NCOPP
National Coalition of Public Pathology

# ENCOURAGING QUALITY PATHOLOGY ORDERING IN AUSTRALIA'S PUBLIC HOSPITALS

**Final Report**
**February 2012**

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Encouraging Quality Pathology Ordering in Australia's Public Hospitals

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# Summary

This project involved exploring, documenting and reviewing the efforts made in Australia's public hospitals to better manage the demand for and appropriate use of pathology testing in the care of patients.

Public hospitals are a vital part of Australia's hospital sector and health system. They vary in terms of size, location and the types of services provided. They are also subject to public scrutiny in relation to access and quality. Government efforts focus on improving efficiency, accountability and quality in the face of increasing demand, community expectations and budgetary pressures. It is in this context that this project on improving the quality of pathology ordering was carried out.

## The evidence base

The picture of efforts to improve appropriate pathology ordering and use was assembled in three parts:

- understanding the different approaches taken to considering appropriate and inappropriate pathology ordering in the hospital setting
- creating a 'snapshot' of current and planned strategies in public pathology services across Australia
- examining the available evidence in relation to the types of interventions and demand management strategies implemented in Australia and overseas and their impact on clinicians' test requesting patterns.

The evidence assembled is heterogeneous, spanning the spectrum from peer-reviewed published articles and systematic reviews to anecdotal reports from informants. Its quality also varies.

Some recurring themes emerged that enable broad conclusions to be made about the effectiveness and sustainability of interventions and strategies targeting clinicians' requesting behaviour, as well as shortcomings in the evidence base that warrant redress.

## The question of appropriateness

One of the questions that is fundamental to the project involves defining 'appropriate pathology ordering'. There has been much debate about, but limited science attached to, the appropriateness of pathology requesting, there being very little in the way of robust research methodology and with various interested parties bringing differing perspectives to the question.

Although the logic of definitions of 'inappropriate pathology requesting'—such as '... performed at the wrong time or too frequently to be of value in diagnosis,

prognosis, or ongoing clinical management'—is persuasive, applying such definitions retrospectively, in the absence of details of the clinical context at the time a request was made, is often hazardous and contributes little information of value.

Appropriateness is a complex and multifaceted concept, and managing it requires an understanding of which different factors are relevant in any local situation. It is also important to remember that the approach to ordering pathology can greatly affect patient flows in busy hospitals, as well as individual patients' clinical outcomes. These matters need to be considered in any health economic analysis.

Pathology is not an end in itself. It is a crucial input to the clinical management of most patients, and its benefits or otherwise must be considered in the context of the clinical and cost outcomes of the episode of care in which it is used—not in isolation. Information from pathology investigations also guides public health surveillance and serves an important health protection function in our communities. This, too, has important economic implications.

## Types of interventions and demand management strategies

The review found that there are many strategies that can change the frequency of pathology ordering, particularly when used in combination, but that sustainability is a major challenge. The strategies identified fall into five broad categories, although rarely was only one strategy implemented. The categories are as follows:

- education, audit and feedback—for example, education programs, guideline dissemination, pre- and post-analytical feedback on test appropriateness, feedback on tests' predictive value and feedback on test costs
- rules and agreements aimed at restricting test requests—for example, re-engineering and implementation of clinical guidelines and pathways, implementation of minimum re-test interval schedules, and linking requesting authority to the seniority of clinical staff (the 'traffic-lights' approach)
- re-design of the request form to provide guidance to requesters—for example, providing a list of approved tests they can circle, tick or order, listing test costs to send a price signal, aligning request forms to modified clinical practice guidelines for test ordering, and 'unbundling' test panels on request forms
- computerised physician order entry systems—includes real-time decision support
- reimbursement and funding models—for example, budget holding by the laboratory, budget holding by the requester, activity-based funding (for instance, by diagnosis related group) and budget holding by the regulator.

## Effectiveness and sustainability

Although the amount and quality of the evidence across these five categories of strategies vary, the following broad conclusions can be drawn in relation to effectiveness and sustainability:

- Education, audit and feedback constitute an effective demand management strategy, although the effect gradually declines during the period after the intervention.

- In the case of rules and agreements aimed at restricting test requests, minimum re-test intervals are successful in effecting and maintaining a reduction in unnecessary repeat test requests by clinicians, as is evident by the sustainability of the interventions. Traffic-light systems have been effective in targeting the test requesting behaviour of junior doctors in emergency departments, improving the quality of requesting and reducing unnecessary testing, including repeat testing. In the three states and the territory where this system has been implemented the effect has been sustained—between four and 11 years. When clinical guidelines are implemented, senior clinicians are likely to request fewer tests if they have a more direct involvement in planning clinical pathways and in the early stages of the patient's management.

- Strategies involving re-design of the request form to provide guidance to requesters are effective in reducing the use of pathology tests regardless of the purpose, the approach to the re-design process or the format of the re-designed request form. As an overall strategy, re-design of request forms appears to be an effective mechanism for supporting good clinical practice, particularly among inexperienced junior doctors. Questions remain, however, about the impact of price signals (for example, displaying test costs on the request form) on test requesting.

- Computerised physician order entry systems are not a panacea, but they have been shown to be effective in bringing real-time evidence-based decision support to requesting physicians, thus facilitating efforts to manage the demand for pathology. To be successful in this, CPOE technology needs to be developed to a level of utility and efficiency that is acceptable to users. Until stakeholders accept the investment requirement and the need to adopt coordinated implementation plans (including impact assessment and better research design), take-up of CPOE systems will be slow. Information technology offers the potential to assist in managing the use of this valuable resource—particularly by providing tools to give clinicians real-time assistance at the time requests for pathology investigations are being made—but the design and deployment of such tools are still in their infancy.

- The role of reimbursement and funding models in managing the demand for pathology testing does not appear to have been examined to any great degree: only one study was found. That study dealt with the transfer of hospital laboratory budgets to requesters. Experience in several Dutch hospitals where such a system has been in operation for a number of years suggests that, although the system

functions well, with a decrease in test ordering observed, demand returned to its former pattern after a few years.

Although all strategies appear to have the capacity to deliver success, there is no consensus on a model (or models) for broader adoption in the long term, and sustainability remains problematic.

## Success factors

The evidence shows there is no single or easy pathway to achieving sustained improvement in appropriate ordering and use of pathology in public hospitals. Success appears to be associated with the interplay of a number of critical factors:

- targeting multiple behavioural factors
- basing models on proven and robust behavioural science principles using a multifaceted approach
- clinical engagement and ownership at a senior level
- clinical 'champions' or lead clinicians to promote the approach
- strategies that are simple and easily integrated into everyday practice
- adapting strategies to meet local needs and circumstances.

The importance of the cultural behaviour determinants of pathology requesting is often underestimated, and it is these factors that most probably hold the key to long-term success.

## Future directions

The review shows clearly that there is much that can be done to clarify our thinking in relation to appropriate use of pathology and establish some useful baseline data to help better tackle the problem in the future. It also shows that considerable efforts have been made to secure improvements in appropriate pathology ordering and use in Australian public hospitals. The survey of current and planned practices found that most public pathology services (75 per cent of respondents) are doing something in this area in the public hospitals they serve and mostly these are efforts led by pathology. The strategies adopted follow those described in the literature.

In the final part of this report some constructive suggestions are made about where and how to start moving ahead, and members of the National Coalition of Public Pathology are keen to assist with this.

The first recommended action focuses on the development of a standard national definition of 'appropriate' pathology test ordering. A fundamental difficulty the project grappled with concerns the lack of a consistent definition of 'appropriate' versus 'inappropriate' pathology test ordering. To resolve this problem the project

developed a matrix encapsulating a uniform national definition that could be applied to the assessment of whether a request for any or every pathology test was appropriate. The matrix recognises that in the hospital system, and the entire health care system, there are many different circumstances when ordering of pathology investigations is warranted.

Essentially, the matrix combines the different purposes of pathology testing with broad clinical indications for use:

- If none of the boxes in the matrix can be ticked, the test should be regarded as inappropriate.
- Similarly, if according to the matrix there is an indication for a test to be done and it is not ordered, this would suggest inappropriate ordering of pathology as a result of failure to order an indicated test.

The matrix is as follows.

### Matrix for appropriate pathology test ordering

| | **Clinical indications for use** | | | |
|---|---|---|---|---|
| **Purpose of testing** | **Indicated for acute or immediate patient care** | **Indicated as part of a clinical pathway or standard care for patients with the condition** | **Indicated for a public health objective** | **Indicated to assist good patient flows** |
| For diagnosis | | | | |
| For treatment | | | | |
| For monitoring disease or therapy | | | | |
| For assessment of a possible adverse event or side-effect | | | | |
| For exclusion of a possible diagnosis | | | | |
| To assess or manage a comorbidity (separate from main diagnosis) | | | | |
| Screening[a] | | | | |

a. This covers the use of tests for the purpose of 'disease screening'. Formal population-based screening programs are recognised indicators for pathology tests, but generally the tests are not done as part of usual patient management in the public hospital setting. Patients in public hospitals can, however, have pathology tests as part of a comprehensive assessment of factors potentially contributing to a problem or as part of a health check strategy.
Source: Copyright NCOPP 2011.

All future research and audits in Australia should use the matrix to review and assess pathology test ordering and when evaluating interventions in this regard. It might also be useful as an educational tool in an intervention strategy or national guidelines, or both.

The review's other recommended actions deal with the following:

- development of standard data sets on pathology use in Australia's public hospitals for data collection and benchmarking purposes, initial efforts being focused on assessing the top 10 to 15 diagnosis related groups for admitted patient services for public hospitals nationally and the top 10 to 15 pathology tests used in public hospitals

- monitoring and participating in developments in electronic health record systems and computerised physician order entry systems.

The National Coalition of Public Pathology thanks the Department of Health and Ageing for funding this project under the Quality Use of Pathology Program. Thanks are due, too, to the many organisations and individuals who contributed information and insights to the project.

# 1 Introduction

In 2010 the National Coalition of Public Pathology received a grant from the Department of Health and Ageing, under the Australian Government's Quality Use of Pathology Program, for the purpose of conducting a project on encouraging quality pathology ordering in Australia's public hospitals. NCOPP is the organisation that represents publicly owned and operated providers of pathology services in each state and territory, and it is these organisations that deliver the vast majority of pathology services for patients of Australia's public hospitals.

## 1.1 Background

Finding ways of better managing the demand for and improving quality use of pathology testing in Australian public hospitals has been an area of growing interest. This is the result of several factors: growing demand for public hospital services and pathology testing; budgetary constraints and pressures to ensure optimal use of scarce resources; continuing questions about the clinical appropriateness and value of current ordering patterns; and government efforts to improve hospital performance and patient safety. A range of interventions have been trialled or developed in various jurisdictions, but there has been no attempt to look at them collectively. Little is known about the overall effort to improve the quality use of pathology services in patient care in Australia's public hospitals or about its effectiveness and sustainability.

## 1.2 Purpose

This project sought to redress that shortcoming through an initial exploration of the area. The aims were threefold:

- to document and review the knowledge and experience in Australian public hospitals in order to better manage the demand for and use of pathology testing in patient care
- to consider the lessons learnt
- to establish future directions for achieving sustainable change.

The project deals with one of the Quality Use of Pathology Program's priority areas—improving the quality of pathology ordering. The project results will provide a useful resource to guide the promotion of evidence-based pathology practices.

## 1.3 Scope

The project focused on the Australian public hospital sector and pathology ordering by doctors and other clinicians for admitted and non-admitted patients. Public hospitals are the main early training ground for clinicians, and initiatives that support quality ordering early in professionals' careers might offer benefits downstream and

over time. The project complements others that have focused on pathology ordering in the community and other settings.

## 1.4 Conduct of the project

The bulk of the project work was done between late September 2010 and the end of May 2011. A Steering Committee was formed to guide and oversee the work; Appendix A lists the members of the committee and the Project Team. In broad terms, the project involved the following:

- consultation with stakeholders
- gathering and analysis of information
- synthesising and evaluating information from a variety of sources using a common assessment approach
- examining lessons learnt
- considering and assessing future directions
- developing a set of findings, conclusions and recommendations.

## 1.5 Consultation with stakeholders

NCOPP approached a variety of organisations and individuals to advise them of the project, ask for their help in identifying relevant information and studies, and enlist their participation in the project. Among those consulted were public pathology services, pathology professional bodies, national health care safety and quality bodies, and clinicians, researchers and academics. Appendix B lists the participating organisations and individuals.

## 1.6 Gathering and analysis of information

Information about studies, initiatives and current practices aimed at reducing unnecessary pathology testing and improving the use of testing was gathered from a variety of sources in four main ways:

- through a limited review of the published literature
- through a review of relevant projects funded under the Quality Use of Pathology Program
- through a survey of the demand management practices of public pathology services
- through discussions with stakeholders.

The literature review concentrated on Australia and a selection of countries with comparable health systems in order to provide an international perspective. The initial pass covered the period from 1995 to the present and focused on hospital pathology services; additional references were found by following up references cited. Studies relating to general practice or family settings were mostly excluded. Appendix C provides details of the literature search.

The Department of Health and Ageing provided final reports on projects funded under the Quality Use of Pathology Program and seen to be relevant to this project. Information about interventions and experiences in the public hospital setting was also provided directly by pathology services, public hospitals, individual pathologists and other clinicians.

NCOPP conducted a survey in order to gather information about public pathology services' current and planned strategies for managing demand and encouraging appropriate use of pathology testing. The aim was to gather information at a high level and to establish a current practice base against which other project results could be compared. The survey content and structure were based on published studies' areas of inquiry to allow similarities and differences to be highlighted and analysed. Appendix D shows the survey instrument; the survey results are discussed in Chapter 4.

A number of stakeholders and researchers were followed up by email and telephone in order to clarify matters and to gather supplementary information about particular studies and initiatives. Information about follow-up discussions is provided in Appendix B.

On 24 May 2011 a roundtable discussion was held with representatives of NCOPP member organisations to review project findings and consider future directions. Appendix E provides details of the discussion.

## 1.7 Assessing the evidence

One of the project's challenges involved assembling evidence from a variety of sources and providing a clear assessment of the evidence base in terms of what is known and unknown and the associated limitations. Studies vary in their level of rigour and quality and use differing methodologies and approaches to reviewing outcomes; further, in some cases their outcomes are unclear. This necessitated the development of a useful grouping of interventions and an assessment framework that drew together and examined the evidence available for similar interventions and allowed conclusions to be made. The results of this are presented in Chapter 5.

## 1.8 Defining 'appropriate' and 'inappropriate' ordering

Another challenge concerned the question of defining 'appropriate pathology ordering'. Differing approaches have been taken to deciding between appropriate and inappropriate ordering and test use and what represents inappropriateness.

These matters are fundamental to the project. The project therefore sought to give an overview of these discussions as reflected in the published literature and consider the elements of a workable definition of 'appropriate' pathology test ordering in order to contribute to efforts to progress. This is discussed in Chapters 3, 5 and 6.

## 1.9 Limitations and boundaries

The project used a variety of methods and sources in order to develop a picture of knowledge and experience in Australian public hospitals in relation to better managing demand for and appropriate use of pathology testing in patient care. Information was gathered largely from a public pathology perspective. There might be some studies, initiatives and practices that are not covered or for which reports are not publicly available. The project focused on the use of central laboratory medicine services. Point of care testing and transfusion medicine fell outside the project's scope because they are the subject of detailed study elsewhere—point of care testing through other Quality Use of Pathology Program initiatives and the quality use of blood and blood products through the National Blood Authority and others. Most of the published literature relates to influencing demand and appropriate ordering for the high-volume, low-cost clinical pathology services of biochemistry, haematology and microbiology, which are the branches of pathology that deal with specimens of blood, fluids and other samples collected from patients. Anatomical pathology, the branch of pathology that deals with the tissue diagnosis of disease where biopsy material is taken from a patient in the operating theatre, on the ward or in a clinic, presents different matters and therefore falls outside the project's scope.

## 1.10 Structure of this report

The chapters that follow present the project's findings:

- Chapter 2 sets the policy context by providing an overview of Australia's public hospital sector, its pathology service needs, and current and emerging developments.
- Chapter 3 deals with the question of appropriate pathology ordering, why it is important and associated discussions and developments.
- Chapter 4 gives an overview of current demand management strategies being used in the public pathology services that support Australia's public hospitals and their patient care needs.
- Chapter 5 draws together and assesses the evidence available from the various sources for similar interventions and strategies to improve pathology ordering and use.
- Chapter 6 presents conclusions about the lessons learnt and future directions.

The appendixes provide supporting information and other material relevant to the project.

# 2 The context: Australia's public hospitals and pathology services

Public hospitals are a vital part of Australia's hospital sector and health system, and pathology (or 'laboratory medicine', as it is often called) is an important component of the clinical services delivered in them. Public hospitals are diverse in terms of size, location and types of services provided. They are also subject to public scrutiny in relation to access and quality. Government efforts focus on improving efficiency, accountability and quality in the face of increasing demand, community expectations and budgetary pressures. It is in this context that this project on improving the quality of pathology ordering was carried out.

## 2.1 Roles and responsibilities of Australia's public hospitals

A public hospital is a hospital controlled by a state or territory authority (AIHW 2011a). Governments in Australia have assumed responsibility for delivering public hospital services, largely to ensure equity of access (Productivity Commission 2009). Services are provided by the state and territory governments, and funding is shared with the Australian Government. In 2009–10 recurrent expenditure (excluding depreciation) on public hospitals amounted to $33.7 billion (AIHW 2011a). Public hospital services represent the largest item of health expenditure for state and territory governments and the second largest for the Australian Government (AIHW 2010).

State and territory governments are assigned specific responsibilities and functions in the delivery of public hospital services under the National Healthcare Agreement (COAG 2011a). This includes ensuring that all residents have equitable access to a broad range of hospital services (including emergency services) free of charge as public patients and regardless of their geographic location. Public hospitals are also required to invest in clinical teaching and research. These functions and community service obligations shape the location, size and service characteristics of the public hospital sector and their pathology services.

## 2.2 The size of Australia's public hospital sector

In 2009–10, the latest year for which statistics are available, there were 753 public hospitals in Australia (AIHW 2011a).[1] They comprised 736 public acute hospitals and 17 public psychiatric hospitals, represented 57 per cent of Australia's hospital sector and accounted for 67 per cent of hospital beds (56 900).

Australia's public acute hospitals recorded about 5.1 million separations for admitted patients in 2009–10, representing about 60 per cent of all hospitalisations (AIHW 2011a). More than 49 million services were provided to non-admitted patients through emergency departments, outpatient clinics and a range of other services.

