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Identifying key attributes that requestors associate with quality in public-hospital pathology: a qualitative study

Louise Anne Wienholt

University of Wollongong

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Identifying Key Attributes that Requestors Associate with Quality in Public-Hospital Pathology: A Qualitative Study.

Louise Anne Wienholt

This thesis is presented as part of the requirements for the award of the Degree of Doctor of Business Administration (DBA) at the Sydney Business School, University of Wollongong.

December 2013
ABSTRACT

This thesis examines service quality in a pathology laboratory at a large metropolitan public teaching hospital. The objective for this study was to clarify the nature of quality and value in public-hospital pathology and understand how these constructs relate to satisfaction.

A modified conceptual framework was developed from the literature, and interpretative phenomenological methodology was used to identify the dimensions that physicians associate with quality. As part of this, satisfaction with service accuracy and overall quality was also measured.

In-depth semi-structured interviews were conducted with 21 physicians from 13 clinical specialities, using purposive sampling. Analysis using dual text mining software (NVivo and Leximancer) identified dimensions relating to service delivery as the most important construct in the overall assessment of quality. The most significant attributes associated with the provision of quality service included: timeliness, reliability and accuracy of results and open lines of communication between the laboratory and the requestor.

All clinicians highly valued the reliability of results at the study site; however, most had a lower assessment of the overall quality of the service. Factors associated with pre- and post-analytical components of testing featured highly in the overall assessment of quality, as well as perceptions of poor service. Communication was a key service element that was shown to encompass many aspects of quality service; however, the two mostly frequently identified themes that were shown to be important to requestors were an accessible, easily used electronic interface and the rapid communication of significantly abnormal patient results.

The results of this study highlight a disconnection between the analytical and functional service quality in public pathology provision. In light of this research it is evident that pathology services must view quality as consumers do. From this, it can be concluded that laboratory quality assurance must encompass all activities from the moment a clinician orders a pathology test until the result is received.
PREFACE AND AUTHOR DECLARATION

This thesis, which fulfils the requirements for the award of Doctor of Business Administration, in the Sydney Business School, University of Wollongong was carried out personally by the author between March 2008 and December 2013 unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

All coursework for this degree was completed between March 2008 and December 2011.

Presentations, publications and awards arising from this research include:


- **Winner of the Outstanding Paper Prize** HDR Student Conference 2012, Sydney Business School, University of Wollongong.

- **Wienholt L.** Methodologies of Soliciting Customer Feedback in Clinical Hospital Staff: An Analysis of the Literature HDR Student Conference 2011, Sydney Business School.


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BSc (Biomedical), MScMed

17th December, 2013
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## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>DBA</td>
<td>Doctor of Business Administration</td>
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<tr>
<td>EHR</td>
<td>Electronic health record</td>
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<tr>
<td>EMR</td>
<td>Electronic medical records</td>
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<tr>
<td>GDP</td>
<td>Gross domestic product</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>LIS</td>
<td>Laboratory Information Systems</td>
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<tr>
<td>MBS</td>
<td>Medicare Benefits Schedule</td>
</tr>
<tr>
<td>NATA</td>
<td>National Association of Testing Authorities</td>
</tr>
<tr>
<td>NHMD</td>
<td>National Hospital Morbidity Database</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>RCPA</td>
<td>Royal College of Pathologists of Australasia</td>
</tr>
<tr>
<td>TAT</td>
<td>Turnaround time</td>
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<td>WHO</td>
<td>World Health Organization</td>
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CHAPTER 1

INTRODUCTION
1.1 Introduction

This thesis is presented for award of Doctorate of Business Administration (DBA). The DBA is a professional doctorate for managers or management specialists that will aid in their professional development (Perry & Cavaye 2004). In this context, the emphasis of the dissertation is on the managerial implications of what the research project has found (Bourner, Ruggeri-Stevens & Bareham 2000).

