levels of tests requested

2 Set up meetings between clinicians and laboratory staff in a chosen pilot speciality/department to secure cooperation

3 Discuss and agree protocols for test requesting

4 Review after 3 months, and change as necessary

5 Set up a series of monitoring sessions between clinicians to discuss individual requesting patterns

6 After 6 months produce data on tests requested during intervention period. Obtain costs and quality of patient care information if possible.

7 Define where money saved will be redeployed

8 Define costs of implementing the procedure

9 Disseminate results to other specialities/departments.

Note that data collection may be costly and time consuming initially, but should eventually be incorporated into the data gathering exercises necessary for the implementation of the NHS Review. Once the procedure has been established as part of the overall policy of the hospital, and data gathering becomes routine, the cost of running the system should reduce, and the benefits of fewer test requests become more apparent.

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