[1] It should be noted that some hospitals that deliver public hospital services are privately owned. Such hospitals are classified as public because they operate on behalf of and are funded by government (Productivity Commission 2009).

There were 7.4 million emergency department presentations, 70 per cent of patients being seen within recommended times for their triage category and 100 per cent of resuscitation patients (those requiring treatment immediately) being seen within two minutes of arriving at the emergency department.

Although public hospitals offer a broad range of services to the community, the majority of services they provide are for the acutely sick and most urgent patients. More than 90 per cent of public hospital admissions are for acute care, especially acute medical care; this is followed by newborn care and rehabilitation (AIHW 2011a).

The remaining 43 per cent of the hospital sector was made up of 573 privately owned and operated hospitals (free-standing day hospital facilities and other private hospitals), accounting for 33 per cent of hospital beds and 40 per cent of hospital admissions in 2009–10 (AIHW 2011a). Private hospitals are more likely to be in metropolitan areas, and their activity is more concentrated on surgical (typically elective) procedures (Productivity Commission 2009).

## 2.3 Diversity in Australia's public hospitals

Public hospitals vary widely in size and location. Seventy-one per cent of them have 50 or fewer beds, representing only 16 per cent of total available beds, while 11 per cent have over 200 beds (AIHW 2011a). They are also widely dispersed geographically. Almost a quarter of them are in major cities and a slightly smaller proportion are in remote areas; the majority are in regional areas (AIHW 2011a).

Public hospitals also vary greatly in terms of the types of services provided (AIHW 2011a): they range from principal referral hospitals in the capital cities of each state and territory and large and medium-sized acute hospitals through to small acute and non-acute hospitals and multi-purpose services in regional and remote areas. There are specialist women's and children's hospitals, specialist rehabilitation hospitals, mothercraft hospitals, and hospitals specialising in the care of people with mental health illness. Although many large metropolitan public hospitals provide a full range of services and have an important teaching role, many small public hospitals in regional and remote areas offer fewer acute services and might be called on to deliver other health services, such as primary care and aged care (Productivity Commission 2009; AIHW 2011a).

Although public hospitals primarily treat public patients, in 2007–08 about 14 per cent of public hospital separations were for patients electing private status, entitling them to a choice of doctor; the majority of these separations were funded by private health insurance (Productivity Commission 2009).

Nationally, about one-third of patients treated in public hospitals are aged 65 years or more (DOHA 2010). As the Productivity Commission highlighted in its 2009 study of public and private hospitals, patients treated in public hospitals are, on average, from lower socio-economic groups or have more complex medical conditions, or both.

There is some variation in this national picture of the public hospital sector between the states and territories, reflecting, for example, differing governance arrangements, demographic profiles, needs and preferences.

## 2.4 Current and emerging challenges

Access to public hospital services, the quality of those services, and funding and management arrangements are the subject of constant public scrutiny and debate (AIHW 2011b).

Several recent studies have reported on the growing pressures facing Australia's hospital system overall and the public hospitals in particular (NHHRC 2009; Productivity Commission 2009; COAG Reform Council 2010; DOHA 2010). Among the factors contributing to these pressures are population growth; the impact of population ageing and the associated fiscal burden; technological advances; more demanding community expectations about access to hospital care and the types of services available; and trends in the health status of the population—including increasing rates of chronic diseases, many of which are preventable.

The growing pressures are reflected in intensified demand for hospital services and budgetary constraints. On the demand side, for example, in the five years from 2005–06 to 2009–10 the following applied:

- The number of beds available in acute public hospitals increased but only to the extent of matching population growth. A ratio 2.6 beds per 1000 population was maintained.
- The number of emergency services provided in public hospitals increased by 4.0 per cent on average each year.
- The number of separations for admitted patients grew by an average of 3.3 per cent a year and the number of separations per 1000 population rose by 1.0 per cent a year, while the average length of stay fell by about 1.3 per cent a year.
- The number of non-admitted patient occasions of service provided grew by 2.5 per cent a year (AIHW 2011a).

On the budgetary side, in the same period recurrent expenditure on public hospitals (excluding depreciation) grew by an average of 5.4 per cent a year (adjusted for inflation) (AIHW 2011a). The majority of this (70 per cent) is spent on admitted patients (DOHA 2010). The Australian Institute of Health and Welfare has reported that the average cost per casemix-adjusted public hospital separation (where the data are adjusted for the average complexity of patients' condition treated in each hospital) increased from $3698 in 2005–06 to $4706 in 2009–10 (not adjusted for inflation) (AIHW 2011a). This represents a total increase of 27 per cent during the period, or an average increase of over 6 per cent annually (AIHW 2011b).

## 2.5 Policy developments

These combined pressures have led governments to pursue reforms aimed at generating greater efficiency, accountability and performance quality in Australia's hospital system. The reforms cover both the public and the private sectors and are part of wider health reforms designed to secure overall sustainability in the health system. This is reflected in the 2008 National Healthcare Agreement; its associated National Partnership Agreement on Hospital and Health Workforce Reform for the public hospital sector; and, most recently, the August 2011 Council of Australian Governments National Health Reform Agreement, the revised National Healthcare Agreement, and the National Partnership Agreement on Improving Public Hospital Services (COAG 2008a, 2008b; COAG 2011a, 2011b, 2011c).

Improving the speed of access to quality care is a central focus for governments and public hospitals: care in emergency departments and planned surgical and medical care are identified as priorities through the implementation of a four-hour target for emergency departments and a national access guarantee for elective surgery (COAG 2008a, 2008b; COAG 2011a, 2011b, 2011c). Efficiency and performance improvements target the management of individual patients and the management of patient flows and access blocks within public hospitals and from hospital to hospital. Other reform measures focus on quality and safety improvements; funding, including a move to activity-based funding; the training of more doctors, nurses and allied health professionals; management of public hospitals and coordination of primary health initiatives; and performance reporting for public hospitals (COAG 2008a, 2008b; COAG 2011a, 2011b, 2011c).

## 2.6 Pathology in the public hospital setting

The common government objectives for public hospitals are to provide acute and specialist services that have four primary characteristics:

- safe and of high quality
- appropriate and responsive to individual needs
- affordable, timely and accessible
- equitably and efficiently delivered (Productivity Commission 2011).

Pathology is the branch of medicine that deals with the essential nature of disease—especially with the structural and functional changes in tissues and organs of the body that cause or are a response to disease (Dorland's 2008). It is an important component of the clinical services delivered in Australia's public hospitals and one of the essential inputs into health care if the objectives just listed are to be achieved and the National Healthcare Agreement functions and obligations are to be fulfilled.

Pathology investigations are an integral part of the clinical decision-making process. They support high-quality patient care by providing for other clinicians information

and expert medical opinion to facilitate decision making about accurate and timely diagnosis and management of patients. Overseas studies show that 70 to 80 per cent of all health care decisions related to diagnosis and treatment involve a pathology investigation and that pathology provides source information for 90 per cent of diagnostic health care records (Forsman 1996; UK Department of Health 2006). Comparable data for Australia are not readily available.

In addition to this role in the care of individual patients, pathology is part of the clinical governance of public hospitals and the health system, playing an important role in monitoring and management of the blood supply, adverse drug reactions, antimicrobial resistance, control of infectious agents, and environmental and occupational health and safety. Providers of pathology services in public hospitals also take a leading role in the education and training of pathologists, medical scientists and other clinicians; in public health protection and bio-preparedness through the identification and surveillance of infectious disease outbreaks, chemical and biological threats and natural disasters; and in research. To meet the needs of today's health system and its hospitals, pathology is a clinical knowledge service (UK Department of Health 2006).

## 2.7 Organisational features

The vast majority of the pathology needs of Australia's public hospital sector are catered to by publicly owned and operated pathology bodies. The way these bodies are organised, their geographical and population reach, and the range of services they provide are shaped by National Healthcare Agreement functions and community service obligations, as well as health service governance arrangements, demographic profiles and needs, the public hospital sector, and the preferences and philosophies of each state and territory.

Some organisations operate single statewide services to meet the needs of hospitals and communities across the jurisdiction (for example, in Queensland, Western Australia, South Australia, the ACT and the Northern Territory), often over huge distances and scattered populations (as is the case in Queensland, Western Australia, South Australia and the Northern Territory). Others are organised on a cluster or area health service basis (for example, New South Wales and Victoria), while yet others are based around individual public hospitals or hospital networks (for example, Tasmania).

Laboratories are located in or near the public hospitals the organisations service in order to meet the 24-hours-a-day, seven-days-a-week rapid-response clinical needs of acute hospital medicine, which includes providing support for busy emergency medicine departments and intensive care units that are highly pathology dependent. This means that many such organisations operate extensive networks of laboratories in order to ensure prompt and equitable access over huge geographical areas (for example, in Queensland, Western Australia and South Australia).

In some jurisdictions the public pathology sector is an important provider of diagnostic and consultative services to general practitioners, specialists in private practice, and communities funded through the Medicare Benefits Scheme. The private pathology sector is, however, the dominant provider of MBS-funded services overall. Some privately owned and operated pathology services also provide services to public hospitals, usually on a contract basis.

## 2.8 Demand for and use of pathology services

As with all public hospital services, the demand for and use of pathology services have risen. This pattern of increased demand for pathology services is not limited to Australia: it has been seen in other countries with similar health care systems. The reasons for the growth in demand are similar to, and related to, the growth in the demand for public hospital services generally, as discussed in Section 2.4. Budgetary pressures that apply to the health system overall are also experienced by and relevant to pathology. Pathology services in public hospitals in all Australian jurisdictions are facing the same policy imperatives to improve efficiency and performance, thereby contributing to overall efficiency, patient care and management improvements in the public hospital sector and the entire health system.

### 2.8.1 Test requests

Use of pathology services is initiated by a request from a clinician who is treating a patient. In Australian public hospitals overall, junior medical staff are responsible for most ordering of pathology tests (Healthcare Management Advisers 2001; Hammett & Harris 2002), although this is not the case in all hospitals.

Pathology can be requested by nurse practitioners, by nursing and other allied health professionals via local clinical governance arrangements (that is, outside formal MBS requirements) and by senior and specialist medical staff. The junior medical staff group covers a broad spectrum, from interns and junior medical officers with limited experience to medical staff formally participating in specialist medical training programs operated under the specialist medical colleges in Australasia and senior registrars, people who have completed all formal assessments for specialist training and are performing advanced roles—'medical specialists in waiting', so to speak.

The ordering patterns of these different categories of health professionals can differ greatly because of the professionals' knowledge and experience, the mix of patients for whom they provide care, and the type of public hospital in which they work.

### 2.8.2 Test use

A wide range of pathology tests are provided in Australian public hospitals. The Royal College of Pathologists of Australasia's Benchmarking in Pathology Quality Assurance Program provides some data on the use of tests in this setting. It identifies some 930 tests as being provided in public hospitals:

- routine tests (80 in number), which are performed by every participating laboratory and account for 92 per cent of all laboratory tests and 50 per cent of costs
- esoteric tests (250 in number), which account for less than 1 per cent of all tests performed and just under 7 per cent of costs
- some 600 other tests, accounting for about 7 per cent of all tests performed and 43 per cent of total costs (RCPA Quality Assurance Programs 2011).

The same pattern of test use and costs is evident in Medicare data. It is important to appreciate that the high-volume routine pathology tests have a broad range of clinically appropriate indications. They include diagnosis of acute illness, monitoring of complications or consequences of treatments and therapies, and exclusion of significant disease states.

Information about pathology test use in episodes of patient care in Australia's public hospitals was not available for this project. It is not collated and analysed in any systematic way by public pathology services or jurisdictions. Data are included in the national casemix information systems for Australian hospitals that are managed and reported by the Department of Health and Ageing, but they are not reported or analysed separately. It was beyond the scope of this project to perform such analyses. Nevertheless, good information about use of pathology tests is essential if we are to understand current patterns of ordering and variations in use across the country, identify areas that warrant closer examination, and accurately target future quality improvement efforts. This project therefore sought to redress this gap in its recommended actions—see Chapter 6.

### 2.8.3 The pathology testing cycle

As noted, pathology investigations are a major contributor to the clinical decision-making process. The pathology testing cycle encompasses the point at which a clinical question is posed through to the point of clinical action in response to the results of pathology investigations, as Figure 2.1 shows.

Ordering the appropriate laboratory tests and having timely access to them and their results are central to the provision of quality care for patients and patient flows through the public hospital system. Tests can be ordered in series or in parallel. Efficient ordering involves finding the optimal balance in order to obtain the necessary information without unnecessary testing that does not contribute to patient care, improved patient flows or public health.

This project focused on one part of the pathology testing cycle—selection of the right set of tests in order to provide prompt and effective care for individuals as well as contributing to hospitals' efficiency and effectiveness.

Regardless of the sub-speciality of laboratory medicine or where the laboratory service is provided, the same basic steps are involved:

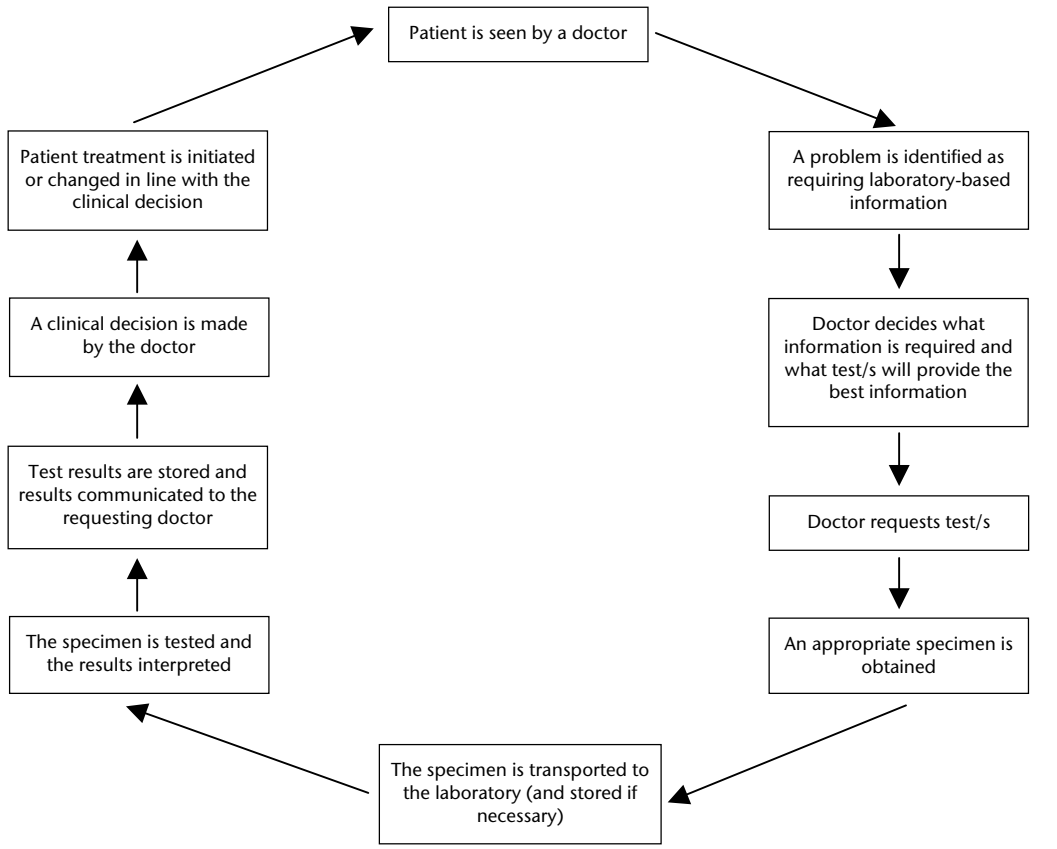


**Figure 2.1 The pathology testing cycle**

Source: British Columbia Ministry of Health (2003).

# 3 The question of appropriateness

This project was concerned with encouraging the quality ordering of pathology in Australian public hospitals. 'Quality' can be defined in different ways. The Quality Use of Pathology Program defines quality in the clinical use of pathology as choosing the right test at the right time for the right patient and for the right clinical condition (DOHA 2011a). Principles of appropriateness are embodied in this definition and underpinned this project. As noted in Chapter 2, laboratory testing is integral to many clinical decisions, providing pivotal information that guides prevention, diagnosis, treatment and continued management of disease. Much of the literature internationally and in Australia focuses on the question of the appropriateness of the use of pathology tests (or use of laboratories) by clinicians. This chapter provides an overview of these discussions and recent developments in Australia.

## 3.1 Why the interest?

Most clinical laboratories experience 5 to10 per cent increases in workload year on year. Growth in the use of pathology investigations and the associated cost impacts on health budgets in many countries, together with quality improvement efforts, have stimulated an interest in understanding the reasons for the growth, variations in ordering patterns among clinicians and whether or not the growth is appropriate, as well as in developing strategies to modify use (see van Walraven & Naylor 1998). Van Walraven and Naylor noted, however, that many studies of inappropriate use of laboratory services are flawed in that they do not comply with evidentiary standards.

Numerous reasons have been put forward to explain the increased use and costs, among them the following:

- advances in technology, enabling multiple tests to be performed on the same specimen reliably and inexpensively and more rapid turnaround of services
- the availability of new tests, giving more from which to choose
- extending the clinical applications of testing across the diagnosis, monitoring, screening and prognosis spectrum
- changes in clinical practice
- over-reliance on test ordering to deal with uncertainty
- 'patient power'—specifically the increase in patients' knowledge through internet access and greater patient expectations of the clinical encounter and the health system generally
- the increased demand for care as a result of an ageing population and growing numbers of people with chronic disease
- the teaching of pathology (laboratory medicine)

- the absence of price signals at the point of request
- perceptions of potential medico-legal liability if tests are not performed
- ignorance of the diagnostic significance of tests and their sensitivity, specificity and predictive value
- fear of being criticised by senior clinicians for failing to order a test
- research, habit and mere curiosity (see, for example, Axt-Adam et al. 1993; Hindmarsh & Lyon 1996; Solomon et al. 1998; Conyers 1999; MacPherson et al. 2005; Sood et al. 2007).

Few of these reasons have been examined with any rigour (Solomon et al. 1998).

## 3.2 Inappropriate versus appropriate use

Standard measures of inappropriateness in pathology use do not currently exist, although their development is seen as important (van Walraven & Naylor 1998).