According to Perry and Cavaye (2004), a DBA should address four main criteria:

- considers what practitioners and others have already learnt and written about the practice;
- explains how ideas in the report are related, as a basis for predictions made in the report;
- explains how processes were carried out to execute the research and prepare the report, so that other practitioners can learn about them and/or verify them; and
- develops implications for other managers in other firms in other industries.

Using the above criteria, this thesis examines the provision of pathology testing with the aim to identify the factors that consumers (in other words, clinicians working at a metropolitan teaching hospital) associate with quality in the delivery of this service. Despite a large body of literature relating to service quality in healthcare settings, there is a paucity of research examining clinicians’ satisfaction with the allied services they use (Forsman 1996).

This study is timely considering the changes that are taking place within the Australian healthcare system. The introduction of the electronic medical record, which will see patients have access to their own pathology results, will have widespread ramifications for providers of health services, especially pathology services, who will have to consider the direct provision of results to patients as a potential service module. To maintain competitiveness in the changing health market, pathology providers will have to be strategic in the way that they interact with clients, and potentially patients, to ensure these consumers’ needs are met. This can only be achieved if pathology providers acknowledge that customer service is multifactorial and often varies depending on their consumer base. This study represents an attempt to resolve this issue.
in one public tertiary referral hospital, and thus gain insights into deficiencies in the service and opportunities for improvement.

The concepts of service quality and customer satisfaction are well established in service industries, and are often seen as an important and necessary component of perpetual quality management. Recently these theories have been extrapolated into healthcare settings. While this will be explored in the following chapter, it is evident that these analyses are predominately related to patient-feedback mechanisms, and that there exists a paucity of literature on the topic of the current study.

1.2 Background

The purpose of this section is to give a background to the research topic and to contextualise the provision of pathology services within the global and national healthcare market. This section also examines the definition of pathology services and outlines the various governing and accrediting bodies that influence the provision of this service.

1.1 Health in the Global Market.

Healthcare creates a supplier-induced demand. The better the healthcare and the more accessible the service, the more the service is used by the consumer. As a result, medical care has become the most integral, commonly used and expensive public service in developed countries. The World Health Organization (WHO) estimates that the cost of healthcare increased from 8% to 8.6% of the world’s gross domestic product (GDP) between 2000 and 2005. This figure, adjusted for inflation, represents a 35% growth in the world’s expenditure on health over that five-year period, equating to an average US$330 billion increase each year (World Health Organization 2009).

This escalating economic burden has prompted government agencies and other stakeholders to reassess spending and justify increased costs, which in recent times have not necessarily equated to an increasing health benefit (Donabedian 2005). Throughout the late 1990s and early 2000s literature relating to the implementation of cost-cutting strategies and management tools in hospital and healthcare systems grew considerably. Methodologies and organisational strategies such as “six-sigma quality” and “lean
techniques” became popular means of improving productivity in healthcare services while reducing costs (Chassin 1993; Buck 1998; Womack & Miller 2005).

The main difficulty or deterrent in using many of these business tools is the unquantifiable nature of health. In a system where no two patients are exactly the same and treatment depends solely on clinical decision-making, assessing what constitutes best practice and identifying opportunities for the improvement and assessment of outcomes is at best subjective. Consequently, there remains intense and divided debate over the best methodologies for quality-management activities and cost-reduction strategies in health services.

1.2 Health in the Australian Market

Consistent with the global phenomenon, Australia has also seen a substantial increase in the demand for healthcare. A report by the Australian Institute of Health and Welfare shows total health expenditure in Australia in 2007-8 was $104 billion, representing 9.1% of GDP (Australian Institute of Health and Welfare 2009b). This report also shows that the average annual growth in health expenditure for the decade ending 2008 was 5.2%, compared with an average growth in GDP of 3.5% per annum. This has had a significant impact on State and Territory as well as Federal Government policy and expenditure, especially considering the low rate of private health coverage, with 57% of Australians relying solely on government-funded facilities (Armstrong, Gillespie et al. 2007).

