

Assessing and increasing the efficiency of Pathology Services

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INTRODUCTION

The increasing volume of tests, on top of tight budgets, is worsening the financial constraints faced by pathology departments in the National Health Service.^{1,2} Up to 80% of medical decisions rely on pathology services³ therefore the standard of these pathology-dependent healthcare services will be adversely affected if the quality of pathology services is compromised. Service providers continually have to develop, assess, review and improve practices in order to deliver services from shrinking budgets without compromising quality of service.⁴⁻⁶ Whilst an efficient national health service is considered as the one that is provided at a reasonable cost to the taxpayer, an inefficient pathology service is wasting resources that could benefit patients in other areas of healthcare.^{7,8} An effective system of evaluating performance contributes to an organisation's ability to deliver quality service. Peer-compare performance reviews and feedbacks from self-audits, using agreed targets are essential for assessing if the best services are being delivered at the lowest cost, and whether the services are satisfying the demands of the consumer. In any forward-thinking organisation, efficiency is a key performance indicator. Through the assessment of efficiency, an organisation is able to recognise successes as well as opportunities to improve existing practice and to channel resources in line with strategic objectives.⁹⁻¹¹

Whilst there are differing opinions regarding how efficiency should be measured, there appears to be a consensus that cost-effectiveness¹² and econometric¹³ evaluations are appropriate options for this purpose. Lord Carter recently recommended a unified system of assessing efficiency in hospital trusts¹⁴ and it is desirable to see that it is adapted for use in pathology departments. Efficiency is viewed as the extent to which the lowest numbers of resources (input) are used to produce an outcome (output) and the cost-effectiveness of that production is the relative cost at which the output is generated, compared to alternative sources of input.^{15,16} However, the actual outcome of a pathology service is health benefit, the financial evaluation of which may be based on assumptions.¹⁷ A more realistic approach is to consider ratios of the number of patients or samples tested and reported per unit pounds invested. Information regarding the cost-effectiveness of the service can be obtained from other pathology departments providing the same services. The sole use of cost-effectiveness to evaluate the efficiency of a pathology service is not encouraged, because it reflects on only a small part of the entire process that generates health benefits for patients.¹⁸ An alternative method is to employ the concept of *value-for-money*. This concept measures the extent to which a program has used resources to optimise intended outcome.¹⁸ In healthcare, this concept may be interpreted as *quality-of-outcome*. Because pathology quality assurance is directly linked to health outcome,¹⁹ the ideal criteria to use in assessing whether a medical laboratory has used available resources to support best clinical outcomes would be the elements

of quality assurance. Poor quality pathology service is likely to result in inferior patient care, possibly costing more money than it should. Common tools for assessing performance from the quality assurance point of view are summarised as pathology quality indicators (QIs) or pathology key performance indicators (KPIs).^{18,21}

Quality Indicators

The assessment of the quality of a pathology service should not be limited to events within the laboratory alone. It should adopt the concept of an *end-to-end pathology service*, which covers all the processes from test requisition to the delivery of interpreted results.¹⁸ Shahangian and colleagues²² described a set of quality indicators based on the United States Institute of Medicine's (IOM) six *critical health care domains*.²³ These are summarised in the three main analytical categories spanning the stages of the *total laboratory testing process*^{24,25} (Table 1).

In assessing the appropriateness of a pathology request, efficiency is directly measured.²⁶ Using the National Laboratory Medicine Catalogue²⁷ as a reference, this tool can highlight needless requests which add unnecessary costs. It can also identify underutilisation of pathology services, which can contribute to delayed or wrong clinical decisions. A drawback of this option is that there is no clear-cut definition of an 'inappropriate' pathology request.^{28,29}

Patient identification: Patient identification errors can have an adverse impact on efficiency, clinical effectiveness and patient safety. For example mislabelled patient samples could lead to incorrect laboratory results,³¹ which could result in the wrong treatment.

Specimen collection: This option evaluates patients' satisfaction with phlebotomy services.³²⁻³⁴ As it represents one of the few areas of pathology services involving direct patient contact, it provides an opportunity to assess patient experience. However, this option has not been standardised for assessing the quality of pathology services and information is lacking about whether results have been linked to any clinical outcomes.

Specimen quality: The accuracy and clinical usefulness of pathology results are influenced by identification, processing, transportation and storage of specimens.^{35,36} This option is useful in assessing the amount of rejected specimens due to these influencing factors. Related errors can result in additional healthcare costs due to repeat specimen collection and poor clinical decisions because of delayed pathology results. Clinicians for example rely on blood culture results in order to manage febrile patients³⁷ and a contaminated blood culture could mean that they are treating an infection which may not exist; a contributory factor to antibiotic resistance.³⁸ Assessing specimen rejection rates may assist the recognition of quality improvement opportunities.

Table 1: Quality Indicators by Stage of the End-to-End Pathology Service Process.