### 3.2.1 Overuse

Most published studies have examined inappropriate test use in terms of overuse, a number of terms being used interchangeably—frequent use, excessive use, unnecessary use, illogical use, redundant use, and so on. In general, 'overuse' means that ordered tests have no clinical indication or are performed at the wrong time or too often to be of value in diagnosis, prognosis or ongoing clinical management, as determined by consensus between experienced clinicians and pathologists or in line with prevailing evidence-based guidelines (Solomon et al. 1998; van Walraven & Naylor 1998; Wilson 2002).

### 3.2.2 Underuse

Few studies have looked at inappropriate use in terms of underuse of pathology tests. In a comprehensive study of the quality of health care delivered to adults in the United States, 23 per cent of the quality indicators used were direct measures of diagnostic use. Average underuse of diagnostics was found to be 51 per cent (McGlynn et al. 2003). This was, however, a broad population study not translatable to the Australian hospital environment. Further, access to health care in the US system is a major factor of difference compared with Australian arrangements. Indeed, several studies of the effect on patient outcomes of demand management strategies related to cost reduction found no evidence of underuse causing adverse effects (Kroenke et al. 1987; Gortmaker et al. 1988; Groopman & Powers 1992; Wachtel & O'Sullivan 1999).

### 3.2.3 Methods used

Many investigators have expressed concern about the methods used to measure inappropriate ordering and estimates of its prevalence. Determining what constitutes appropriate test ordering and how it is assessed is complex (Solomon et al. 1998; van

Walraven & Naylor 1998; Wilson 2002), and drawing broad conclusions about rates of inappropriate use across tests, settings and time frames can be flawed (The Lewin Group 2008). Some studies have focused on a single laboratory test; others have covered a number of tests. Tests have a number of clinical applications—in screening for disease in asymptomatic individuals, in diagnosis of people with signs and symptoms of disease, in monitoring disease progression, and in targeting and monitoring treatment. Most inappropriate test use is found retrospectively through reviews of medical records and other documentation. But records do not necessarily capture all the detail required to make an informed decision about the appropriateness of a test in patient care. Test utility can be judged in several ways; for example, although test results might not lead to changed diagnosis or treatment decisions, they can still provide useful information to guide decision making or help rule out a problem.

### 3.2.4 Differing approaches

Differing approaches to deciding what constitutes appropriate and inappropriate ordering have been adopted. A variety of criteria have been used to assess appropriateness. They cover subjective (implicit) criteria that rely on the interpretation of the reviewer and explicit criteria such as the appropriateness of test choice, frequency and timing and the probability of a positive result. In their systematic review of 44 eligible published studies of laboratory test use from 1966 to 1997 van Walraven and Naylor (1998) found that reported rates of inappropriate use ranged from 4.4 to 95.0 per cent, suggesting major inconsistencies in the validity and reliability of implicit or explicit criteria for appropriateness and the reliability of their application. Most of the studies were conducted in teaching centres on hospitalised patients and analysed the ordering practices of a small number of physicians in training. The investigators suggested that researchers develop alternative evidentiary standards for measuring the inappropriateness of laboratory test use.

More recent studies using clearly defined algorithms have found that, when guidelines were applied, 20 to 25 per cent of frequently ordered tests such as auto-antibody tests and infectious disease serology tests were inappropriately requested (Tampoia et al. 2003; Crump et al. 2004; Ozbek at al. 2004).

Regardless of the debate about methods and quantum, it is agreed that inappropriate testing occurs, in terms of both overuse and underuse, and this needs to be tackled (van Walraven & Naylor 1998; Rao et al. 2003; DOH 2008).

## 3.3 Why appropriate requesting is important

Appropriate pathology test requesting is central to cost-effective, quality patient care and health care generally. Like other health care interventions, pathology tests are accompanied by benefits, risks and costs (Hammett & Harris 2002; McGlynn et al. 2003; The Lewin Group 2005; Schattner 2008). Overuse through frequent and unnecessary ordering results in a higher risk of false positives, which can lead to unnecessary additional tests, treatments and hospital stays; patient anxiety, discomfort and stress; and unnecessary costs and a waste of scarce resources for

health funders and consumers. Underuse can result in failure to diagnose or inaccurate or delayed diagnosis, which can lead to greater patient suffering, adverse health outcomes, and higher costs associated with treating advanced disease.

## 3.4 Defining 'appropriate' test use

Few studies have attempted to identify standard measures of the appropriateness of test use. Wilson (2002) notes that defining appropriate use of clinical microbiology tests remains an elusive goal. There are many reasons for this, including the fact that the appropriateness of the test depends on whose perspective is adopted—the clinician, the laboratory, the patient, funders, public health officials or regulators—and these perspectives and resulting definitions are often incompatible with one another. Wilson suggests that this, in part, accounts for the often inconsistent and conflicting data reported in studies. He considers that clinical relevance, cost-effectiveness, and performance parameters such as sensitivity, specificity and test turnaround times are important guiding principles when considering the appropriateness of testing. There is obviously a duty of care to provide the best service for patients, and this includes promoting appropriate laboratory testing. There is, however, a question about how this fits with current business models: in general, successful businesses do not strive to regulate demand for services, and this constitutes a major challenge (Fryer & Hanna 2009).

Development of a process for defining appropriate use has been called for by some (van Walraven & Naylor 1998). Appropriate use is a multifaceted concept. Test ordering is a dynamic process, and often there are repeated communications between the requesting or treating clinician and the laboratory about add-on tests and results. Test utility can take a number of forms. A patient's condition might change rapidly during an episode of care. Appropriateness also needs to be considered in the clinical management context—both from the standpoint of efficient and effective management of an individual patient and from the standpoint of managing patient flows and access blocks, which are important factors in improving performance in hospital and non-hospital settings, as noted in Section 2.5. Within a hospital, and within the entire health system, there are many different circumstances in which the ordering of pathology investigations is appropriate. In some instances, there can be competing or conflicting perspectives on this.

One area of particular interest in relation to quality use of pathology appropriate to the clinical setting is test turnaround times in hospital emergency departments. Promptness in reporting laboratory results is an important quality attribute (Howanitz & Howanitz 2001). Several studies have investigated the contribution of improved test turnaround times in reducing the length of state in emergency departments and optimising patient care (Lee-Lewandrowski et al. 2003; Holland et al. 2005; Francis et al. 2009). A reduction in the length of stay also helps minimise emergency department overcrowding, a factor that has been associated with increased patient mortality (Sprivulis et al. 2006; Richardson 2006).

Ultimately, appropriate pathology ordering depends on achieving a balance between ordering too little, ordering too much and ordering the right test at the right time. And this balance can vary in different settings and at different times.

Looking at this topic from the perspective of pathology and taking into consideration the relevance of pathology tests across the health spectrum and the continuum of care, this project sought to redress some of these deficiencies in definitions, approaches used and associated measures of appropriate versus inappropriate test ordering. In particular, standard and objective measures that capture in concrete terms the dynamic clinical management context of an individual patient's episode of care are required if we are to advance quality improvement efforts and build the evidence base in the area. Recommended actions aimed at resolving this problem are presented in Chapter 6.

## 3.5 Modifying use

In most developed countries governments, hospital administrators, pathologists, laboratory medicine services, clinicians and teaching universities have responded in some way to the increase in pathology testing (Hindmarsh & Lyon 1996; van Walraven & Naylor 1998; Schattner 2008). Efforts have sought to decrease test use, curb costs and improve appropriateness in test ordering and use by focusing on modifying clinicians' behaviour. Among the strategies have been altering pathology request forms; clinician education, audit and feedback; introduction of clinical guidelines; instituting computer rules and reminders; introduction of rules and agreements aimed at restricting requests; process changes; changed reimbursement policies; electronic decision-support systems; and budget holding and financial controls.

Many of these initiatives have been designed as quality improvement programs rather than research projects. There are few randomised controlled trials of interventions aimed at modifying diagnostic test behaviour, and the overall quality of the literature is not optimal (Solomon et al. 1998).

Several investigators have highlighted the importance of understanding and basing interventions on proven, robust behavioural science principles and models. Solomon et al. (1998) analysed a range of published interventional studies in terms of predisposing, reinforcing and enabling factors that facilitate or discourage particular behaviours. Predisposing factors are cognitive attributes such as attitudes or knowledge underlying testing behaviour. Reinforcing factors reward specific behaviour through feedback. Enabling factors are skills, resources and structural barriers that facilitate or discourage action. The researchers concluded that interventions targeting multiple behavioural factors were more successful at producing change.

Sood et al. (2007) have added to this understanding through a systematic review of published studies of physician variables affecting test ordering. The aim was to identify the factors that were likely to affect the test ordering practices of clinicians

and whether or not these practices could be modified by changing the physician's own behaviour. Factors identified as being modifiable included clinician experience and knowledge, belief systems, fear of litigation and clinician regret (fear of failing to diagnose a life-threatening illness), financial incentives, awareness of the cost of testing, and education and feedback. Among the non-modifiable factors (factors over which the physician has no control) were practice location, practice setting, and the age, sex and specialisation of the clinician. The investigators noted that the studies they reviewed were very heterogeneous in structure and quality, and they concluded that test ordering is a skill that changes with time and is related to several complex and interacting variables.

None of this collective experience appears, however, to have led to consensus on a sustainable model (or models) for broader adoption in institutions or jurisdictions. Similarly, in institutions and jurisdictions where interventions have been successful in changing pathology ordering practices, there is little evidence that there have been moves to implement those interventions more widely. Studies commonly report that most interventions targeting clinicians' requesting behaviour tend to have an immediate and noticeable effect on reducing the number of requests for inappropriate or redundant tests, but the effects tend to be short-lived and behaviour returns to pre-intervention patterns if the interventions are not sustained (Lyon et al. 1995; Winkens & Dinart 2002; Durieux et al. 2003). This might, in part, reflect the limited time frame of most published studies, the interventions generally lasting from several months to a year or two, and a lack of follow-up on longer term sustainability.

## 3.6 Developments in Australia

In Australia work directed at more appropriate use of pathology testing has been done at a time of heightened recognition locally and internationally of the need to strengthen the safety and quality of health care generally, as well as to respond to concerns about increased demand, use and costs.

The Australian Government has tried a number of approaches aimed at managing growth in or demand for testing through a mix of cost containment and quality measures for private pathology services funded under the Medicare Benefits Scheme. Cost containment measures have included restrictions on reimbursements for some tests; monitoring, audit and feedback to clinicians in relation to ordering and fraud control by Medicare Australia; and reviewing and investigating possible cases of inappropriate practice by the peer review mechanism of the Professional Services Review. Use of quality measures has largely occurred through the Quality Use of Pathology Program and, more recently, the National Prescribing Service.

### 3.6.1 The Quality Use of Pathology Program

The QUPP was established in 1998, is administered by the Department of Health and Ageing and is supported by the Quality Use of Pathology Committee, which is made up of representatives of the pathology sector, general practice and consumers. The QUPP's goal is to achieve improvements in health and economic outcomes arising from the use of pathology services in health care through the pursuit of better

practice among requesters and referrers, providers of pathology services, and knowledgeable and involved consumers (DOHA 2011b). It funds projects in the areas of quality consumer services, quality referrals (requesting and ordering) and quality pathology practice.

In the area of quality referrals, for example, QUPP-funded projects have examined the teaching of laboratory medicine in undergraduate medical education and in prevocational and GP vocational training and have studied why request forms are not completed correctly. A current project involves developing an online patient simulation program for educating junior doctors in the rational use of investigations (DOHA 2011a, 2011b). Public hospitals have also been funded to implement interventions that incorporate elements from international studies of interventions. These include computerised ordering with and without decision-support functionality; traffic light–based ordering, which restricts the range of tests junior doctors can order without approval from more senior clinicians in an emergency department and involves education, audit and feedback on compliance and test use; hand-held devices for ordering tests and checking results in an emergency department and wards; and minimum re-test intervals for certain common but over-ordered tests (DOHA 2011b).

The QUPP has also supported the development and maintenance of LabTests OnLine, a web-based resource that provides to the general public, consumers, health professionals and pathology services up-to-date and reliable information about laboratory tests and how they are used and news about advances (DOHA 2011a, 2011b).

### 3.6.2 The National Prescribing Service

More recently, the NPS, which has had a major role in ensuring the quality use of medicines, has been funded by the Australian Government to extend its work into the diagnostics area. In its 2009–10 budget, the government announced four-year funding for the establishment of a national diagnostic test requesting service run by the NPS to promote high-quality and appropriate requests for pathology and diagnostic imaging tests (Australian Government 2009). Since July 2009 the NPS has received funding for this new measure; the program offers the opportunity to look at the link between prescribing medications and diagnostic investigations and develop educational interventions for health professionals and consumers covering both medicines and diagnostic testing (NPS 2010). In the first year of the four-year program cycle, consensus was reached on the initial areas of focus—managing low back pain, vitamin D testing, health checks, vitamin $B_{12}$ and red cell folate, and headaches (NPS 2010). In 2010 the project developed the first set of interventions for managing back pain for health professionals and consumers (NPS 2010).

### 3.6.3 Other initiatives

Other public hospital–based projects were funded in 2002–03 by the National Institute of Clinical Studies under the Rational Investigation Ordering Collaborative. The projects focused on reducing unnecessary testing and were implemented by clinician-led teams using the Institute for Healthcare Improvement Breakthrough

Series, which included workshops, conference calls, site visits, a website, multidisciplinary change teams, data feedback, and processes for implementing change in the ordering of pathology investigations in 13 hospitals (MacPherson et al. 2005; Henderson et al. 2006).

Some state governments have also implemented statewide initiatives; for example, Queensland has established a laboratory process for intercepting and rejecting repeat requests for tests within minimum re-test intervals. Other initiatives have been introduced by local area health services, and some emergency departments and pre-admission clinics for elective surgery in public hospitals have initiated their own demand management initiatives as part of their continuous quality improvement activities.

The Royal College of Pathologists of Australasia has a history of teaching and overseeing quality initiatives and standards in pathology requesting and testing. It has developed resources for use by clinicians and laboratories; these include the *Manual of Pathology Tests*, *Common Sense Pathology* and, more recently, a series of cancer protocols for clinicians ordering tests and laboratories reporting on tests (RCPA 2011). At present the RCPA and the Australasian College of Emergency Medicine are engaged in a joint project to develop guidelines for pathology ordering in Australian emergency departments. Most public hospital emergency departments already have some sort of guidelines in place, but they are often local and site specific. This joint project aims to harmonise some of the basic principles associated with appropriate ordering and develop standardised Australasian guidelines.

# 4 Current and planned activities and practices

## 4.1 The NCOPP Survey

In order to gain a better understanding of current activities and practices, the National Coalition of Public Pathology surveyed public pathology services in Australia to collect information about current and planned strategies for managing demand and encouraging appropriate use of pathology testing in public hospitals.

The survey instrument was sent to all NCOPP member organisations (20 in all); 19 responded, giving a response rate of 95 per cent. Twenty-one responses were received: one member organisation submitted separate returns for its three constituent hospitals.

The aim of the survey was to establish a current practice base against which other project results might be compared with information collected at a high level. The survey content and structure were based on areas of inquiry in published studies, as identified through the literature search, to allow similarities and differences to be highlighted and analysed. The survey instrument is shown in Appendix D.

The information gathered was from the pathology service perspective. There could well be other strategies in operation or planned in other areas of public hospitals that were not covered by the survey. The main results are summarised in the rest of this chapter; their implications are considered in subsequent chapters.

## 4.2 The importance of demand management and problems redressed

The survey asked three questions about demand management and action to redress problems, as follows.

- *Does your pathology department have any current demand management strategies?*

  Demand management in pathology is seen as a national priority: more than 75 per cent of the organisations surveyed had strategies in operation or were implementing them. Of those with strategies in operation, the period of operation ranged from one to seven years. The vast majority noted that no formal review had been carried out. No multiple cycles of implementation and review were reported.

- *If you are planning or have demand management strategies in place was this the result of:*

  *(a) mutual agreement between pathology and its clinical clients*

  *(b) directive from management*

  *(c) other—please provide details?*

  The introduction or planning of demand management strategies is largely being promoted by pathology department initiatives, usually with the cooperation or agreement of clinical clients. In about 25 per cent of cases, however, the push had come from outside pathology, either from clinical users or central management of the hospital or health unit.

- *What are the problems being addressed by your demand management strategies?*

  Most respondents were concerned with unnecessary frequency of testing and/or inappropriate use of expensive tests—reported by 76 and 67 per cent of respondents respectively. Selection of inappropriate tests for clinical indications was reported by just under 50 per cent of respondents. Incomplete request forms and overall cost pressures were raised by 43 per cent of respondents (in both cases) as other problems. New diagnostically useful tests not yet listed on Commonwealth Medical Benefits Schedule were identified by 33 per cent of respondents, and 19 per cent of respondents raised the problem of non-existent or incomplete clinical information accompanying pathology requests.

## 4.3 Strategies and targets

The following questions were among those asked in relation to strategies and targets.

- *What is the range of strategies your pathology department has put in place to manage demand for pathology services?*

  Sixteen organisations (76 per cent) had in operation a combination of educational activities for pathology requesters and feedback to clinicians on test appropriateness. Twelve (57 per cent) had a minimum re-test interval schedule or a 'traffic-light' system (where authority to request is linked to clinical staff seniority), or both. Electronic order entry was seen as a useful tool where implemented, although few organisations had developed computer-assisted decision making. About 50 per cent of respondents saw online access to pathology results as a useful strategy for managing demand. Very few sent price signals to requesters. Most (67 per cent of respondents) considered the implementation of demand management as commonsense, with a minority (33 per cent) referring to published studies to support their efforts.

- *Who are the key targets of your educational activities?*

  Most organisations regarded medical staff below the level of consultant—junior doctors, registrars and in some cases medical students—as the appropriate target for their interventions. This is consistent with the fact that junior medical staff are the main requesters of pathology services in public hospitals (see Section 2.8).

- *On what particular locations of the hospital are your demand management strategies focused?*

  The majority (67 per cent) of respondents saw demand management as a hospital-wide concern; relatively few organisations targeted specific clinical areas such as emergency departments and intensive care units.

## 4.4 Monitoring success and effectiveness

Two questions were asked about monitoring success and effectiveness.

- *What measures do you use to monitor the success of your demand management strategies?*

  A wide range of measures are being used to monitor the success of the demand management strategies that have been adopted, and no particular measure predominated. Measures included the number of participants in education sessions and the number of pre- and post-analytical sessions provided on the appropriateness of tests requested; tracking the number and proportion of instances of non-compliance with traffic-light request schedules; tracking non-compliance with minimum re-test intervals for selected tests and monitoring incomplete request forms; monitoring the proportion of test results viewed online; measurement of test volumes pre- and post-interventions and the cost of selected tests over time; recording of adverse patient events; and the use of KIMMS (the RCPA Quality Assurance Program's Key Incident Monitoring and Management System) to monitor the success of strategies.