New South Wales (NSW) provides Australia’s largest state health system consisting of 235 hospitals and public nursing-home facilities, along with many community-based programs and services across the state. Health is also the largest portfolio in the state budget, accounting for approximately 27% of expenditure (Australian Institute of Health and Welfare 2009b).

In 2004-2005 health expenditure accounted for $9.97 billion of the NSW state budget, an increase of 7.6% from 2003-2004 and a 106% increase since 1995-1996 (Australian Bureau of Statistics 2006). Escalation indices have shown that costs for health in NSW have risen an average of 4% per year since 2002 (NSW Health 2003); a trend that is predicted to increase over the coming two decades.
1.3 Definition and the Process of Pathology Testing

Pathology and the delivery of in-vitro diagnostics have become an integral part of medical care in modern medicine both for the diagnosis and monitoring of disease states. In the literature the term “pathology” can refer to both a disease state and the service provided for assessing disease states. This study therefore refers to “pathology” as the performance of diagnostic laboratory tests and “pathology services” as the laboratories or organisations that provide this service.

The Pathology Services Accreditation Act (1984) (Cwlth) defines a pathology service as “A service in which human tissue, human fluids or human body products are subjected to analysis for the purposes of prevention, diagnosis or treatment of disease in human beings and includes any premises from which a service is conducted.”

The process of diagnostic pathology testing is composed of multiple steps that begin when a physician requests the test, and concludes with the receipt and actioning of the patient result (Figure 1.1). Lundberg (1998) identified five phases involved in the testing cycle for diagnostic pathology:

1. Preparatory: Determining to test and choosing the specific test.

2. Pre-analytic: Procuring and transporting the specimen.

3. Analytic: Processing and interpreting the specimen.

4. Post-analytic: Reporting the test results.

5. Clinical implementation: Acting upon the test results.
Automation of pathology services has grown exponentially in the last two decades, with most laboratories now relying on electronic modes of ordering, resulting and reporting pathology through the use of Laboratory Information Systems (LIS). These systems are complex and include automated processes that interface with host information systems, other integrated clinical information systems and electronic medical records (EMRs) (Harrison & McDowell 2008). A LIS can be seen as the link between requestors, medical scientist or technicians, laboratory analysers and test results.

### 1.4 Accreditation and Funding of Pathology Services in Australia

In Australia, pathology testing is performed in a mixture of privately owned and government (public) laboratories, which are accredited for medical testing by the National Association of Testing Authorities (NATA) in conjunction with the Royal College of Pathologists of Australasia (RCPA). Through a Memorandum of Understanding with the Commonwealth Government, NATA is the sole national accreditation body for establishing and maintaining competent laboratory practice.
Accreditation is gained through formal inspection whereby the laboratory is certified against the ISO Standard 15189 (International Organization for Standardizations 2012) “Medical laboratories - Particular requirements for quality and competence”. Only laboratories holding medical-testing accreditation are eligible to claim Medicare rebates for eligible pathology tests.

Funding of pathology services is predominately rebated through the Australian Medicare Program. Conditions relating to provision of services, as outlined in Note p1.1 of the Medicare Benefits Schedule (MBS) (Australian Government Department of Health 2012), are as follows:

(i) The service must be provided by or on behalf of an approved pathology practitioner.
(ii) The service must be provided in a pathology laboratory accredited for that kind of service.
(iii) The proprietor of the laboratory where the service is performed must be an approved pathology authority.
(iv) The approved pathology practitioner providing the service must either be the proprietor of the laboratory or party to an agreement, either by way of contract of employment or otherwise, with the proprietor of the laboratory in which the service is provided.
(v) No benefit will be payable for services provided by an approved pathology practitioner on behalf of an approved pathology authority if they are not performed in the laboratories of that particular authority.