Stage of Pathology Service		IOM Domain * addressed
Pre-analytical	Pathology request; appropriateness of request	Effectiveness, efficiency, timeliness
	Patient identification; identification errors	Safety
	Specimen collection; patient satisfaction with collection process	Patient-centeredness
	Specimen quality; identification issues/insufficiency/contamination/age/haemolysis	Effectiveness, efficiency, timeliness, safety
Analytical	Turnaround time	Timeliness
	Requestor satisfaction with service	Effectiveness, timeliness
	Result accessibility	Effectiveness, efficiency, patient-centeredness
	Critical result communication	Safety, timeliness
	Amended laboratory reports	Efficiency, safety
	Performance in proficiency testing	Safety, efficiency
Post-analytical	Clinical advice availability; result interpretation and follow-ups	Effectiveness, timeliness

* Description of IOM health care domains: Effectiveness – to provide care and achieve outcome supported by body of evidence in scientific literature; Efficiency – to avoid wastage of resources; Equity – to provide care which is of same quality and standard irrespective of personal characteristics e.g. gender, sexual orientation, ethnic origin; Patient-centeredness – to meet patient’s demands; Safety – to prevent or limit harm; Timeliness – receiving the required care without undue delay.^{22, 23}

Turnaround time (TAT) and result accessibility: For example, the timeliness of diagnosing acute myocardial infarction using cardiac markers such as troponin in the emergency department may influence treatment and clinical outcome.³⁹ Unavailable or inaccessible pathology results by clinicians may delay clinical decision making and may also unnecessarily delay diagnosis or prolong hospital stay, causing additional healthcare expenses. Although the laboratory would define TAT as the time from receipt of specimen to reporting,⁴⁰ clinicians would define it as the time it takes from requesting to reporting⁴¹ so a consistent approach is required.

Critical result communication: Critical pathology results are defined as those results which can lead to adverse or even life-threatening outcomes for patients, if immediate action is not taken.⁴¹ Communicating critical results to clinicians is important as it can influence clinical decisions, operational efficiency and patient safety.⁴² However if using this option for quality assessment when selecting parameters, such as what laboratory tests to include or what critical value limits to set, consideration should be given to variations such as individual patient characteristics, general patient population, assay method etc.

Amended laboratory reports: This indicator can identify the causes of amendments to pathology reports so that actions can be taken to prevent the future release of wrong reports. Amended pathology reports have been linked to adverse clinical impacts such as delayed, unnecessary or inappropriate treatments.⁴³

Performance in proficiency testing: Participation in external quality assurance (EQA) schemes is a requirement for medical laboratory accreditation.⁴⁴ It is believed that a laboratory’s EQA performance reflects the quality of pathology results of actual patient specimens.^{45,46} Pathology service users as well as health regulators recognise the value of accreditation as a measure of confidence.^{47,48} The users of a laboratory service should be able to access EQA performance data. By providing confidence in laboratory results, a well-performing pathology service can assure taxpayers of *value* for their *money*.

Requestor satisfaction with service: It is obvious that customer satisfaction is a measure of quality for any service. As clinicians are frequent users of pathology services, a measure of their satisfaction with the quality of services they receive may point a service provider in the direction of improvement. However, currently, there is no standardised system for measuring satisfaction. Even if a ‘points-based system’ is proposed for selected areas of pathology services (whereby each area is awarded points based on relevance), there is no certainty that clinicians will agree on how to prioritise the selected areas, for instance TAT versus availability of clinical advice.

Clinical advice availability/result interpretation and follow-ups: Using a cervical cytology request as an example, timely clinical follow-up is crucial if this test is to be used as an effective tool in managing cervical cancer.^{49, 50} However, for some critical result follow-ups, clinical advice at consultant level or out-of-hours may mean longer response times. Therefore, this possibility

should be considered when using this option to assess the performance of a pathology service.

ECONOMETRIC APPROACH

An econometric method of assessing the efficiency of a health service will address the overall efficiency by taking account a spectrum of factors that influence spending.⁵¹ Popular econometric measures of efficiency include the use of Data Envelopment Analysis (DEA)^{52, 53} and Stochastic Frontier Analysis (SFA).^{54, 55}

SFA is a parametric analysis of cost versus profit. The cost-analysis approach tries to determine an organisation's position from achieving full cost minimisation while the profit-analysis approach attempts to measure an organisation's standpoint from profit maximisation. The principle of SFA is to determine production-cost versus profit function by using regression analysis. Here, deviations from more efficient input choices or optimal profit are modelled as 'statistical noise'. An ideal econometric evaluation attributes this statistical noise to two production factors; (1) failure to optimize input and (2) random, one-off events. SFA is one such approach used to model the behaviour of a producer, who, with this information, is able to make product or service improvements.^{54, 56, 57}

DEA on the other hand is a non-parametric approach that compares each producer with only the best-performing producers and it is based on the observation that different producers will generate different outcomes from the same input.⁵⁹ Therefore in the context of pathology services, each laboratory has a certain number and skill level of staff, using certain types of equipment and consumables (inputs). The number of samples tested or the TAT of requests can be used as measures of the outputs. DEA will attempt to identify the most efficient laboratories as well as specific inefficiencies in other laboratories. This is based on the assumption that if a laboratory (A) is able to complete a certain amount of requests within a certain timeframe, then other laboratories should also do the same, if they are to operate efficiently. Likewise, if another laboratory (B) is able to perform a certain number of tests for a specified amount of reagents, then other laboratories should be able to do the same. The performances of laboratories A and B are then combined to form a virtual laboratory, to which the efficiencies of other laboratories can be compared.