- *Overall, how effective have your strategies been in positively changing demand for pathology in your hospital?*

  In general, about 50 per cent of respondents claimed their strategies to be effective to some extent.

# 5 Interventions: what the evidence shows

This chapter provides an overview of the evidence gathered in relation to the types of interventions and demand management strategies implemented in Australia and overseas, with emphasis on public hospitals, and the impact of these interventions and strategies on clinicians' test requesting patterns.

The evidence was compiled using published articles generated by the literature search and other articles found by following references cited in those articles. In addition, details of unpublished initiatives and reports were obtained from the Department of Health and Ageing. Clinicians and pathology departments in public hospitals also contributed anecdotal evidence. As a consequence, the evidence presented here comes from a mix of studies with different aims, study designs, hospital settings, patient groups and measures. The approach to analysis focused on identifying and drawing together high-level common themes associated with successful interventions and strategies, barriers where these were identified, and possible areas for future inquiry.

## 5.1 Approach to the analysis

The evidence from Australia and overseas shows that interventions were initiated by hospital administrations and pathology and other clinical departments but, of necessity, usually involved more than one group. The interventions tended to be characterised by a number of elements, including a primary, or lead, strategy (for example, clinical guidelines or protocols) supported by complementary strategies such as minimum re-test intervals, education, feedback and/or some form of computerised support. Rarely was only one strategy implemented.

Using this approach, it was possible to group studies and projects found during the information gathering phase into one of five broad approaches to demand management, as Table 5.1 shows.

**Table 5.1 Broad approaches to demand management**

| Category of approach | Examples |
|---|---|
| Education, audit and feedback | Education programs, guideline dissemination, pre- and post-analytical feedback on test appropriateness, feedback on test predictive value and feedback on test costs |
| Rules and agreements aimed at restricting test requests | Re-engineering and implementation of clinical guidelines or pathways, implementation of minimum re-test interval schedules, and linking requesting authority to clinical staff seniority—the 'traffic-lights' approach |
| Re-design of the request form to provide guidance to requesters | Providing a list of approved tests that requesters can circle, tick or order, listing test costs to send a price signal, aligning request forms to modified clinical practice guidelines for test ordering and unbundling or banning the use of test panels on request forms |
| Computerised physician order entry systems | Includes real-time decision support |
| Reimbursement and funding models | Budget holding by the laboratory, budget holding by the requester, diagnosis related group–based or activity-based funding, and budget holding by the regulator |

In the remainder of this chapter the evidence relating to each intervention type is discussed and the effectiveness of each intervention is assessed.

## 5.2 Education, audit and feedback

Education of and provision of feedback to clinicians have a role in most interventions aimed at achieving more appropriate use of pathology tests. In some cases, this can be the only strategy.

### 5.2.1 Description

There is general consensus that the use of protocols can lead to reduced demand for laboratory tests (Mehari et al. 1997; Capdenat et al. 1998) without a demonstrable effect on the quality of care (Wachtel & O'Sullivan 1999). Knowledge about the clinical utility of tests is commonly passed on to clinicians in formal presentations, in case reviews and in comments embodied in laboratory reports. Knowledge can also be transferred by providing to clinicians laboratory test ordering guidelines or protocols pertinent to clinical scenarios. Simply issuing guidelines does not, however, ensure adoption, and ongoing strategies are required to stimulate use of the guidelines and effect behavioural change (Winkens & Dinant 2002).

Although much effort has been expended on continuing medical education, effectiveness cannot be clearly demonstrated (Davis et al. 1999). This has implications for the design of strategies aimed at improving clinicians' understanding of appropriate use of laboratory medicine investigations.

Feedback to clinicians can contain information about requesting patterns along with, in some cases, ranking of requesters vis-à-vis their colleagues and data on the cost of investigations, either in total or by patient.

The increasing use of computerisation in health care offers a useful tool for immediate provision of feedback to individual clinicians, with the potential to improve adherence to guidelines.

### 5.2.2 Studies

Table 5.2 shows the studies that were identified from the published literature in relation to education, audit and feedback.

**Table 5.2 Education, audit and feedback: studies reviewed**

| Author | Year | Country | Setting |
|---|---|---|---|
| Kelly | 1998 | Australia | Western Hospital, Melbourne, Victoria |
| Stuart et al. | 2002 | Australia | Lyell McEwin Health Service, Elizabeth, South Australia |
| Miyakis et al. | 2006 | Greece | Academic medical department, Athens Hospital |

In addition, information was provided about a project aimed at improving the appropriateness of diagnostic test use that was implemented in 2008 at the Western Hospital in Melbourne (S Jansson, pers. comm., December 2010, July 2011).

### 5.2.3 Results

In Australia several studies have demonstrated a reduction in pathology requests after the introduction of requesting guidelines. At the Western Hospital in Melbourne, Kelly (1998) reported a 53 per cent reduction in blood culture requests up to 12 months after the introduction of evidence-based guidelines developed in house as the sole intervention. Stuart et al. (2002) reported a 40 per cent decrease in test requests in the emergency department of a public teaching hospital in South Australia with a three-component approach consisting of test ordering protocols, education programs and audit feedback.

In an academic medical department study in Athens Miyakis et al. (2006) identified factors contributing to laboratory test overuse and assessed the effect of an educational feedback strategy on inappropriate test ordering behaviour. The intervention involved an assessment of the clinical usefulness of 25 laboratory tests. Tests considered inappropriate were isolated according to previously validated uniform implicit criteria. Clinical staff were also surveyed to determine the extent of their knowledge of test costs. The findings were presented to the entire clinical staff, as was a review of the literature. This was followed by open discussion and proposal of strategies for reducing unnecessary testing.

Before the intervention 28.6 per cent of tests ordered on the ward on the first day of admission and 69.3 per cent of tests ordered after the first day were considered inappropriate. Six months after the intervention a review of patient records managed by the same trainees found that 26.7 per cent of tests ordered on the first day of admission and 63.2 per cent of tests requested after the first day were regarded as inappropriate.

Following the intervention test ordering was significantly reduced after the first day of admission for all patient groups, but there was no significant difference in the number of tests ordered on the first day. The decrease was gradual in the first two months after the intervention, reaching significance in the third and fourth months, but returned almost to pre-intervention levels in months five and six. Senior trainees were found to order more tests than junior trainees, although the number of inappropriate tests did not differ significantly between them. Cost awareness among trainees was variable, but none estimated the cost of all tests correctly. Display of test costs on the request form was considered a factor in modifying the volume of tests ordered during the intervention period.

### 5.2.4 Assessment

Although the data support the effectiveness of education and feedback, the effect was seen to decline gradually after the intervention. This supports previous observations (Winkens & Dinant 2002) that have concluded attention needs to be paid to perpetuation of interventions if they are to be successful in the longer term. Miyakis et al. (2006) found that the success of demand management strategies was not so much dependent on the intervention itself but more on its design and implementation in the hospital and clinical setting.

In 2008 the Western Hospital in Victoria (S Jansson, pers. comm., December 2010, July 2011) implemented a project aimed at improving the appropriateness of use of diagnostic tests. At the time, growth in the use of diagnostic services, including pathology, was about 6 to 7 per cent a year. The project was initiated by a senior clinician with support from hospital management through funding for a project officer. A range of biochemical test requests were reviewed, and clinicians received evidence-based feedback about requesting practice and the appropriateness of the tests requested. Measures of success were changes in test volumes and costs based on the Medicare Benefits Schedule.

According to anecdotal evidence, the Western Hospital project has been successful in reducing unnecessary testing. In the first 12 months of the project the rate of pathology ordering fell by 4 per cent. Overall growth in service provision has since risen to 6 per cent, although this is largely because of an increase in patient throughput for the hospital. The effectiveness of the intervention is attributed to clinical leadership with a focus on good clinical practice, continuous feedback to clinicians, support and resources from the hospital administration, and continuing support by the pathology department.

## 5.3 Rules and agreements aimed at restricting test requests

The second group of interventions involves the development and implementation of rules and agreements that re-design clinical pathways and restrict requests in order to encourage more appropriate test use. Included are clinical guidelines, minimum re-test interval schedules, and traffic-light systems that link requesting authority to the seniority of clinical staff.

### 5.3.1 Clinical guidelines

Published guidelines are commonly used for supporting medical decision making. In laboratory medicine, guidelines have been developed for the use of a wide range of tests for detecting or predicting a clinical condition, for monitoring disease, and for decision making related to treatment. Although it is well recognised that guidelines should be based on identification, appraisal and synthesis of the evidence, the lack of good research evaluating the use of pathology tests leads to laboratory medicine guidelines that are largely based on consensus. The latter can be developed rapidly and have high user acceptance, but they are not based on a systematic literature review and so can result in biased conclusions and even contradictory recommendations leading to non-compliance (Oosterhuis et al. 2004).

#### *Studies*

Table 5.3 shows the clinical guideline studies identified from the published literature on rules and agreements aimed at restricting test requests.

**Table 5.3 Rules and agreements aimed at restricting test requests: clinical guideline studies reviewed**

| Authors | Year | Country | Setting |
|---|---|---|---|
| Mehari et al. | 1997 | New Zealand | Waikato Hospital |
| Mancuso | 1999 | United States | Cornell University Medical Centre |
| Sucov et al. | 1999 | United States | University of Rochester School of Medicine and Dentistry, New York |
| Board et al. | 2000 | Australia | Prince of Wales Hospital, Sydney |
| Merlani et al. | 2001 | Switzerland | Geneva University Hospital |
| Barazzoni et al. | 2002 | Switzerland | Six acute-care community hospitals in the Canton Ticino public hospital organisation |
| MacPherson et al. | 2005 | Australia | Royal North Shore Hospital, Sydney—pre-admission clinic |

#### *Results*

As with clinical practice guidelines in general, there is concern that laboratory medicine guidelines are not well complied with and in the absence of an implementation strategy are largely ineffective. Although a few studies have found that simply distributing guidelines in a hospital setting can lead to reduced laboratory testing rates (Mancuso 1999; Mehari et al. 1997), others have observed changes in testing practice only when guideline dissemination is coupled with other strategies (Sucov et al. 1999; Merlani et al. 2001). Direct involvement of guideline users in the identification of possible barriers to change has also been highlighted as a success factor in promoting the use of practice guidelines (Barazzoni et al. 2002). Solomon et al. (1998) found that the most effective implementation strategy was assessment followed by consensus building, targeted behaviour change and re-assessment as elements of a continuous quality improvement program.

There is ample evidence that routine, indiscriminate pre-operative testing of low–anaesthetic risk patients undergoing elective surgery cannot be supported on

scientific grounds (Munro et al. 1997). In a multiple-site study in Canton Ticino, Switzerland, practice guidelines aimed at reducing pre-operative testing, including pathology, were developed and introduced after consultation between the relevant health professionals. This was followed by a pre- and post-intervention observational study (Barazzoni et al. 2002). Adoption of the recommended guidelines was associated with an 81 per cent reduction in the probability of patients undergoing coagulation testing, a 73 per cent reduction in testing for glycaemia, a 62 per cent reduction for azotaemia and 95 per cent for creatinaemia. Barazzoni et al. concluded that local implementation of guidelines can be successfully achieved through a strategy of active involvement on the part of health professionals stimulated by explicit consideration of their concerns and instilling a sense of ownership.

In the pre-admission clinic at Royal North Shore Hospital in Sydney a small team consisting of a surgeon, an anaesthetist and several junior doctors initiated an intervention as part of the Rational Investigation Ordering Collaborative funded under the National Institute of Clinical Studies (MacPherson et al. 2005). A two-stage assessment protocol was developed after consultation with surgeons and anaesthetists. Stage one involved a list of commonly performed surgical procedures and pathology tests appropriate for each, and stage two involved a list of pre-existing conditions that necessitated additional tests being requested. The referral for admission form was redesigned to encourage compliance. Junior doctors were obliged to justify any additional tests they requested on the form. Complementary strategies included an education phase relating to the test protocol for junior doctors hospital-wide. All pre-admission clinic staff received an information pack and had to sign to the effect that they had read it. Pre-admission clinic nurses and allied health staff were educated to question any non-compliant test requests made without a written justification on clinical grounds.

A statistically significant drop in the ordering of seven of the eight tests listed for patients with no pre-existing conditions was reported. Ordering of coagulation studies was reduced from 22.5 to 13.8 per cent of patients and electrolytes, urea and creatinine from 65.2 to 48.25 per cent (MacPherson et al. 2005). The average number of tests performed per patient declined from 2.48 to 1.88, representing a saving of $10.33 per patient. In a follow-up assessment one year later, the proportion of patients having no tests had increased from 30.4 per cent before the intervention to more than 50.0 per cent.

Re-engineered clinical pathways alter the way in which health care has historically been provided and can occur at any point in diagnosis and management as part of quality improvement programs. Changes to management can relate to admission and discharge criteria, where care is provided and by whom. Examples of re-engineered pathways for medical and surgical patients are ‘hospital in the home’ arrangements and early discharge home with external support following surgical procedures.

Board et al. (2000) investigated the use of pathology services in two prospective clinical trials of re-engineered clinical pathways, one for elective surgery and the other for acute unplanned medical admissions, at Prince of Wales Hospital in Sydney.

Patients from each group were allocated to treatment based on a re-engineered clinical pathway (alternative care model) or usual practice (traditional clinical pathway). The re-engineered pathway specified the laboratory tests to be performed. A significant reduction in test requests was observed. In the elective surgery intervention group compared with the control group, 70 per cent fewer laboratory tests were requested; in the acute medical intervention group 25 per cent fewer tests were requested. Clinical outcomes and patient satisfaction were comparable or better in the re-engineered clinical pathway group (Caplan et al. 1998, 1999).

#### *Assessment*

The results of the two Australian studies support the observation that senior clinicians are likely to request fewer tests when they have a more direct involvement in planning clinical pathways and in the early stages of the patient's management. It could be useful to explore how this approach might be adapted to regional areas where some of the approaches—such as laboratory interception of unnecessary repeat tests or computerised physician order entry systems—are not feasible in the near future.

### 5.3.2 Minimum re-test intervals

#### *Description*

The minimum re-test interval is an intervention aimed at repeat requests for tests within a time frame that is regarded as too short for detection of a meaningful change in clinical status. The time interval—usually based on analyte half-lives and analytical variability—is established from clinical protocols or guidelines and agreed with local clinicians. Test requests are monitored in order to identify repeat requests that fall within the minimum re-test interval. This process is often fully or partially computerised. Commonly, computer-generated notifications and feedback are provided to clinicians if repeat requests are made within the re-test interval, inviting cancellation of the repeated test. Clinicians can override the time limit subject to documentation of a clinical reason on the request form or accompanying an electronic request.

#### *Studies*

Table 5.4 shows the studies of minimum re-test intervals identified from the published literature on rules and agreements aimed at restricting test requests.

**Table 5.4 Rules and agreements aimed at restricting test requests: minimum re-test interval studies**

| Authors | Year | Country | Setting |
|---|---|---|---|
| Bryant | 2002 | Australia | Monash Medical Centre and Dandenong Hospital, Victoria |
| Queensland Health Pathology and Scientific Services | 2004 | Australia | Queensland public hospital network |
| Fremantle Hospital | 2005 | Australia | Fremantle Hospital, Western Australia |
| Sharma & Salzmann | 2007 | UK | Royal Devon and Exeter Hospital |

Two of the studies—the Queensland Health Pathology and Scientific Services (now Pathology Queensland) one and the one from the Fremantle Hospital site of PathWest—were QUPP-funded projects. The other studies involved a program implemented by Southern Health at the Monash Medical Centre and Dandenong Hospital in Victoria (Bryant 2002) and a published study from Royal Devon and Exeter Hospital in the United Kingdom (Sharma & Salzmann 2007).

***Results***

In all four studies evidence-based minimum re-test intervals for a limited number of common tests were agreed with clinicians beforehand on the basis of clinical evidence.

In Queensland this was initiated centrally by the pathology department. Its hospital network obtained test results via Auslab, a statewide laboratory information system. At Fremantle Hospital the intervention was led by a local clinician, and at Royal Devon and Exeter Hospital the intervention was initiated by the Department of Clinical Chemistry.

The work of laboratories was essential to each project, although the extent of the laboratories' involvement varied. Pathology Queensland took the lead role on that project and worked closely with clinicians, who led the development of tests to include in the re-test algorithm. Clinicians led the project at Fremantle Hospital, while in the UK study the Department of Clinical Chemistry took the lead role but worked closely with clinicians.

Processes differed somewhat, but in all cases clinicians received automated alerts or notifications when repeat requests were made within re-test intervals. Pathology Queensland and Royal Devon and Exeter Hospital used handwritten request forms; this approach was reliant on laboratory staff intercepting repeat requests at the time of logging the request into the system, reviewing the database for a previous test result, ascertaining the minimum re-test interval period and triggering the alert, which was sent electronically and later seen by the clinicians when viewing the results on line. Fremantle Hospital developed a customised online ordering system (Padlok—discussed further in Section 5.5) whereby the clinician received an alert at the time a repeat request was made or when a repeat request had already been ordered by another clinician. All interventions allowed clinicians to override the time limit subject to documentation of a clinical reason on the request form or after consultation with the laboratory. Specimens were kept for a period and could be tested if it was agreed that the testing should proceed.

All projects resulted in decreases in the number of unnecessary repeat requests. Pathology Queensland reported a significant drop in repeat tests ordered across all except one of its hospital sites—equating to a monthly saving of $10 000 (Queensland Health Pathology and Scientific Services 2004). Although no reduction in the number of patient episodes or in the total volume of tests requested was demonstrated, a decrease of 19 per cent in the cost of inappropriate repeat test requests was observed over one month. The Southern Health program reported that the number of re-tests

ordered within the specified re-test interval was reduced by 50 per cent (Bryant 2002). The Department of Clinical Chemistry at Royal Devon and Exeter Hospital reported a decrease in repeat requests from 4.0 to 2.8 per cent over four years, despite a 34 per cent increase in workload over the period (Sharma & Salzmann 2007).

***Assessment***

The evidence shows that each of the four initiatives was successful in effecting and maintaining a reduction in unnecessary repeat test requests by clinicians and that the interventions were sustainable.