The combination of policy, accreditation and national funding arrangements are a means to ensure that the majority of pathology tests performed in Australia are freely available to patients, and are carried out by experts in a manner that ensures safety and quality (Isouard 2013). However, an unintended consequence of these regulations is that the actual attributable cost of pathology services is not a consideration in the utility of pathology ordering, as neither the clinician nor the patient directly pays or has any awareness of the cost of services rendered (Bates, Winkelman, Brennan et al. 1997).
This in turn has widespread implications in ordering patterns and the potential for over-ordering, considering the requestor has little incentive to reduce the number of tests requested per patient (Gopal Rao, Crook & Tillyer 2003). This, and the market forces that influence the increasing demand for pathology testing will be discussed in the following sections.

1.5 Diagnostic Pathology in Australia

Approximately half of Australians have at least one pathology test each year (Statistics 2011), 70% of which are ordered by general practitioners (GPs) (Britt & Miller 2009). In the 2011-12 financial year at least 79 million pathology tests were performed and rebated through the MBS (Australian Government Department of Human Services 2012). However, this is an underestimation of total pathology tests, due to coning (MBS limitations pathology on specific item numbers that can be claimed per episode of care) and the fact that each MBS pathology item number can represent a group of pathology tests.

In the community (that is, outside hospitals), pathology services are dominated by a few large companies, which coordinate delivery from medical practices or pathology collection centres to centralised testing laboratories for analysis. More than 80% of pathology requested by GPs is conducted are owned by one of Australia’s four major pathology companies (KPMG 2006). Unlike many international healthcare systems, such as those of the United Kingdom and Canada, where pathology laboratories are often affiliated with public hospitals, in Australia the pathology sector “is much more heavily for profit and more tightly integrated into primary care” (Studdert, Britt, Pan et al. 2010).

Approximately 40% of pathology is performed in the public sector, which includes public hospital services, reference laboratories and other affiliated laboratory specialities including transplant, neonatal and genetic services (Isouard 2013). Due to the differing workload, structure and operational objectives, public-health pathology services will be the focus of this review.
1.6 The Utility of Diagnostic Pathology in Australia

Even more than most other health services, increasing costs of pathology testing are an international phenomenon, rising between 5 and 10% per year (Gopal Rao, Crook et al. 2003). This is also true of pathology request patterns in Australia. In the 2000-01 financial year, the cost of pathology services to the MBS was $1.2 billion, compared with $1.9 billion in 2007-08, an increase of 62.2% (Australian Government 2009b). In 2007 pathology accounted for 34.4% of all Medicare services and 14.5% of all Medicare payments (Department of Human Services 2012). The increase in the use of pathology tests in Australian has outstripped the growth of most other medical activity. Despite this, many authors have shown this has not equated to an increase in measurable health benefit, and most of the time testing appears to be unnecessary (Tierney 1996; Bates, Winkelman, Brennan et al. 1997).

Both the underuse and overuse of diagnostic tests have important implications for health outcomes and costs, and the mechanisms to achieve optimal use of diagnostic tests in clinical practice remain elusive (Roshanov, You, Dhaliwal et al. 2011). A number of factors have been implicated in provoking increasing ordering rates including: the ageing population, increases medical technology and accessibility to health care, the ease of ordering pathology tests, increasing follow-on testing and changes in medical training for new clinicians.

1.6.1 The Ageing Population

In 2000 the average worldwide population in developed countries of people over 65 was estimated to be 420 million, a 9.5 million increase from the preceding year (Kinsella & Velkoff 2001). This is a trend that is expected to escalate for the foreseeable future. By 2030, the number of person over 65 in developing countries is projected to almost triple from that in 2000 (Goulding, Rogers & Smith 2003). This increase is primarily attributed to two factors: a decrease in fertility rates and an increasing in life expectancy, which has seen the average lifespan in developing countries increase from 49 years to almost 80 years from 1900 to 2000 (Kinsella & Velkoff 2001).

As people age there is a greater need for, and dependence on, healthcare. It can be shown that the cost of healthcare for persons aged over 65 is three to five times higher
than the cost for those under 65 (Goulding, Rogers & Smith 2003). This change in the epidemiology of populations has, and will continue to have, huge implications for the demand for healthcare and consequently, pathology services. This is especially true for the significantly prolonged survival of patients with previously untreatable diseases, who require more pathology tests to monitor their disease status and response to treatment.