Although one advantage of DEA is that it does not require any data other than input and output quantities,⁵⁹ it can be prone to measurement errors because it has a deterministic nature and tends to attribute any variation from the frontiers to inefficiency, without considering an organisation's individual characteristics such as size, location etc.⁶⁰ SFA on the other hand can separate this stochastic (random) noise from inefficiency.⁵⁶ DEA can estimate relative efficiency of a service, but not absolute efficiency.⁵⁹ In other words, DEA assesses performance in comparison to peers, but not in comparison to a theoretical possibility. In contrast, SFA allows testing of statistical hypotheses regarding productivity or efficiency.⁵⁷ The key advantage of SFA over linear programming techniques (such as DEA) is its ability to measure cost-function

parameters,⁶⁰ which means that factors affecting cost such as the foundation status of a trust or economies of scale properties can be considered.

SUGGESTIONS FOR INCREASING EFFICIENCY OF PATHOLOGY SERVICES

In order to optimise the value derived from the money invested in pathology services, emphasis should be placed on the quality of pathology requests – by ensuring the quality of the service to support patient care – rather than focusing solely on efficiencies of scale. Therefore, all the elements of the IOM's healthcare domain discussed above, offer avenues for quality improvement and these should be considered before anything else.

The appropriate use of pathology services can be optimised by:

1. Discouraging clinicians from requesting unnecessary laboratory tests. This can be achieved by switching from the 'tick-box' style request form to 'problem-based' electronic-requesting. This means clinicians using an algorithm of patient medical problems to guide the selection of laboratory tests. For this, a remodelled national laboratory medicine catalogue²⁷ will most likely be required. Emphasis is on electronic-requesting so that revisions and updates are synchronised in real-time and effective immediately. It should also be linked to electronic patient records, so that it can be audited.
2. Reducing duplicate laboratory requests. There is evidence of this in personal experience. The laboratory information systems (LIS) should be configured to recognise and alert of potential duplicate requests. This configuration is likely to require extensive clinical knowledge of the time intervals that constitute a clinically 'duplicate' request for each analyte or parameter.
3. Validating and assuring the quality of point-of-care testing (POCT) where used. Sometimes, during the review of a patient's previous test results, laboratory staff observe that the same tests have very recently been reported via POCT. Personal correspondence revealed that some clinicians are reluctant to accept the result of POCT, so they repeat tests in the central lab 'just to double-check'. This is a clear case of resource wastage due to test duplication. Assuring clinicians of the quality of POCT will reduce unnecessary test duplication.

It can be argued that a laboratory with staff that are inexperienced and/or inadequately skilled and/or trained will be unable to operate efficiently. For example, a trained/experienced biomedical scientist (BMS) is likely to waste fewer resources in troubleshooting a malfunctioning instrument than a trainee BMS. Therefore, a laboratory must have an effective system of developing its workforce skill profile in order to reduce operational inefficiency.

Laboratories should review, in detail, the skill set and staff grade required to perform each task in order to understand the cost-per-hour implication of each test. This will inform whether human resources are being channelled appropriately and will identify areas that require adjustments.

Another suggestion is the creation of a 'national pathology efficiency assessment scheme'. This will aim to compare the efficiency performance of service providers who will have an efficiency dashboard that is created from data input, such as the amount of resources used to analyse a certain number of patient samples. It is envisioned to encourage periodic review of efficiency performance and fast-track the initiation of improvement actions where required. In the way the National External Quality Assurance Scheme (NEQAS) provides information about the quality of a pathology service, the pathology efficiency assessment scheme aims to provide assurance to the trust and the taxpayer that their pathology service is efficiently delivered.

The consolidation of pathology services⁶¹ is the result of the direction of travel of pathology services towards securing long-term efficiency.⁴ Some pathology mergers have reported increased efficiency, attributed to working at scale⁶²⁻⁶⁴ while others have not.^{65,66} The recognition of the diversity of pathology disciplines⁶⁵ may assist in deciding whether certain disciplines are required locally, or only at regional or national levels. This may help to eliminate the unnecessary cost of maintaining a local service that should have been established as a regional or national service.

CONCLUSION

It is easier to determine cost than to evaluate health benefit, and it would be myopic to concentrate on economies of scale without consideration of quality. Efforts to optimise pathology services should be based on the circumstances of individual services. This may be achieved through the use of country-wide data envelopment analyses to develop a model pathology service, which can then serve as a benchmark for each service provider to compare their efficiencies and adjust their practices accordingly, based on individual scale of work.

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(a full list is available on request)

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