The interventions shared common elements that influenced their effectiveness. From the conceptual stage all had clinicians' support and involvement in shaping the strategies that made up the intervention. Laboratories were perceived as partners, and clinicians' judgment was respected by the inclusion of an override option with clinical justification. Most started with an agreed small number of tests that was gradually expanded. There was recognition that the intervention came at a cost, but this was outweighed by the savings accrued and potentially better patient care. The unchanged manual request processes impose a cost burden when information technology solutions can offer business process improvements through online ordering.

### 5.3.3 Authority to request linked to clinical staff seniority

***Description***

The traffic-light system fits into a behavioural model of intervention that involves a number of mutually reinforcing strategies. Traffic-light systems are most frequently deployed in emergency departments, and the main strategy used is to restrict the range of tests that can be ordered depending on the seniority of the clinician. Tests are grouped into one of three traffic-light categories—green, amber or red—which are determined by local clinicians and based on clinical protocols. Pathology request forms are commonly colour-coded. Green covers routine tests that can be ordered without restrictions but with a requirement that test results be checked before the patient is discharged; tests listed in the amber category require approval by the registrar before they can be ordered, and results have to be followed up and documented before the patient is discharged; requests for tests listed in the red category must have the approval of an emergency department consultant or the supervising registrar.

The strategy might or might not include decision support such as clinical indications for use of the test. It generally relies on support from the laboratory in monitoring compliance with restrictions on requesting by junior doctors to ensure that the prerequisite approvals have been obtained and to provide feedback when they have not. Traffic-light systems usually involve education and audit or feedback as complementary reinforcing strategies.

### *Studies*

Table 5.5 shows the traffic-light studies identified from the published literature on rules and agreements aimed at restricting test requests.

**Table 5.5 Rules and agreements aimed at restricting test requests: traffic-light studies**

| Author | Year | Country | Setting |
|---|---|---|---|
| Stuart et al. | 2002 | Australia | Lyell McEwin Health Service, Elizabeth, South Australia—emergency department |
| McCarthy | 2009 | Australia | Prince of Wales Hospital, Sydney—emergency department |
| Gold Coast Health Service District | 2009 | Australia | Southport and Robina Hospitals, Queensland—emergency departments |

No overseas studies were found. For Australia, anecdotal information was provided about two other traffic-light systems in emergency departments in public hospitals—for a group of seven public hospitals in Western Australia (K Bayley, pers. comm., January, February 2011; F Brogden, pers. comm., July 2011; Y Nagree, pers. comm., December 2010) and for The Canberra Hospital (ACT Pathology, pers. comm., December 2010, July 2011).

The study at Lyell McEwin Health Service has the key elements of a traffic-light system, although the lead author based the intervention on a specific behavioural change model.

Each of the five examples was initiated by the senior clinician in charge of the emergency department, with the support of other ED clinicians, in response to concerns about inappropriate ordering of pathology by junior doctors and the impact of this on quality of care for patients and growth in use of and expenditure on pathology tests and the impact of this on ED budgets.

Projections of high growth in ED presentations to the Gold Coast Health Service District provided an additional impetus for managing requests for tests (Gold Coast Health Service District 2009), while Lyell McEwin Health Service sought to improve the level of documentation of test results in patients' records (Stuart et al. 2002). One of the objectives of the intervention at Prince of Wales Hospital was to identify sicker patients and have them seen sooner by senior clinicians. It also aimed to encourage doctors to question and justify their decisions (McCarthy 2009). The request form contained a reminder that not every patient needed to have tests.

The model adopted by Lyell McEwin Health Service was based on a behavioural change model known as PRECEDE (Predisposing, Reinforcing, Enabling Causes in Educational Diagnosis and Evaluation) (Stuart et al. 2002). It had three mutually reinforcing strategies common to the traffic-light systems implemented by the Gold Coast Health Service District, Prince of Wales Hospital and Western Australia. These were an education program for medical staff; implementation of a protocol for

ordering tests, resulting in categorisation of tests and restricted ordering by seniority of clinician; and an audit and feedback process.

Educational activities were designed to raise awareness about inappropriate use of tests and why this was a concern. In each initiative the education program was delivered by the senior ED clinician. In addition, the Gold Coast Health Service District developed an orientation program for all medical staff and nurses and a tutorial program for interns. Prince of Wales Hospital developed a database on the evidence for tests on a shared drive in the emergency department. It also developed an orientation manual and included discussions on the utility of tests during rounds. In Western Australia, Fremantle Hospital's ED orientation manual on policies and procedures for junior doctors on six months' rotation included the traffic-light system. Lyell McEwin Health Service also developed an evidence-based list of clinical indications for ordering tests.

In all cases ED clinicians designed a test ordering protocol on the basis of evidence and classified tests into one of three categories linked to restrictions on ordering related to clinicians' seniority. Request forms were re-designed to highlight restrictions, and some listed clinical indications. In Western Australia clinical staff in each emergency department determined the order and priority of the tests to limit ordering to those required to treat a medical emergency and/or triage a patient for admission to hospital, treat them and send them home, send them home or refer them to a general practitioner. This was ultimately linked to the introduction of the four-hour turnaround time target in emergency departments in that state.

Audit and feedback processes were important aspects of all the traffic–light system initiatives. The clinical resource utilisation group of the Gold Coast Health Service District conducted regular audits and provided feedback, including direct feedback to medical and nursing staff. Prince of Wales Hospital handled the audit process differently because there was no capacity to involve laboratory staff in monitoring compliance with the test ordering protocol. This was done in the emergency department by stamping forms before the forms left emergency. Prince of Wales Hospital's traffic-light system was embedded through a business-as-usual approach in emergency. It used a variety of attention-grabbing materials to promote and provide information on the effect of the intervention on use of tests. 'Stop and Think' became the catchphrase used to represent the intervention. In the seven ED sites in Western Australia the lead clinician was responsible for monitoring use of the traffic-light forms, auditing the system and providing feedback on compliance. The laboratory would not perform the tests if the patient was not in the emergency department. The laboratory at The Canberra Hospital would not perform the tests if the request did not have the relevant approval. In addition to audits of compliance, the lead clinician at the Lyell McEwin Health Service conducted a daily audit of a random sample of patient records to see if test results had been appropriately documented.

***Results***

Each site reported a decrease in the volume of tests requested.

The Gold Coast Health Service District emergency department measured the effect of the intervention in terms of test orders and test costs. Overall, coagulation studies ordered in the period November 2008 to February 2009 decreased by 43 per cent compared with November 2007 to February 2008. Requests for tests decreased for serum electrolytes, liver function and coagulation studies at both ED sites, with associated savings of 4.17 per cent ($66 000) (Gold Coast Health Service District 2009). Growth in pathology use has now reduced from 10 to 3 per cent a year and is level, despite an increase in overall patient presentations at the two hospitals (T Ghent, pers. comm., January and October 2011).

Prince of Wales Hospital reported fairly dramatic decreases in the numbers of tests ordered in the amber and red test categories (McCarthy 2009). Of the 12 tests in the green category, requests for five tests decreased and those for the other seven increased. Pathology costs decreased by about $40 000 a month. No evidence of cost shifting was found; costs for pathology in other departments did not increase. No adverse patient events were reported. The data Prince of Wales Hospital presented at the Department of Health and Ageing's Best Practice in Pathology Requesting and Reporting Workshop in 2009 showed that the model had continued to have the desired impact on test ordering.

In Western Australia the Department of Health encouraged all its hospitals to introduce traffic-light systems into their emergency departments following a successful pilot in 2006 at Sir Charles Gairdner Hospital, where an audit showed a decrease of 10 per cent in the costs of tests per patient. Anecdotal evidence from Fremantle Hospital is that the traffic-light system worked well but was less effective initially because junior doctors were reluctant to comply. Considerable effort was put into monitoring, keeping a log of non-compliant junior doctors, and taking a fairly heavy handed but cordial approach to this.

Lyell McEwin Health Service reported an overall decrease of 40 per cent in the ordering of pathology tests in the emergency department, with a decrease of 50 per cent in the amber category and more than 80 per cent for many tests in the red category (Stuart et al. 2002). There was also a decrease of 75 per cent in the time requesting doctors took to check and follow up test results, from around 234 minutes a day to 57.5 minutes a day. The random audits of patients' case notes found only one case where results were not recorded. No adverse events were reported during the intervention period, and there was no evidence of cost shifting to other areas of the hospital as a consequence of the test ordering protocol. The introduction of an online test request capability reduced the need for auditing compliance with the test protocol because junior doctors' requests for tests in the amber category had to be approved online by a senior clinician. Red category tests requested by individual senior registrars and consultants were reviewed and discussed at monthly meetings. The intervention at Lyell McEwin Health Service has been in operation since 2000.

The Canberra Hospital reported a decrease of 27 per cent in the number of tests requested (ACT Pathology, pers. comm., December 2010, July 2011). The laboratory supported the implementation by providing data on the number of tests and their costs, although these data were not available for this report. Growth in test requests has increased since the introduction of the system in 2001, but the extent to which this is a result of an increase in patient numbers is not known. The intervention is still operating—because of the commitment of the lead ED physician—but it has been reported that the system is not well adhered to when this clinician is away.

***Assessment***

The evidence shows that the traffic-light system has been an effective intervention in targeting the test requesting behaviour of junior doctors in the ED setting, improving the quality of requesting and reducing unnecessary testing (including repeat testing) and associated costs. In each of the four jurisdictions where the system has been implemented the effect has been sustained for between four and 11 years.

Effectiveness can be attributed to a number of common factors. All the interventions had a 'champion': a senior ED physician led all the strategies that made up the intervention, from categorisation of tests and protocols to education, auditing and feedback for non-compliant junior doctors and feedback for senior clinicians about their requesting patterns in relation to tests not regarded as being routine in the ED setting. Auditing non-compliance and providing feedback to junior doctors was crucial to reinforcing and upholding desired requesting practices and served to reinforce the behaviour change sought through the design of the traffic-light request forms. The approach to delivering feedback to junior doctors was also important—evidence-based, timely and cordial. In Western Australia it was reported that interns are returning as residents to the emergency department and are modelling the desired behaviour for new interns (Y Nagree, pers. comm., December 2010).

Lead clinicians carried most of the burden, with other senior clinicians moving in to share or own aspects of the intervention after its effectiveness and acceptance had been established. This would appear central to success but to pose a potential threat to the sustainability of a successful intervention—for example, when an individual is on leave or moves on. Inclusion of clinicians in the establishment of locally adapted, evidence-based test protocols was a prerequisite for their support and participation in the intervention, for their role as teachers and supervisors of rotating junior doctors, and hence for the continuity of the intervention.

The way in which the intervention moved from a project to a business-as-usual approach seemed integral to changing the culture of requesting in some sites through a number of mutually reinforcing strategies—setting out expectations of junior doctors from the first day of arrival in the emergency department, orientation packages, education sessions, monitoring on the floor, and audit and feedback built into day-to-day ED operations.

Some of the studies recruited members of the clinical team to reinforce compliance with the interventions in the absence of a lead clinician or other senior clinicians. This

involved the team in planning and implementation and making explicit their role to support, monitor and provide feedback on non-compliance.

In response to this present NCOPP project, Pathology Queensland provided a brief update on the status of traffic-light systems in its participating hospitals. The traffic-light indicator is used as a prompt or reminder hospital-wide, with more specific protocols in intensive care units, pre-admission, emergency departments and oncology. The Pathology Utilisation Medical Project was a statewide Queensland Health initiative based on the success factors identified in the Gold Coast Health Service District model. Successful pathology use programs must be led by clinicians and supported by education, data monitoring and feedback to staff in relation to ordering practices. Districts that have adopted suitable pathology ordering projects have reviewed the strategies used at the Gold Coast and adapted them to their local environment while continuing to ensure that clinicians support the protocols, that educational programs continue, and that communication programs are regularly undertaken.

Pathology Queensland also provided some specific observations about the ED traffic-light system, reporting that the system is effective and accepted but can have downstream effects with respect to add-on tests. These add-on tests need to be carefully managed and, after data analysis, strategies put in place to respond to them.

## 5.4 Re-design of the request form

### 5.4.1 Description

Re-design of the request form involves making changes so as to restrict requests for individual tests or groups of tests in a way similar to the principles behind traffic-light systems and with the objective of encouraging more appropriate test use in a range of clinical settings. In general, it is closely aligned to promotion of clinical practice guidelines. Some approaches include listing of test costs to send a price signal to the clinician at the time of requesting. Where the use of tests is to be specified for certain clinical presentations, a consensus-based approach involving clinicians is adopted. The process involves a review of evidence-based guidelines on the usefulness of tests in diagnosis and clinical management of the patient, these being adapted for local use. The guidelines are incorporated in pathology request forms or other supporting protocols, along with the rationale for tests to be requested. Interventions can also include complementary strategies of education, monitoring and feedback.

### 5.4.2 Studies

Table 5.6 shows the six studies that were reviewed in relation to the re-design of the request forms.

**Table 5.6 Re-design of request forms: studies reviewed**

| Author | Year | Country | Setting |
|---|---|---|---|
| Hindmarsh & Lyon | 1996 | Canada | Several unspecified public hospitals |
| Isouard | 1999 | Australia | Bankstown–Lidcombe and Nepean Hospitals, Sydney |
| Seguin et al. | 2002 | France | Hospital de Pontchaillou—intensive care unit |
| Durieux et al. | 2003 | France | Cochin Hospital—gastroenterology and internal medicine departments |
| MacPherson et al. | 2005 | Australia | Royal North Shore Hospital, Sydney—pre-admission clinic |
| Attali et al. | 2006 | Israel | Kaplan Medical Centre |

Each of the interventions in this group of six studies was developed in response to specific concerns. Only one study adopted a single strategy, a price signal, to measure the intervention's impact on reducing test ordering behaviour (Seguin et al. 2002). The other five studies focused on implementing changes to test requesting practices through re-designing the request form in order to restrict the use of tests (Durieux et al. 2003), support a change in patient management (MacPherson et al. 2005; Isouard 1999) or unbundle test panels to reduce automatic ordering of multiple tests (Hindmarsh & Lyon 1996; Attali et al. 2006). The strategies adopted to reinforce the re-designed request form for each study are described in the following paragraphs.

### *Re-design of the request form to send a price signal*

The intervention in the intensive care unit of Pontchaillou Hospital in France (Seguin et al. 2002) consisted of comparing test requesting behaviour with and without providing information about test costs on the request form. Clinicians were not informed of the study. The characteristics of patient groups were not statistically different between the two test periods. Apart from liver function tests, all tests evaluated were requested less frequently when clinicians were aware of the test cost, regardless of whether the tests were routine or were requested during an emergency. The difference reached significance, however, only for arterial blood gas and urinary electrolytes. Nevertheless, a significant 22 per cent reduction in pathology costs could be demonstrated.

### *Re-design of the request form to restrict tests*

The study at Cochin Hospital in France targeted demand for the three most frequently requested gastro-intestinal tumour markers, which accounted for 60 per cent of tumour markers requested in the hospital. This was a prospective study with time-series analysis (Durieux et al. 2003). Local clinical guidelines for the requesting of all tumour markers were developed and implemented through a new request form. If the request was deemed inappropriate, it was disallowed, although this could be overridden if an acceptable reason was provided. The cost of each test was also displayed on the request form, alongside the test. To evaluate the appropriateness of requests, audits were conducted before and after introduction of the new forms. A decrease in requests for the three tumour markers was reported, ranging from 55 per cent in the entire hospital to 25 per cent in the gastroenterology department. The

appropriateness of requests increased from 54.6 to 73.6 per cent after introduction of the new form but decreased to 52.9 per cent two years after the intervention. The extent to which the display of the cost of tests influenced requests is not known.

### *Re-design of the request form to support a change in patient management*

At Bankstown–Lidcombe Hospital a test protocol for patients with acute myocardial infarction was developed and implemented using a total quality management approach (Isouard 1999). Another metropolitan teaching hospital, Nepean, was used as a control. Practice guidelines and pre-stamped pathology request forms listing the recommended tests from the guidelines for test ordering were adopted for the first 72 hours after admission of patients with suspected or confirmed acute myocardial infarction. Education, training and feedback were provided to clinicians. At Bankstown–Lidcombe Hospital the proportion of clinically indicated tests requested in the first 72 hours increased from 77.5 to 88.2 per cent, and non-clinically indicated tests per admission reduced by 81.7 per cent. Requests at Nepean Hospital did not change significantly. After 15 months the study team was disbanded, the pre-stamped request forms were withdrawn and, although the guidelines remained in operation, compliance fell.

### *Re-design of the request form to 'unbundle' test panels*

Two studies implemented an intervention banning the use of test panels and requiring that each test be listed individually on the request form (Hindmarsh & Lyon 1996; Attali et al. 2006). Both had complementary reinforcing strategies to support the primary strategy.

In Israel the Kaplan Medical Centre study was conducted to assess the impact of a simple (electronic) request form–based intervention on test ordering and diagnostic accuracy in one of four departments of internal medicine (Attali et al. 2006). The intervention had four mutually reinforcing strategies. Residents and senior clinicians in the department received a lecture on the economic implications of excessive use of blood tests and were told about a case study on inappropriate ordering of lipids. Residents were involved in changing the process for ordering blood tests; this involved unbundling test panels and requiring each test to be specified—no groups of serum metabolic tests were allowed. The three control departments received advice about the change to test ordering and a lecture from the study department senior clinician on expenditure on laboratory tests. A senior clinician from the study department supervised test ordering and was available to provide advice in relation to the patients and relevant tests.

Before the unbundling of test panels the number of tests per admission was 1.91 across the four departments. The number of tests requested by clinicians in the department studied decreased for each of the three years of the intervention—0.76, 0.80 and 0.78 respectively—and, in all, 97 365 fewer tests were ordered, saving US$1.9 million. In the control departments test ordering dipped after the intervention but increased and decreased briefly on two subsequent occasions. Attali et al. (2006) concluded that a significant and sustainable reduction in tests ordered could be achieved without adversely affecting diagnostic capability or patient care.

In Canada a study was carried out at Ottawa General Hospital to redress inappropriate use of test panels for clinical chemistry and determine the effectiveness of different interventions in changing test ordering behaviour (Hindmarsh & Lyon 1996). Using a pre- and post-intervention survey design, the study examined the effect of clinician education, disease-specific test request algorithms, and a ban on test panel ordering of common clinical chemistry tests reinforced by audit and feedback by way of written reminders to clinicians not adhering to the ban. There was a sustained 6 to15 per cent reduction in requests for more than 16 tests for inpatients and an 11 to 44 per cent reduction for outpatients. There was, however, little change in ordering patterns for seven common tests for inpatients. The intervention showed an overall 38 per cent decrease in the ordering of common biochemistry tests, with savings of CA$20 000.