1.6.2 Advances in Medical Testing and Accessibility to Healthcare

The many advances in medical technology over last the 100 years have led to a rise in healthcare costs both internationally and within Australia (Armstrong, Gillespie, Leeder et al. 2007). Part of this can be attributed to the increased range and utility of pathology tests; however, other factors have also influenced this increase.

Socioeconomic changes have also enhanced routine physical and financial access to clinical care, diagnostic tools and medicines (Armstrong, Gillespie, Leeder et al. 2007). This has also been intensified by the internet explosion in the last 20 years, which has led to increased consumer awareness; patients now take a more active role in their own health management, and have higher expectations for their medical care (Gopal Rao, Crook & Tillyer 2003; Ouschan, Sweeney & Johnson 2006). This has resulted in increased demand for more, often inappropriate, medical testing.

1.6.3 The Introduction of Electronic Ordering of Pathology Tests

The introduction of computerised electronic ordering of pathology tests, known as a Laboratory Information System (LIS), has seen clinicians move from handwritten requests to electronic forms. While there is no literature regarding the effect that this has had on ordering in Australian public hospitals, one Australian study showed that simple interventions requiring any additional clinician input reduce the number of tests requested by up to 50% (Zaat & Vab Eijk 1992).

The introduction of electronic ordering also allows clinicians to order a designated set of pathology tests depending on the clinical presentation of the patient, known as care-sets. While ensuring that no pathology tests are missed, this form of ordering often results in more pathology tests per patient than if the clinician was hand-writing a
request. While the benefits of electronic interfacing reduce potential errors, especially relating to the transcription of patient information and requests (Greenes, Fleisher & Kohane 2000), the effect on ordering rates cannot be underestimated.

Electronic ordering is set to increase in the future, with the drive by both government and health organisations to have fully integrated electronic systems, and the effect of this on increasing test rates will need to managed. Some have suggested that the use of the electronic interface in areas such as displaying prior test results when physicians are ordering may be an effective means of reducing unnecessary ordering in the future (Tierney, Miller, Overhage et al. 1993).

1.6.4 Inappropriate Ordering

A number of studies have indicated that a significant proportion of testing performed in Australia is inappropriate (Isouard 2013). This not only adds unnecessary costs to the sector but also increases the number of false-positive test results. Reference ranges for any given test are generated on the premise that 95% of the normal population that is being tested will fall within these limits. Conversely 5% of all normal patients tested will be outside the “normal” reference intervals for any given test. This can create confusion among requesting doctors who do not fully understand the constraints to the predicative value of specific tests, such as sensitivity and specificity (Reid, Lane & Feinstein 1998; Gopal Rao, Crook & Tillyer 2003). This further perpetuates the cycle of ordering pathology with no benefit or in clinically inappropriate situations, as well as additional medical investigations.

1.6.5 Changes to Medical Training

In the last 20 years there has been a paradigm shift in the way medicine as a discipline is taught, with an emphasis on evidence-based care; there is now a belief that diagnosis should be based on symptoms backed up by pathology tests, rather than on symptomology alone. Hence it has been shown that younger doctors request more pathology tests than so their older counterparts (Studdert, Britt, Pan et al. 2010). In Australia it has been shown that GP’s aged 35 to 44 years have the highest pathology-ordering rate (30.4 tests per 100 encounters), while those aged 55 years or more are the lowest requestors (22.0 per 100 encounters) (Britt, Knox et al. 2003).
1.7 Changes to Funding

In an attempt to reduce the escalating cost of pathology services, the Australian Federal Government announced as part of its 2009 health budget reforms a plan to vastly decrease the costs associated with pathology testing by decreasing rebates for pathology testing and collection, as well as allowing greater “competition and improving patient choice in Australia’s pathology…”, both public and private (Australian Government 2009).

Key features of this reform were:

- Making a commitment to deregulation and improving productivity.
- Reducing “red tape” and encouraging providers to compete for patients on price and convenience.
- Reducing the regulation of pathology centres so that there is no limit on the number of Medicare-eligible collection centres an individual pathology provider can operate. Subsequently providers will be able to have as many collection centres as they choose, with the aim of giving greater choice to patients and enhancing competition.
- Enhancing patient choice by allowing patients to choose their pathology or diagnostic-imaging provider for Medicare services regardless of the request form that their clinician uses for these services.

Part of this reform was also the dissolution of the current Memorandum of Understanding with the pathology and diagnostic-imaging sectors. A review of pathology-funding arrangements was completed, and a five-year Pathology Funding Agreement between the Government and the pathology sector came into effect from 1 July 2011. While the Agreement was primarily introduced as “a mechanism to manage pathology outlays”, the policy also listed the following initiatives as objectives:

- Developing of a National Pathology Framework.
- Developing better decision support for pathology requesting to improve the quality and clinical appropriateness of requests.
• Implementation of electronic requesting and reporting of pathology across the sector.

• Developing appropriate policy and funding mechanisms for genetic services.

• Ensuring a sustainable workforce for pathology.

• Making a commitment to the National Pathology Accreditation Advisory Council, National Association of Testing Authorities/Royal College of Pathologists of Australasia laboratory accreditation.

• On-going funding for and commitment to the Quality Use of Pathology Program.

• Making a commitment to the Government’s broader e-Health agenda, including adoption of National e-Health Transition Authority standards in relation to the Personally Controlled Electronic Health Record.

1.8 Implications of Policy Changes

These initiatives highlight some of the important considerations of providing pathology services, and underscore how cost-reduction strategies may have significant impacts on quality service. While ideally the management of any healthcare sector should be focused on patient outcomes, it is inevitable, especially in light of the current economic conditions, that the justification of costs can become the paramount focus.

Internationally, the results of such a focus have been deleterious. Canadian Anatomic Pathology has recently suffered a crisis of serious testing errors and misdiagnosis “like a crashing wave”. A subsequent review identified a solution: “urgent attention to the serious human-resource issues should help alleviate long-standing staffing problems and improve future laboratory performance” (Egbertson 2008). It is essential that issues associated with funding cuts are thus managed appropriately, and potential adverse implications identified.

This agreement acknowledges that defining the costs of pathology services is on many levels not as straightforward as simply deriving the cost per test or result. Other total patient-care costs must also be considered and incorporated into the costing of
pathology service provision; however, these can often be hard to quantify in both monetary terms and the extent to which they are directly related to pathology results. Variables such as patient admission to hospital, length of stay and drug administration and dosage usually rely on pathology results, and this must be taken into consideration in costing. However, the mechanisms in which to do this are not well understood.

1.9 The Costs of Pathology Services

As mentioned, an interesting phenomenon in pathology services that the consumer of the service is the requesting clinician; the end user (the patient) does not directly pay for the service. It is likely that the requestor has no idea of the cost associated with any test they request (Gopal Rao, Crook et al. 2003). A number of studies have shown a reduction the in number of pathology tests requested when the cost associated with pathology and total patient care was displayed (Tierney, Miller & McDonald 1990); however, this has not been replicated in other studies that have evaluated these interventions long-term (Bates, Winkelman, Brennan et al. 1997).

Bates (1997) notes that cost-reduction strategies are generally only effective if “they do not affect quality adversely, can be maintained indefinitely, generalized to all providers, focused at the level of individual decisions, and yet be nonintrusive—a difficult combination to achieve.”