### 5.4.3 Assessment

The evidence showed that re-design of the request form was effective in reducing the use of pathology tests, regardless of the purpose, the approach to the re-design process or the format of the re-designed form. Displaying the costs of tests on the request form in an intensive care unit staffed by senior intensivists had a more variable impact on test requests compared with other re-design strategies (Seguin et al. 2002). This is not surprising: the evidence suggests that more highly trained and experienced senior clinicians are less likely to request inappropriate tests. In one other study in which the display of test costs was a strategy complementary to an evidence-based test protocol for tumour markers (Barazzoni et al. 2002) there was no attempt to determine the relative effect of price signals on requesting decisions. Questions therefore remain about the impact of price signals on test requesting.

It is, however, possible to make observations about the studies in which the re-design of the request form was based on clinical protocols aimed at improving patient care (Isouard 1999; Barazzoni et al. 2002; Durieux et al. 2003; MacPherson et al. 2005). Each of these studies involved clinicians having a central role in leading the development of test protocols in their clinical settings to determine how tests will be used. This approach supports the premise that local participation in adaption of clinical practice guidelines is important, both as a process and as an outcome: the former (the process) builds ownership; the latter (the outcome) encourages acceptance and the preparedness of senior clinicians to support use of the protocols in day-to-day work, particularly by junior doctors. The test protocol—be it in the form of a risk assessment profile or a clinical pathway—seemed to serve an educative function and to remind those involved of what constitutes good clinical practice and the basis for accountability.

The results of published studies also suggest that implementation of test request protocols alone has limited effect. This might explain why most of the studies in the re-designed request form category included education and feedback on compliance with test protocols as reinforcing strategies (Hindmarsh & Lyon 1996; Isouard 1999; MacPherson et al. 2005; Attali et al. 2006).

The intervention in the pre-admission clinic at Royal North Shore Hospital has been sustained since 2003. Considerable effort continues to be required to ensure

compliance with the pre-admission risk assessment protocol, partly because of the high turnover of junior medical staff (R MacPherson, pers. comm., November and December 2011).

Declining compliance with the guidelines for acute myocardial infarction introduced at the Bankstown–Lidcombe Hospital provides a useful example of how quickly the effect of an intervention can diminish if there are no mutually reinforcing strategies to discourage non-compliance or workarounds. The education program, request form re-design, laboratory monitoring and feedback serve this purpose.

This group of studies also shows that the effectiveness of interventions involving re-designed request forms is fragile and very much linked to the presence of a clinical champion. Little is known about why this is so, but it suggests that reinforcing strategies need to complement the role of the champion in a way that is not dependent on the champion's presence.

As an overall strategy, re-design of request forms appears to be an effective mechanism for supporting good clinical practice—particularly among inexperienced junior doctors. Little is known about the potential for and transferability of evidence-based test requesting protocols between hospitals of similar size, clinical settings (for example, pre-admission clinics) and clinical presentations (for example, elective general surgery). Greater insights into the barriers to transferability of effective models could provide some answers on ways of making progress.

## 5.5 Computerised physician order entry systems

### 5.5.1 Description

A computerised physician (or provider) order entry system, or CPOE, allows clinicians to enter orders directly into a computer. This improves efficiency, encourages compliance with clinical guidelines, aids clinical decision making when decision-support software is incorporated, and has the potential to improve the quality of health care and final patient outcomes (Mekhjian et al. 2002). Although the emphasis was initially on electronic drug prescribing to minimise medication errors, CPOE is seen as a useful tool for improving the appropriateness of pathology testing. In Australia in various jurisdictions—for example, the Victorian Government's Health Smart project—extensive CPOE implementation has been proposed. Roll-out of this functionality has, however, been slow for a number of reasons, among them cost, inadequate technical support and user resistance.

Decision-support functionality ranges from simple mechanisms such as defined order sets relevant to particular clinical scenarios through to complex rule-based alerts. Complex systems have been described that can provide information linking a patient's clinical status, analysis of previous results and relevant available test choices. It has been shown that CPOE can reduce the number of redundant test requests (Bates et al. 1999) and, where decision support is operational, improve compliance with clinical guidelines and reduce inappropriate requests (Smith & McNeely 1999). The ability to structure order screens and to manipulate order sets has been shown to

improve the data provided to laboratories and to improve the quality of test result information received by clinicians (Westbrook et al. 2006).

CPOE systems commonly pre-populate request forms with the patient's and the requesting doctor's details, the primary clinical diagnosis and other relevant clinical information from an interface with other hospital systems. Some CPOE systems send an electronic request to initiate specimen collection and populate the laboratory information system. Others require a hard-copy request form to be created, printed and signed by the doctor and then transferred with the specimen to the laboratory, where the information is entered manually into the laboratory information system.

CPOE systems can also support the use of clinically relevant order sets or restrict requests for tests using a traffic-light system, generate alerts when minimum re-test intervals for repeat tests are not met, and offer different levels of decision support in the test requesting process.

### 5.5.2 Studies

Of the seven Australian implementations of CPOE requesting in public hospitals that were investigated for this project, four were subject to formal evaluation in the published literature, as shown in Table 5.7.

**Table 5.7 Computerised physician order entry system: studies reviewed**

| Author | Year | Country | Setting |
|---|---|---|---|
| Mekhjian et al. | 2002 | United States | Ohio State University Medical Centre, Columbus |
| White et al. | 2005 | Australia | Flinders Medical Centre, South Australia |
| Fremantle Hospital | 2005 | Australia | Fremantle Hospital, Western Australia |
| Westbrook et al. | 2006 | Australia | Royal Prince Alfred Hospital, New South Wales—Central Sydney Laboratory Service |
| Health Informatics Research and Evaluation Unit, University of Sydney | 2010 | Australia | Various hospital settings |

Information about three other implementations was provided anecdotally—Royal Melbourne Hospital, Victoria (J Burns, pers. comm., December 2010, July 2011); PathWest, Western Australia (K Bayley, pers. comm., January and February 2011; F Brogden, pers. comm., July 2011); and South Eastern Sydney Illawarra Health (R Wilson & S Winter, pers. comm., September 2011). Formal evaluation was not available for these three projects, although the last one is currently the subject of a QUPP-funded evaluation, as discussed shortly.

This section, and this project overall, are not intended to provide a comprehensive examination of CPOE implementations in all Australian jurisdictions; rather, what follows is an exploration of the area and the available published studies.

### *Royal Prince Alfred Hospital*

Implementation of CPOE at Royal Prince Alfred Hospital in Sydney allowed clinicians to electronically order, verify and review test orders for all major test categories (Westbrook et al. 2006). The effect of CPOE on 'within the laboratory' turnaround times, the number of tests requested, and the proportion of clinicians requesting plasma levels of gentamicin and vancomycin who specified blood specimens as peak or trough was investigated. Although the average number of tests ordered did not change greatly, a 21 per cent decrease in within the laboratory turnaround times was observed. There was a significant improvement in the proportion of clinicians who specified blood specimens as peak or trough, from 16 to 73 per cent for plasma levels of gentamicin and from 13 to 77 per cent for vancomycin.

### *Health Informatics Research and Evaluation Unit, University of Sydney*

This QUPP-funded multi-hospital study sought to identify how different levels of electronic decision support (basic, intermediate and advanced) in CPOE systems can improve pathology practice, ordering behaviour and patient outcomes (Health Informatics Research and Evaluation Unit, University of Sydney 2010). One part of the project investigated the effect of CPOE on provision to the haematology department of information about patients' warfarin or heparin treatment when requesting prothrombin time (PT), or International Normalised Ratio (INR), or activated partial thromboplastin time (aPTT). Another part of the project was based in the emergency department of a large metropolitan hospital in Melbourne. It examined the impact of CPOE on ordering of more than three troponin I tests at three different points in system implementation in the period 2000 to 2007.

Following the introduction of CPOE, the proportion of requests that included details of warfarin and heparin treatment when requesting INR or aPTT increased from 3.0 to 3.9 per cent and from 1.9 to 2.6 per cent respectively. A significant reduction in turnaround times was also observed.

In the study that monitored troponin I, the proportion of patients for whom less than three troponin I tests were requested rose from 92.7 to 95.9 per cent of all tests post-implementation and was maintained at 97.4 per cent. There was an associated reduction in mean total costs per patient per admission during the same period.

The studies conducted at Royal Prince Alfred Hospital (Westbrook et al. 2006) and by the University of Sydney QUPP-funded project (2010) showed that implementation of CPOE was associated with improved and more complete test requesting information that would potentially make the test results more clinically relevant to patient medication monitoring and management. Although the studies did not deal with the design of the CPOE systems or any complementary strategies that might explain the observed changes in requesting, the results show that CPOE can have a positive effect on the test requesting process.

### *PathPilot*

The PathPilot project, the QUPP-funded project at Flinders Medical Centre in South Australia, investigated whether the requesting of pathology tests could be improved

by giving clinicians hand-held wireless-enabled personal digital assistants that could be used at the bedside to provide past results, recommend tests, and provide information about overly frequent repeat testing (White et al. 2005). The project was based in three medical wards and the emergency department, and the targets of the intervention were interns, residents and registrars. A survey was conducted of patient records on the selected wards to identify the most common primary and secondary clinical diagnoses. The findings of this were used to develop a clinical problem or diagnosis cascade for display as a single screen on PathPilot. Scrolling permitted viewing of all choices and allowed more than one diagnosis to be selected. Each diagnosis was associated with a set of best-practice pathology tests or panels determined jointly by the heads of general medicine and the pathology service. Clinicians were trained in the use of PathPilot and prepared for the technical and implementation challenges of using a system in development.

PathPilot generated request forms identical to the standard laboratory forms, with software capable of printing the requesting clinician's name, the date of the request, full patient details, the ward, the selected clinical diagnosis or problem, and test codes. Alerts for minimum re-test intervals for tests ordered and performed were initiated, and the user was able to view previous results, to accept deletion of the test or to overrule the deletion. Forms were printed on the ward and signed by the requesting clinician. A mandatory pop-up menu required the clinician to note when the specimen was to be collected. The phlebotomist's identification details and the date and time of collection were subsequently included. Further tests could be added by using an onscreen laboratory menu.

The PathPilot project found that use of the guidelines improved the ordering of tests (White et al. 2005). In the first 12 weeks 85.3 per cent of requested tests met minimum re-test interval guidelines. Compliance with guidelines resulted in 6.9 per cent of requests not proceeding. A limited activity audit found that PathPilot was used to view results 62 per cent of the time, whereas it was used to request tests only 38 per cent of the time (White et al. 2005). Junior medical staff used PathPilot more often than registrars. There was variable use of PathPilot in favour of ward-based workstations for ordering tests at the end of the day, when other functions could be performed concurrently at the workstation.

PathPilot was an ambitious initiative offering a mobile device that would support doctors in generating and pre-populating request forms, support selection of recommended tests, and allow doctors to view test results at the patient's bedside. It was decommissioned several years ago.

### *Padlok*

Padlok, a QUPP-funded project at PathWest's Fremantle Hospital site, was introduced in an effort to resolve the problems of inappropriate re-testing and poorly completed hard-copy request forms (Fremantle Hospital 2005). It was a customised online pathology ordering system with patient information incorporated via an interface to the hospital's patient administration application (which included clinical notes such as diagnosis on admission) and with online access to results. It was not connected to the

laboratory information system and produced a hard-copy request form at ward locations. It became the preferred method of requesting in clinical areas with a regular phlebotomy service and in intensive care units where testing was routine and repetitive. It was less used in the emergency department, where there was no phlebotomy service and the pace of work and slowness of computer log in made it less attractive. Technical and user problems ultimately resulted in only 30 per cent of all requests being generated via Padlok, the remaining 70 per cent continuing to be handwritten. PathWest decommissioned Padlok at the Fremantle Hospital site in 2010 and replaced it with a statewide hospital CPOE system (see below).

The experience with Padlok highlights the risks associated with visionary IT systems that aim to deal with complex problems and that require long-term organisational support and continuing investment of resources in competition with changing or emerging needs amid fluctuating budgetary scenarios and unrealistic expectations of both time frames and what IT systems can deliver.

### *Royal Melbourne Hospital*

The aim of the project at Royal Melbourne Hospital was to implement an electronic pathology requesting system through a new clinical package in the emergency department of one of Australia's busiest hospitals (J Burns, pers. comm., December 2010, July 2011). The system design incorporates advanced decision support, and clinicians can search for pathology tests by name (including many common acronyms and pseudonyms), patient presentation signs and symptoms, preliminary diagnosis and clinical stratification. Incorporation of printed barcodes in request form fields such as patient identifiers and tests requested streamlines the data registration process. The electronically generated request form is printed and forwarded to the laboratory. All pathology requests are automatically recorded at the point of care, aiding clinical follow-up.

### *PathWest*

Western Australia's PathWest began rolling out CPOE to all metropolitan public hospitals in 2007, the first hospital 'going live' in November of that year (K Bayley, pers. comm., January and February 2011; F Brogden, pers. comm., July 2011). Implementation involved customisation of the order entry functionality of the existing clinical information system and the construction of an interface to the laboratory information system. To date, CPOE has been implemented at three major teaching hospitals and is in the process of being rolled out to two other major teaching hospitals; roll-out to a further eight metropolitan and country non-teaching hospitals is being planned. All tests in the catalogue have a minimum re-test interval defined in the system and the construction of order sets appropriate to various clinical settings, as determined by consultation with clinicians to encourage compliance with clinical guidelines. About 70 per cent of inpatient requests are made through CPOE, and 10 per cent of requests are cancelled in response to the re-test interval prompt (K Bayley & F Brogden, pers. comm.). Implementation of CPOE in outpatient clinics has not been as successful, mainly because of the inadequacy of the technical infrastructure. The use of PathWest CPOE in emergency departments has also been problematic: clinicians routinely use a dedicated ED information system because of

the need for them to log in to the general hospital patient information system to place orders. Planning is under way to construct an interface between these two systems and so facilitate use of CPOE.

#### *South Eastern Sydney Illawarra Health*

South Eastern Sydney Illawarra Health implemented CPOE in some 17 hospitals, including seven major teaching hospitals, in a staged program between October 2008 and October 2009 (R Wilson & S Winter, pers. comm., September 2011). In addition to enabling electronic requesting and review of pathology orders, the system offers pre-constructed order sets, re-order interval alerts, test-specific mandatory data collection, and reference text for some orders indicating criteria for appropriateness. More than 90 per cent of inpatient pathology orders are now placed electronically, and there is a growing number of orders from on-site non-inpatient clinics, currently at approximately 40 per cent of orders. In five hospitals the impact of implementation of CPOE on pathology use and patient flows, as well as pathology service levels and operational performance, is the subject of a QUPP-funded study currently being conducted by the Centre for Health Systems and Safety Research in the Australian Institute of Health Innovation at the University of New South Wales (DOHA 2011a; R Wilson & S Winter, pers. comm.). The five hospitals are in different demographic settings (metropolitan, regional and rural) in the South Eastern Sydney and Illawarra Shoalhaven Local Health Networks and are serviced by SEALS (South Eastern Area Laboratory Services).

### 5.5.3 Assessment

In a systematic review of the CPOE literature, Georgiou et al. (2007) found that 11 studies (eight with some form of decision support) investigated the impact of CPOE on test volumes or costs, or both; three showed no change in test volume, one showed an increase, and seven were able to demonstrate a decrease in tests ordered after implementation of CPOE. Five of these studies investigated impacts on costs; four showed significant decreases and the other showed no change. Four studies investigated CPOE with decision support and compliance with testing guidelines; all four demonstrated improved compliance.

CPOE is not a panacea, but it has been shown to be effective in bringing real-time evidence-based decision support to requesting physicians, thus facilitating efforts to manage the demand for pathology. To be successful, CPOE technology needs to be developed to a level of efficiency that is acceptable to users, and until stakeholders accept the investment requirement and the need to adopt coordinated implementation plans, including impact assessment and better research design, take-up of the system will be slow (Doolan & Bates 2002; Georgiou et al. 2010).

The current QUPP-funded project—'The Impact of the Implementation of Electronic Ordering on Pathology Requesting and the Quality and Effectiveness of Hospital Pathology Services: building a robust evidence base and benefits framework for successful eHealth diffusion' (DOHA 2011a)—will contribute to a better understanding of the impact of the application of CPOE systems in hospital pathology settings.

## 5.6 Reimbursement and funding models

The role of reimbursement and funding models in managing the demand for pathology testing does not appear to have been examined to any great degree. Only one study, relating to the transfer of laboratory budgets to requesters, was found; it was conducted in various hospitals in the Netherlands (Janssens 2010).

Efficient pricing of laboratory procedures and framing of rational budgets, which fluctuate according to clinical activity and are held and managed by the clinical units concerned, have been proposed as the most effective mechanism for creating awareness of laboratory request behaviour (Janssens 2010). Experience in several Dutch hospitals where such a system has been in operation for a number of years suggests, however, that although the system functions well, with a decrease in test ordering observed, demand returns to its previous pattern after a few years (Janssens 2009).

## 5.7 Summary

This chapter examines the various sources of evidence available from Australia and overseas on the effectiveness of various types of interventions designed to improve the use of pathology tests by clinicians. The literature suggests that there is no single or consistent definition of 'appropriate' versus 'inappropriate' pathology ordering and that there is no quick or easy pathway to securing improvements in appropriate pathology ordering and use. It highlights the complex interplay of strategies within each type of intervention associated with effective outcomes and those associated with less effective outcomes.

As Fryer and Hanna (2009) observe, the reasons for the ever-increasing clinical laboratory workloads are manifold. The authors emphasise the impact of technology, noting that the more rapidly laboratories produce results the more rapidly the results are required and that rapid result availability gives the impression that tests are easy to perform, with a consequent effect of increased requesting. They also note that, when technology fails and results are not available within the expected fast turnaround time, increased duplicate testing occurs. Further, there is considerable evidence in the literature that a slow turnaround time for pathology results is linked to increased lengths of stay in emergency departments (Lee-Lewandrowski et al. 2003; Holland et al. 2005; Francis et al. 2009).

It is obvious that quality health care would be encouraged if there were a better balanced approach to diagnostic testing. The evidence supports a multifaceted approach as being most likely to achieve this balance.

# 6 Conclusions: lessons learnt and future directions

This project explored, documented and reviewed the efforts made in Australia's public hospitals to better manage demand for and the appropriate use of pathology testing in patient care. The picture emerging from these efforts is assembled in three parts in this report:

- understanding the different approaches taken to considering appropriate and inappropriate pathology ordering in the hospital setting since these are fundamental to the project
- creating a 'snapshot' of current and planned strategies in public pathology services across Australia
- examining the available evidence in relation to the types of interventions and demand management strategies implemented in Australia and overseas and their impact on clinicians' test requesting patterns.

This final chapter brings together the findings of this work in order to present the project's conclusions about lessons learnt and future directions. This assessment draws on the results of a roundtable discussion with representatives of National Coalition on Public Pathology member organisations to 'road test' the project's findings, consider central factors and emerging themes, and identify opportunities for future work, including other analysis and evaluation.

## 6.1 A heterogeneous evidence base

The evidence base assembled for the project was drawn from a mix of sources using a variety of methods. This approach was adopted so as to establish an understanding of the area and associated efforts while recognising the limitations in the available evidence and the exploratory nature of the project.

The evidence spans the spectrum from peer-reviewed published articles and systematic reviews through to anecdotal reports from informants. The identified studies and projects had different aims, study designs, hospital settings, patient groups and measures. The evidence base is thus heterogeneous and varies in quality. As a result, the analysis focused on identifying high-level common themes in relation to successful interventions and strategies, barriers where these have been addressed, and the determinants of success and sustainability.

Some recurring themes emerged that enable broad conclusions to be made about the effectiveness and sustainability of interventions and strategies targeting clinicians' requesting behaviour, as well as shortcomings in the evidence base that warrant redress.

## 6.2 Types of interventions or demand management strategies: effectiveness and sustainability

The evidence supports the use of a multifaceted approach to achieving improvements in appropriate pathology ordering and use. Interventions typically involve a key, or lead, strategy supported by complementary strategies. The strategies fall into five broad categories:

- education, audit and feedback—for example, education programs, guideline dissemination, pre- and post-analytical feedback on test appropriateness, feedback on tests' predictive value and feedback on test costs
- rules and agreements aimed at restricting test requests—for example, re-engineering and implementation of clinical guidelines and pathways, implementation of minimum re-test interval schedules, and linking requesting authority to the seniority of clinical staff (the 'traffic-light' approach)
- re-design of the request form to provide guidance to requesters—for example, providing a list of approved tests that they can circle, tick or order, listing test costs to send a price signal, aligning request forms to modified clinical practice guidelines for test ordering, and unbundling test panels on request forms
- computerised physician order entry systems—includes real-time decision support
- reimbursement and funding models—for example, budget holding by the laboratory, budget holding by the requester, activity-based funding (for example, by diagnosis related group) and budget holding by the regulator.

The amount and quality of the evidence across these five broad categories of strategies vary.

Reimbursement and funding models were not examined to any great degree. In Australia rules and agreements aimed at restricting test requests—especially the use of 'traffic lights' in emergency departments and minimum re-test intervals—have been examined in several public hospitals in a few jurisdictions, often with funding support from the Quality Use of Pathology Program.

Computerised physician order entry systems are a rapidly emerging area of interest, and continued inquiry into optimal design considerations is required to improve clinicians' efficiency and requesting behaviour. Computerisation offers the potential to overcome the human factors influencing the sustainability of interventions, but this will occur only with effective design. Computerisation provides an ideal opportunity at the point of requests being made to support clinicians with real-time decision-support tools, but the great hope of its wide availability continues to be restrained by the under-appreciated complexity of the challenge.

The available evidence suggests that virtually all interventions usually have an immediate and significant impact on ordering patterns; the impact tends, however, to be short-lived. This might reflect, in part, the limited time frame of most published

studies (interventions generally lasting from several months to a year or two) and lack of follow-up on longer term sustainability.

Most interventions have tended to be studied in a particular setting in a single public hospital (for example, emergency departments or pre-admission assessment clinics) or across several hospitals. Applicability is variable and dependent on the setting.

In terms of the five broad strategy categories, this review found as follows:

- Education, audit and feedback constitute an effective demand management strategy, although the effect gradually declines during the period after the intervention.

- In the case of rules and agreements aimed at restricting test requests, minimum re-test intervals are successful in effecting and maintaining a reduction in unnecessary repeat test requests by clinicians, as is evident by the sustainability of the interventions. Traffic-light systems have been effective in targeting the test requesting behaviour of junior doctors in emergency departments, improving the quality of requesting and reducing unnecessary testing, including repeat testing. In the three states and the territory where this system has been implemented the effect has been sustained—between four and 11 years. When clinical guidelines are implemented, senior clinicians are likely to request fewer tests if they have a more direct involvement in planning clinical pathways and in the early stages of the patient's management.

- Strategies involving re-design of the request form to provide guidance to requesters are effective in reducing the use of pathology tests regardless of the purpose, the approach to the re-design process or the format of the re-designed request form. As an overall strategy, re-design of request forms appears to be an effective mechanism for supporting good clinical practice, particularly among inexperienced junior doctors. Questions remain, however, about the impact of price signals (for example, displaying test costs on the request form) on test requesting.

- Computerised physician order entry systems are not a panacea, but they have been shown to be effective in bringing real-time evidence-based decision support to requesting physicians, thus facilitating efforts to manage the demand for pathology. To be successful in this, CPOE technology needs to be developed to a level of utility and efficiency that is acceptable to users. Until stakeholders accept the investment requirement and the need to adopt coordinated implementation plans (including impact assessment and better research design), take-up of the systems will be slow.

- The role of reimbursement and funding models in managing the demand for pathology testing does not appear to have been examined to any great degree: only one study was found. That study dealt with the transfer of hospital laboratory budgets to requesters. Experience in several Dutch hospitals where such a system has been in operation for a number of years suggests that, although the system

functions well, with a decrease in test ordering observed, demand returned to its former pattern after a few years.

Although all strategies appear to have the capacity to deliver success, there is no consensus on a model (or models) for broader adoption in the long term, and sustainability remains problematic. These findings echo those of earlier studies (for example, Lyon et al. 1995; Winkans & Dinart 2002; Durieux et al. 2003).

## 6.3 Success factors

The evidence shows there is no single or easy pathway to achieving sustained improvement in appropriate ordering and use of pathology in the public hospital setting. Success appears to be associated with the interplay of a number of critical factors:

- targeting multiple behavioural factors
- basing models on proven and robust behavioural science principles, using a multifaceted approach
- clinical engagement and ownership at a senior level. Junior doctors might be the primary requesting group in public hospitals overall, but they represent a transient population that rotates through departments at regular intervals and are influenced by the ordering behaviours and requirements (real or perceived) of the senior clinicians in the department in which they are working. Ultimately, clinicians determine the day-to-day care that patients receive. Continuing success requires the active support and participation of senior clinicians and their ownership of initiatives
- clinical 'champions' or lead clinicians to promote the approach
- strategies that are simple and easily integrated into everyday practice. They need to take account of the competing interests and pressures requesting clinicians face in managing individual patients, patient flows and access and achieving an appropriate balance in test ordering and use against a number of other potentially competing factors relevant to the patient's care and/or the culture of the work environment
- adapting strategies to meet local needs and circumstances—for example, in the development of locally adapted evidence-based test protocols.

At the same time, however, some of these critical success factors represent potential threats to sustainability. Reliance on clinical champions brings with it burdens, pressures and problems when the individual is on leave or moves on. Local adaptation can impede wider uptake and adoption and limit the ability to compare results within and across institutions.

These findings suggest that achieving sustainable success and permanent change relies on embedding strategies in the culture of public hospitals and the behaviour of

their clinicians. Pathology services must be involved and participate in these efforts, but the promoters of practice change must be senior clinicians. This highlights the challenge of understanding the types of incentives required to gain clinical ownership and support in order to change practices and cultures in different hospital settings.

## 6.4 Applicability in differing public hospital settings

As this review highlights, Australian public hospitals vary in terms of size, location and types of services provided. They are also complex organisations (Productivity Commission 2009). The project findings suggest that every intervention would require a multifaceted approach and that different elements or areas of emphasis would be required for different hospital settings. This is likely to be the case for different clinical areas within a single large hospital facility, and it is certainly the case across the broad spectrum of public hospitals—for example, large quaternary metropolitan, regional, rural and remote—in Australia. In terms of designing local initiatives, this review identified five categories of interventions from which to draw and apply to local needs, circumstances and conditions. All have the potential to deliver success, although, as noted, their impact tends to be short-lived and depends on local factors and individual champions.

## 6.5 Australian efforts

Although this review found that considerable efforts have already been made to secure improvements in appropriate pathology ordering and use in Australian public hospitals, the overall sense is that such efforts tend to be ad hoc and fragmented. In jurisdictions and institutions where interventions have been successful in changing pathology ordering patterns, there is little evidence of moves to implement the interventions more widely. The survey of current and planned practices found that most public pathology services (75 per cent of respondents) are doing something in this area in the public hospitals they serve and mostly these efforts are led by pathology. The main focus has been on unnecessary frequency and the inappropriate use of expensive tests. The main strategies adopted are education and feedback, minimum re-test intervals and traffic-light systems. The services emulate the strategies reported on in the literature. There is little sharing of results, and nor are there attempts to collect data on a similar basis in order to benchmark practices and so allow broad conclusions to be drawn about the effectiveness of similar strategies employed at different sites or in different settings.

## 6.6 Opportunities for improvement

In considering possible areas for future action, NCOPP looked at where public pathology services might best contribute and add value to building the evidence base and extending the effort to improve appropriate pathology ordering and use in Australia's public hospital sector. This remains an important but challenging area of endeavour in relation to quality patient care, health system efficiency and efficacy, and the economy.

This review's proposed approach is guided by five principles:

- acting on major gaps where pathology services can add value
- promoting a collaborative effort among public pathology services throughout Australia in order to overcome current fragmentation
- targeting efforts to areas where they are likely to have an impact
- identifying factors likely to contribute to sustainability
- supporting the development of a framework that is useful throughout the country and in a variety of public hospital settings.

The primary gaps this review identified relate to the following:

- lack of a single or consistent definition of 'appropriate' versus 'inappropriate' pathology ordering
- lack of consistent measures and data collection to determine baseline levels of pathology ordering and to assess the impact of interventions implemented
- lack of data to guide the selection of which areas to target—particularly across the diverse range of public hospital settings Australia.

Filling these gaps is at the heart of this review's recommended areas of action.

## 6.7 Recommended actions

### 6.7.1 The question of appropriateness: development of a standard national definition of 'appropriate test ordering'

A fundamental difficulty the review grappled with concerns the lack of a single or consistent definition of 'appropriate' versus 'inappropriate' pathology test ordering. Appropriateness is a complex and multifaceted concept. Its meaning depends on the perspectives and perceptions of the adjudicator. The perspectives and perceptions of pathologists, clinicians, patients and funders, for example, might well not be in alignment. This project highlights the need for standard and more objective measures that capture in concrete terms the dynamic clinical management context of an individual patient's episode of care. Most studies and commentaries on inappropriate use of pathology are based on retrospective determinations, in the absence of access to much of the contextual clinical detail and circumstances. This places the conclusions drawn under a cloud, although, notwithstanding this, there is general agreement that both overuse and underuse of pathology investigations occur.

The lack of a standard definition and associated measures makes it difficult to compare baseline levels of pathology ordering and the results of interventions with a view to gaining a clear picture of the effectiveness and sustainability of approaches and providing a guide for broader application of pilot trials and future improvements. With this in mind, the project proposes the following approach.

### *Proposal*

Within a hospital and the entire health care system there are many different settings and circumstances where the ordering of pathology investigations is appropriate. In some instances there might be competing or conflicting perspectives on this. Assessing this topic from the perspective of pathology, and taking into consideration the relevance of pathology tests across the health care spectrum and the continuum of care, this project worked to develop a matrix encapsulating a uniform national definition that could be applied to the assessment of whether a request for any or every pathology test was appropriate. The matrix was developed at the roundtable discussion held as part of this project and is as follows.

#### Matrix for appropriate pathology test ordering

| | **Clinical indications for use** | | | |
|---|---|---|---|---|
| **Purpose of testing** | **Indicated for acute or immediate patient care** | **Indicated as part of a clinical pathway or standard care for patients with the condition** | **Indicated for a public health objective** | **Indicated to assist good patient flows** |
| For diagnosis | | | | |
| For treatment | | | | |
| For monitoring disease or therapy | | | | |
| For assessment of a possible adverse event or side-effect | | | | |
| For exclusion of a possible diagnosis | | | | |
| To assess or manage a comorbidity (separate from main diagnosis) | | | | |
| Screening[a] | | | | |

a. This covers the use of tests for the purpose of 'disease screening'. Formal population-based screening programs are recognised indicators for pathology tests, but generally the tests are not done as part of usual patient management in the public hospital setting. Patients in public hospitals can, however, have pathology tests as part of a comprehensive assessment of factors potentially contributing to a problem or as part of a health check strategy.
Source: Copyright NCOPP 2011.

Essentially, the matrix combines the different purposes of pathology testing with broad clinical indications for use:

- If none of the boxes in the matrix can be ticked, the test should be regarded as inappropriate.
- Similarly, according to the matrix if there is an indication for a test to be done and it is not ordered, this would suggest inappropriate ordering of pathology as a result of failure to order an indicated test.

All future research and audits in Australia should use the matrix to review and assess pathology test ordering and when evaluating interventions in this regard. It might also be useful as an educational tool in an intervention strategy or national guidelines, or both.

Ultimately, appropriate use is about achieving a balance between ordering too little and ordering too much, as well as ordering the right test at the right time. This balance might vary in different settings and at different times. The proposed matrix should, however, cover most or all scenarios. Although it will require further development and testing, it does provide a basis for a standard national definition of 'appropriate test ordering' that can be used in future research and audits throughout Australia.

### 6.7.2 Data collection and benchmarking: development of standard data sets on pathology use

The second area of proposed action concerns having good information about the use of pathology tests in patient episodes of care in Australia's public hospitals in order to better understand current patterns of pathology ordering and variations in usage across the country. Such a data set would provide comparative data for benchmarking, and it would assist in identifying areas that require closer examination in terms of appropriateness and in targeting future quality improvement efforts in a wider range of settings as part of a national framework. The data currently exist, but they are not collated and analysed in any systematic way across public pathology services and jurisdictions. Development of a standard agreed initial data set represents a major step forward.

***Proposal***

With this objective in mind, it is proposed that the initial data set focus on the top 10 to 15 diagnosis related groups for admitted patient services for public hospitals nationally and the top 10 to 15 pathology tests used in public hospitals. As noted in Section 2.8, some 80 routine tests account for 92 per cent of all tests performed by public pathology services and 50 per cent of costs (RCPA Quality Assurance Programs 2011). It is likely that a greater impact on pathology expenditure (at least) will accrue from targeting these high-volume tests, where reductions should be more readily achievable, than from focusing on lower frequency although possibly individually more costly tests.

A standard agreed initial data set could be collated by assessing the top 10 to 15 diagnosis related groups versus the top 10 to15 pathology tests, with each participating National Coalition of Public Pathology member organisation reporting median and interquartile ranges for each test for each DRG. Consideration should also be given to including pharmacy costs and length-of-stay costs or days as other important parameters in order to gain a clear understanding of the potential inter-relationships between the major elements of costs associated with each episode of inpatient care. It is important to examine how pathology investigations contribute to the cost of an entire episode of patient care, as opposed to just considering the cost of the pathology used. There might be circumstances when spending more on

pathology reduces the total cost of an episode of care, for example, through faster identification and attention to clinical problems reducing the length of stay.

### 6.7.3 Electronic health record systems and CPOE systems

It is evident from this report that electronic health record systems and computerised physician order entry systems are a rapidly emerging and evolving area of development and interest in Australian public hospitals and the health system generally. They have the potential to increase the amount and quality of information available on pathology test ordering in patient care and health care generally, as well as to support appropriate use of testing or target interventions. It is important to keep abreast of and participate in these developments and their evaluation.

## 6.8 Concluding remarks

This review shows that there are many strategies that will change the frequency of pathology ordering—particularly when they are used in combination—but sustainability is a major challenge. The cultural behaviour determinants of pathology requesting are often underestimated and are most likely hold the key to long-term success.

There has been much debate about the appropriateness of pathology requesting but very little in the way of robust research methodology and science, and different stakeholders bring quite different perspectives to the matter.

Appropriateness is a complex and multifaceted concept and managing it calls for an understanding of which diverse factors are relevant in any local setting. The approach to ordering pathology can also significantly affect patient flows in busy hospitals as well as individual patients' clinical outcomes. This needs to be considered in any health economic analysis.

Pathology is not an end in itself. It is a crucial input to the clinical management of most patients. Its benefits or otherwise must be considered in the context of the clinical and cost outcomes of the episode of care in which it is used—not in isolation. Information from pathology investigations also helps guide public health surveillance and serves an important health protection function in our communities.

Information technology offers the potential to facilitate management of the use of this valuable resource—particularly by providing tools to give clinicians real-time assistance when requests for pathology investigations are being made—but the design and deployment of such tools are still in their infancy.

This review shows that there is much that can be done to clarify our thinking in relation to appropriate use of pathology and establish some useful baseline data to help better tackle the problem in the future.

One important question concerns identifying which changes in the frequency of pathology ordering frequency will minimise waste without having detrimental effects on patients' health care outcomes or access in Australia's public hospitals.

This report puts forward some constructive suggestions about where and how to start, and members of the National Coalition of Public Pathology are keen to assist in efforts to move ahead.