This lack of awareness effectively means there is little incentive to reduce the number of tests ordered (Gopal Rao, Crook et al. 2003), and that the cost of this service pays little to no part in the requestors psychosomatic association with pathology testing. Assessments of pathology services using established service-industry models, which have shown that value is proportional to quality divided by cost (Forsman 1996; Cronin, Brady & Hult 2000) reveal that if the consumer perceives no cost associated with a service, the value of the service is directly proportional to the perceived quality of the service. Subsequently identifying the “value” and “quality” of pathology services in the delivery of healthcare will provide a more accurate and relevant benchmark for consumers of the service, where cost has little to no impact.
1.10 Research Question Justification

To date very little research has examined pathology services from requestor perspective. While healthcare organisations appear to excel at understanding the factors that affect patient satisfaction, few acknowledge that referring physicians are also their customers (Schwartz 2011). Chapter 2 gives a detailed account of the literature that examines both the value and quality of pathology services. Most of published literature relating to quality of pathology services is inherently quality-control-based, with only a very few studies examining the wider issues associated with total quality management. Within the Australian context very little research has been published looking at pathology provision from a consumer’s perspective. This study attempts to address the scarcity of literature in this area by exploring the factors that requestors associate with quality in the provision of public-hospital pathology services.

This work contributes to both theory and practice and provides a basis for further research. It establishes a relationship between clinicians’ assessment of quality in pathology and specific service dimensions, which are often neglected. This study highlights to managers and policy-makers the areas in which there is scope to improve the quality of pathology services.

1.11 Research Paradigm, Methodology and Thesis Structure

The overall aim of this study was to investigate the attributes that requestors associate with quality service in public diagnostic pathology. Chapter 2 examines the literature relating to this topic and develops a conceptual framework. Chapter 3 then details the methods utilised in conducting and analysing the research presented in this dissertation. This study specifies that the nature of the theory is ‘explaining’ (Gregor 2006) and the research philosophy is ‘qualitative-interpretivist’ (Myers, Straub, Mingers et al. 2004).

Qualitative research aims to explain, evaluate or understand personal experiences, draw from a participant’s perspective or research that focus on human-interest issues (Veal 2005, p126). The intention of this research is to gain large amounts of in-depth information from a relatively small study cohort (Veal 2005, p25). Qualitative methodology shares its philosophical foundation with the interpretive paradigm, in which supports the view that there are many truths and multiple realities (Weaver &
Interpretative phenomenology aims to explore individuals' perceptions and experiences (Pringle, Drummond, McLafferty et al. 2011) and emphasizes the understanding of the meaning individuals attach to their actions and the reactions of others (Weaver & Olson 2006).

The design of this research involves a qualitative approach using in-depth semi-structured interviews as the primary method of data collection. Clinicians as identified through both national hospital statistics and internal data were selected using stratified purposive sampling purposive to participate in interviews. Data was analysed using dual text mining software applications (Leximancer and NVivo) as a means of ensuring validity and reproducibility in results. Chapter 3 details these methodologies and establishes rigor in the research design by supporting the application of techniques using necessary logic and support from the literature. Table 1.1 outlines the structure of the thesis that follows.
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>The introduction gives an overview of the emerging issues in healthcare from an international and national perspective. It then describes pathology services as an entity to establish the justification for the research question</td>
</tr>
<tr>
<td>2</td>
<td>Literature Review</td>
<td>This chapter covers relevant literature relating to the value and quality of pathology services and how functional quality is assessed in this sector, and develops a conceptual framework. The chapter then specifies the aims and research questions.</td>
</tr>
<tr>
<td>3</td>
<td>Methodology</td>
<td>This chapter provides an outline of the methodological approaches used to address the research questions and the justification for their use. It also links the conceptual model with the research paradigm.</td>
</tr>
<tr>
<td>4</td>
<td>Results</td>
<td>This chapter describes the findings of the study as identified by in-depth interview technique, and correlates the results with the conceptual framework and aims.</td>
</tr>
<tr>
<td>5</td>
<td>Discussion</td>
<td>This chapter describes the main findings of the research and integrates these findings with the literature.</td>
</tr>
<tr>
<td>6</td>
<td>Conclusion and Recommendations</td>
<td>This chapter addresses the academic and professional contributions of the research, as well as its limitations; proposes future research stemming from the data and presents a summary the main findings.</td>
</tr>
</tbody>
</table>
1.12 Summary:

The objective of Chapter 1 was to provide an overview of the present study. The chapter initially discussed the role of a DBA and examined the current state of pathology services within healthcare, and highlighted a number of current challenges in the provision of this service. Definitions of pathology services and accrediting bodies in Australia were identified and the research problem, rationale and objectives discussed. The research paradigm and methodology were stated and finally the structure of the thesis was outlined.