# Appendix A The Project Steering Committee and Project Team

## Steering Committee

| | |
|---|---|
| A/Professor Roger Wilson (Chair) | Executive Director, South Eastern Area Laboratory Services, New South Wales |
| Professor Leslie Burnett | Consultant Pathologist, Pathology North, New South Wales, and Clinical Professor, Pathology, University of Sydney |
| Dr Andrew Francis | Deputy Director, Pathology Queensland |
| Dr Dominic Mallon | Chief Pathologist, PathWest, Western Australia |
| Professor Paul Monagle | Haematologist, Royal Children's Hospital and Royal Women's Hospital, Victoria, and Professor and Stevenson Chair, Department of Paediatrics, University of Melbourne |
| Professor Julia Potter | Executive Director, ACT Pathology |
| Professor Ruth Salom | Executive Director, SA Pathology |
| Ms Penny Rogers | Chief Executive Officer, National Coalition of Public Pathology |

## Project Team

| | |
|---|---|
| Ms Tatiana Utkin | Project officer and research services, 27 September 2010 to 15 April 2011 |
| Dr Darryl Nichol | Technical advisor |
| Ms Alison Koschel, Alik Consulting | Literature search services |

# Appendix B Participating organisations and individuals

## Organisations

ACT Pathology

Alfred Pathology Service, Victoria

Austin Pathology, Victoria

Australian Commission on Safety and Quality in Health Care

Australian Government Department of Health and Ageing

Bendigo Pathology, Victoria

Department of Pathology, Peter MacCallum Cancer Centre, Victoria

Eastern Health Pathology, Victoria

Goulburn Valley Health Pathology Service, Victoria

Laboratory Services, The Royal Children's Hospital and Royal Women's Hospital, Victoria

Melbourne Health Pathology, Victoria

National Institute of Clinical Studies, National Health and Medical Research Council

National Prescribing Service Ltd

Northern Tasmania Pathology Service, Launceston General Hospital, Tasmania

Northern Territory Government Pathology Service

Pathology Associations Council

Pathology North, New South Wales

Pathology Queensland

PathWest Laboratory Medicine, Western Australia

Royal College of Pathologists of Australasia

Royal Hobart Hospital Pathology Service, Tasmania

SA Pathology, South Australia

South Eastern Area Laboratory Services, New South Wales

Southern Health Pathology, Victoria

Sydney South West Pathology Service, New South Wales

Western Pathology Cluster, New South Wales

## Individuals

Kathy Bayley, PathWest, Western Australia

Maria Bisignano, Melbourne Health, Victoria

Frances Brogden, PathWest, Western Australia

James Burns, Melbourne Health, Victoria

Matt Ford, Pathology Queensland

Andrew Georgiou, University of New South Wales

Tony Ghent, Clinical and Statewide Services Division, Queensland Health

Charmaine Gray, ACT Pathology

Aine Heaney, National Prescribing Service

Scott Jansson, Melbourne Health Pathology, Victoria

Rakesh Kumar, University of New South Wales

Ross MacPherson, Royal North Shore Hospital, New South Wales

Yusef Nagree, Fremantle Hospital, Western Australia

Aabha Sharma, Royal Devon and Exeter Hospital, United Kingdom

Peter Stuart, Modbury Hospital, South Australia

Graham White, Flinders Medical Centre, South Australia

Roger Wilson, South Eastern Area Laboratory Services, New South Wales

Simon Winter, South Eastern Area Laboratory Services, New South Wales

# Appendix C The literature search strategy

The literature review involved a search of electronic databases, hand searches of reference lists of retrieved articles, searches of relevant medical colleges' websites and personal communication with experts.

The search focused on studies published in the English-language literature since 1995 and was performed between 6 and 9 November 2010. Initial searches were made using the following:

- annual reviews
- BMJ Publishing Group
- Cambridge University Press
- CRC Press
- directory open access journals
- EBSCOhost (Academic Search Premier—CINAHL)
- Elsevier (Scopus)
- Informa pic
- Informit
- Massachusetts Medical Society
- Ovid (Medline ISI)
- Oxford University Press
- Wiley Inter Science
- Web of Science (ISI)
- PsycINFO (CSA)
- PubMed.

Articles excluded after the initial search dealt primarily with the following:

- interventions in general practice, community or family settings, or private hospitals
- quality assurance processes in laboratories, including pathology reporting
- restructuring of pathology services
- turnaround times for results
- point-of-care testing
- managed care in the United States because of the differences between our health systems.

In addition to searching electronic databases, checking the websites of professional medical colleges and personal communication with experts, reports on projects funded by the Department of Health and Ageing under the Quality Use of Pathology Program were examined. These are included in the reference list at the end of this report. Additional relevant articles were identified by following references cited in publications found as a result of the initial search.

A survey instrument was designed and distributed to all National Coalition of Public Pathology member organisations to enable a situational analysis of efforts to manage demand and encourage appropriate use of pathology services.

It was recognised that many initiatives implemented in Australian public hospitals are generally focused on local concerns such as business imperatives, safety and quality, and clinical effectiveness and efficiency improvements. In this context little consideration appears to be given to sharing information or reporting the success or failure of initiatives more broadly, the latter possibly being discouraged because failure is associated with the wasting of public resources. As a consequence, it is possible that self-selection could showcase only successful interventions and introduce bias into the analysis.

The challenge for this project was to encourage as much participation and disclosure as possible about interventions in hospitals and their impact. This was approached through the high-level demand management survey of NCOPP member organisations. The high response rate (95 per cent) validated the approach.

Informants who provided insights to this project are commonly proponents of particular views in relation to intervention projects or initiatives, and their input can be biased. Despite this, in the context of a health services research approach, their views constitute a level of evidence that is valid.

The methodology used to identify and analyse the evidence reflects a health services research approach spanning the hierarchy of evidence, from peer-reviewed articles to anecdotal evidence from interested parties. With such a broad spectrum of material and sources, the challenge was to identify and draw together common themes and to analyse all sources of evidence for any convergence of these themes.

# Appendix D The survey instrument

As part of the project the National Coalition of Public Pathology surveyed its member organisations in order to gain a clear picture of current efforts aimed at managing the demand for and encouraging appropriate use of pathology services in Australia's public hospitals. The survey instrument was as follows.

As part of undertaking this project, NCOPP is conducting a situational analysis of current demand management strategies for pathology services in Australia's public hospitals. For the purposes of this project, demand management strategies refer to actions that are being taken to address inappropriate ordering of tests. We are adopting a combined approach to gathering this information.

- One involves a review of studies and initiatives that have been undertaken in public hospitals including through a literature search for published articles and other publicly available reports—this is already underway.

- The other is to tap into pathology departments' demand management practices in place as part of running their laboratory and consultation services within public hospitals.

We are interested in learning about the demand management efforts of your pathology service to enable us to understand the diversity and similarities in practices nationally, their evidence base and their effectiveness. NCOPP has prepared a survey to help you provide the information we need to progress this project and we thank you for taking the time to complete it. You can do this directly, or alternatively, a member of the project team can help you complete the form. Please forward any queries and the completed form to ..... at ..... and/or telephone ..... to arrange for assistance with completing the form.

Your contribution is valuable to us and will be used in considering possible directions of managing demand for pathology into the future.

| | |
|---|---|
| 1. We would like to know about demand management strategies for pathology services in your laboratory | **PLEASE CIRCLE RELEVANT RESPONSE(S) eg (a) THAT APPLY TO YOUR PATHOLOGY DEPARTMENT**<br>Does your pathology department have any current demand management strategies?<br>a) none planned<br>b) contemplated but not yet started<br>c) currently being planned<br>d) currently being implemented<br>e) implemented since (date) .....<br>f) implemented and reviewed (date reviewed) .....<br>g) multiple cycles of implementation and review (how many cycles) ..... |

| | |
|---|---|
| 2. If you are planning or have demand management strategies in place was this the result of: | a) mutual agreement between pathology and its clinical clients<br>b) directive from management<br>c) other—please provide details<br>If (b) did the directive come from (circle all that are applicable):<br>a) pathology management<br>b) clinical users of the pathology service<br>c) hospital/health unit management unit (eg finance department)<br>d) other—please provide details |
| 3. Problem(s) being addressed by your strategies | a) inappropriate test(s) selected for clinical indications (safety, quality & cost)<br>b) unnecessary frequency of testing (safety, quality & cost)<br>c) inappropriate use of expensive tests (quality & cost)<br>d) emerging new diagnostically useful tests not yet listed on CMBS (quality & cost)<br>e) patient details incomplete on request form (safety)<br>f) patient's clinical notes accompanying pathology request non-existing or incomplete (safety & quality)<br>g) overall cost pressures<br>h) other—please provide details |
| 4. Indicate the range of strategies your pathology department has put in place in your laboratory to manage demand for pathology services. Please circle all that apply to your pathology department | a) education activities for requesters of pathology<br>b) pre-analytical feedback on appropriateness of test requested<br>c) post-analytical feedback on appropriateness of test requested<br>d) restricted ordering of tests based on medical staff seniority (ie traffic light)<br>e) minimum re-test intervals for selected tests/panels<br>f) electronic order entry<br>g) computerised generation of pathology test request form<br>h) computer assisted decision-making<br>i) reduced test turnaround time<br>j) on line-access to test results<br>k) reporting test cost to send a price signal to requesters<br>l) any other—please provide details |
| 5. What is the evidence base for the demand management strategies implemented by your pathology department? | a) published studies<br>b) commonsense<br>c) good management<br>d) good faith principles<br>If (a) please provide references if possible |
| 6. Who are the key targets of your education activities? | a) medical students<br>b) junior doctors<br>c) registrars<br>d) consultants<br>e) nurses<br>f) others—please provide details |

| | |
|---|---|
| 7. Are your demand management strategies focused on particular locations of the hospital? | a) emergency department<br>b) medical wards<br>c) surgical wards<br>d) outpatient departments<br>e) all of the above<br>f) other—please provide details |
| 8. Measures you use to monitor the success of your demand management strategy for pathology services | a) number of participants in education sessions<br>b) number of pre-analytical feedback sessions provided on appropriateness of test/panel requested<br>c) number of post-analytical feedback sessions provided on appropriateness of test/panel requested<br>d) number/proportion of non compliance with 'traffic light' request schedules<br>e) number/proportion of non-compliance with minimum re-test intervals for selected tests/panels<br>f) number/proportion of incomplete request forms for patient details, clinical information<br>g) number of hand written pathology request forms where computer assisted ordering is available<br>h) proportion of test results accessed on line<br>i) measures of test volumes pre and post interventions<br>j) measures of costs of selected tests/panels over time pre and post interventions<br>k) adverse events for patients<br>l) other—please provide details |
| 9. Overall how effective have your strategies been in positively changing demand for pathology in your hospital? | a) very effective<br>b) moderately effective<br>c) unchanged<br>d) moderately ineffective<br>e) very ineffective<br>Optional comment: |

10. Please indicate the effectiveness of each demand management strategy you indicated that you have in place in Q4 above & how you know this

| **Strategy** | **Effectiveness of strategy** | **How do you know the relative effectiveness of the strategy?** |
|---|---|---|
| (a) education activities for requesters of pathology | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |

| | | |
|---|---|---|
| (b) pre-analytical feedback on appropriateness of test requested | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (c) post-analytical feedback on appropriateness of test requested | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (d) restricted ordering of tests based on medical staff seniority (ie traffic light) | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (e) minimum re-test intervals for selected tests/panels | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (f) electronic order entry | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (g) computerised generation of pathology test request form | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (h) computer assisted decision-making | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |

| | | |
|---|---|---|
| (i) reduced test turnaround time | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (j) on-line access to test results | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (k) reporting test cost to send a price signal to requesters | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |
| (l) any other—please provide details | a. very effective<br>b. moderately effective<br>c. unchanged<br>d. moderately ineffective<br>e. very ineffective | |

| | |
|---|---|
| 11. From your experience, what are the critical success factors (ie essential pre-conditions to have in place) for the demand strategies you are implementing? | a) laboratory staff buy-in<br>b) clinician agreement of problem(s)<br>c) clinician involvement in development of strategies<br>d) clinical champions<br>e) clinician acceptance of strategies to manage demand for pathology services<br>f) senior hospital administration/Executive recognition of need for demand management strategies & support for action<br>g) adequate resources to implement strategies<br>h) consensus between clinicians & pathologists on minimum re-test intervals<br>i) a strong evidence base for selecting & limiting use of tests<br>j) restrictions on requesting of tests known to be of limited value in certain clinical presentations<br>k) organisation wide information system (IT)<br>l) measures to track effect of strategies to manage demand for pathology services<br>m) regular audit & timely feedback to clinicians on their pathology requesting behaviour<br>n) other—please provide details: |

| | |
|---|---|
| 12. Does your pathology department have any control over the acquisition and operation of point of care instrumentation in your hospital? | (a) yes<br>(b) no<br>If yes please elaborate: |
| 13. Are you aware of any leakage to point of care testing as a consequence of your laboratory's demand management strategies? (*this is in response to concerns that EDs may be circumventing initiatives to manage demand for tests by purchasing their own Point of Care Testing instruments)* | a) yes<br>b) no |
| **Is there a person we may contact to follow up on any issues that may arise from the completed survey?** | **Name:**<br>**email:** |

THANK YOU

# Appendix E The roundtable discussion

On 24 May 2011 a roundtable discussion was held with representatives of NCOPP member organisations to review project findings and consider future directions. The workshop aimed to 'road test' the project's findings and to consider core issues, emerging themes and opportunities for future work. The roundtable deliberations helped shape the project's conclusions, as presented in Chapter 6.

## Participants

Twenty-five representatives of public pathology services across Australia participated in the roundtable discussion:

| Participant | Organisation |
|---|---|
| Kathy Bayley | PathWest, Western Australia |
| Stephen Braye | Pathology North, New South Wales |
| Wade Clarkson | Northern Tasmania Pathology Service, Launceston General Hospital |
| Trevor Cobain | South Eastern Area Laboratory Services, New South Wales |
| Nick Crinis | Austin Pathology, Victoria |
| Darren Croese | Pathology North, New South Wales |
| Joe D'Agostino | Alfred Pathology Service, Victoria |
| Andrew Francis | Pathology Queensland and Project Steering Committee member |
| Tony Ghent | Pathology Queensland |
| Charmaine Gray | ACT Pathology and NCOPP councillor |
| Bob Heddle | SA Pathology, South Australia |
| Scott Jansson | Melbourne Health Pathology, Victoria, and NCOPP President |
| Tom Kennedy | Pathology North, New South Wales, and NCOPP councillor |
| Jerry Koutts | Pathology West, New South Wales, and NCOPP councillor |
| Michael Lynch | Northern Territory Government Pathology Service and NCOPP councillor |
| Gary Ma | Pathology West, New South Wales |
| Dominic Mallon | PathWest ,Western Australia, NCOPP Vice President and Project Steering Committee member |
| Katherine Marsden | Royal Hobart Hospital Pathology Service, Tasmania |
| Paul Monagle | The Royal Children's and Women's Hospitals Laboratory Services, Victoria, and Project Steering Committee member |
| Vicki Pitsiavas | Pathology West, New South Wales |
| Chris Rebeiro | Eastern Health Pathology, Victoria |
| Penny Rogers | NCOPP Chief Executive Officer |
| Wyndham Timmins | Sydney South West Pathology Service, New South Wales |
| George Streitberg | Southern Health Pathology, Victoria |
| Roger Wilson | South Eastern Area Laboratory Services, New South Wales, NCOPP immediate past president and Chair of Project Steering Committee |

## Agenda

The agenda for the day was as follows:

**Encouraging Quality Pathology Ordering in Australia's Public Hospitals Project**

A Project Funded under the Australian Government's Quality Use of Pathology Program

Roundtable Discussion

Tuesday, 24 May 2011
9.30am – 3.30pm

Mascot B Room
The Stamford Plaza Sydney Airport Hotel
Cnr Robey & O'Riordan Streets Mascot NSW 2020

**Agenda**

| | |
|---|---|
| 9.00am | Pre Meeting Coffee and Tea<br>Served in foyer outside meeting room |
| 9.30am | Welcome, Introductions and About the Day<br>Scott Jansson, NCOPP President |
| 9.40am | Setting the Context for the Project<br>Penny Rogers, NCOPP Chief Executive Officer |
| 9.50am | The Question of Appropriateness<br>Roger Wilson, Chair of Project Steering Committee with discussion to follow |
| 10.10am | The Evidence Base: What It Is and What it Says<br>Roger Wilson with discussion to follow |
| 11.00am | MORNING TEA |
| 11.15am | Discussion: Break Out Groups Session<br>Participants will be allocated to one of four groups and given some questions to consider in light of preceding presentation |
| 11.45am | Reports from Groups |
| 12.15pm | Core Issues and Determinants of Successful Development and Implementation in Different Public Hospital Environments<br>Views of break out groups, what the project has found and considering similarities and differences<br>Led by Dominic Mallon, NCOPP Vice President & Project Steering Committee Member, and Roger Wilson |
| 1.00pm | LUNCH |
| 1.40pm | Open Forum: Facilitated Discussion<br>On some key questions, where to target efforts, future opportunities and directions<br>Led by Dominic Mallon & Roger Wilson |
| 2.30pm | Panel Discussion: Reflecting on Key Themes and Messages of the Day and for the Project<br>Including Project Steering Committee Members Andrew Francis, Dominic Mallon & Roger Wilson, Scott Jansson and others |
| 3.15pm | Closing Remarks<br>Scott Jansson & Roger Wilson |
| 3.30pm | Afternoon Tea and Post Roundtable Discussion |

# Shortened forms

| | |
|---|---|
| ACT | Australian Capital Territory |
| AIHW | Australian Institute of Health and Welfare |
| aPTT | activated partial thromboplastin time |
| CPOE | computerised physician order entry |
| COAG | Council of Australian Governments |
| DOH | Department of Health, United Kingdom |
| DOHA | Department of Health and Ageing, Australia |
| DRG | diagnosis related group |
| ED | emergency department |
| ID | identification |
| INR | International Normalised Ratio |
| IT | information technology |
| KIMMS | Key Incident Monitoring and Management System, RCPA Quality Assurance Program |
| MBS | Medicare Benefits Scheme |
| NCOPP | National Coalition of Public Pathology |
| NHHRC | National Health and Hospitals Reform Commission |
| NHMRC | National Health and Medical Research Council |
| NPS | National Prescribing Service Ltd |
| NSW | New South Wales |
| NT | Northern Territory |
| PathWest | PathWest Laboratory Medicine, Western Australia |
| PT | prothrombin time |
| PUMP | Pathology Utilisation Medical Project, Queensland |
| Qld | Queensland |
| QUPP | Quality Use of Pathology Program |
| RCPA | Royal College of Pathologists of Australasia |
| SA | South Australia |
| Tas | Tasmania |
| UK | United Kingdom |
| US | United States |
| Vic | Victoria |
| WA | Western Australia |

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# Pathology

Pathology is the branch of medicine concerned with measurement and assessment of patients' samples. Doctors who have ordered tests receive reports offering expert interpretation of the test results relevant to each patient's clinical presentation; in this way the doctors gain greater insight into the nature and impacts of disease processes and an objective framework for their clinical decision making.

An ever-growing clinical knowledge service, pathology continues to expand our understanding of diseases and provide new opportunities for patients through more accurate diagnosis and better targeted therapies. It is fundamental to good medical practice and central to the quality and cost-effectiveness of our health care system.

Publicly owned and operated pathology services in each state and territory support public hospitals and clinical practice in Australia. The National Coalition of Public Pathology is the organisation that represents Australia's public pathology services.

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