The next chapter reviews the literature and synthesizes the findings and gaps relating to the research topic, and reinforces the study of pathology from a service delivery perspective as worthy of investigating.
CHAPTER 2

LITERATURE REVIEW
2.1 Introduction

The purpose of this chapter is to provide the reader with a review of the concepts associated with the delivery of pathology services in Australia, and to define key concepts associated with the research matter. This chapter will evaluate the literature with a focus on the four following domains of knowledge:

- The value of pathology services.
- The quality of pathology services.
- Assessing functional quality in pathology services.
- A conceptual framework identifying dimensions associated with the assessment of satisfaction by clinical requestors who use pathology services.

The initial review of the literature focused on medical databases including MEDLINE, CINAHL and the Cochrane Database for Systematic Reviews. Sourcing was also supplemented by the reference list of apt articles and the tracking of citations of relevant texts. Specific journals, including the International Journal of Health Care Quality Assurance and the Journal of the American Medical Association (JAMA) were also monitored for pertinent articles.

Due to the limited number of publications directly relating to pathology from a service perspective, all publications from 1980 onwards were sourced for analysis. Articles relating to broader concepts of quality in healthcare were limited to 2000, onwards unless the article was deemed seminal to the field of knowledge.

Analysis of the literature identified a number of deficiencies in the research relating to pathology-services provision. This allowed for the elucidation of the aims and research questions posed at the conclusion of this chapter.
2.2 The Value of Pathology Services

In service industries, value can be defined in terms of a consumer’s perception of cost, quality, benefit, and social psychology (Kuo-Ming 2009). Predominant methodologies in the literature for the measurement of value in healthcare settings include cost-benefit, cost effectiveness and cost-utility analysis (Vanhook 2007; Ix 2008). However, many of these methodologies rely on patient-outcome measures such as hospital separations and morbidity/mortality indicators, and thus cannot be applied to pathology services.

In assessing the value of pathology services an important consideration is the extent to which pathology results influence clinical decision-making. Despite its importance, there is limited published data that examines this relationship. A much-cited figure is that of Forsman (1996), who states “laboratory services…leverage 60-70% of all critical decision-making”. This figure, however, is not derived from a body of empirical research, but from an estimation of the usefulness of pathology services.

To identify the value of pathology services it may be necessary to first establish how consumers of use the service. While most service providers usually have direct contact with their customers and stakeholders, and thus “are uniquely placed to influence as well as respond to their customers” (Rynja & Moy 2006), the supplier-consumer relationship in pathology services is atypical. In this situation the clinician (consumer) is the intermediary between the patient and the laboratory; however, often the only contact between the pathology service and the requesting clinician is via computerised inputs and outputs. Requestors are often not viewed as “customers”, even though they both initiate and consume the service.

A relatively small number studies have used survey methodologies to assess clinician/requestor feedback on the performance of pathology services (Table 2.1). Universally these studies have shown common areas of dissatisfaction. Communication between clinicians/requestors and the pathology provider has been identified as the area with the greatest potential for improvement, though a number of other aspects including the quality of professional interaction, diagnostic accuracy, staff courtesy, notification of results and timeliness of reporting have all been identified as factors that influence customer satisfaction (Allen & Harris 1992; Boyde, Earl, Fardell et al. 1997; Dale, Novis & Meier 2001; Steindel & Howanitz 2001; Zarbo, Nakhle, Walsh et al. 2003;
Jones, Walsh & Ruby 2006; Oja, Kouri & Pakarinen 2006; Zarbo 2006; Nakhleh, Souers & Ruby 2008). This highlights the necessity of having clinician (consumer) involvement and feedback in assessing the value of the service they use. In the marketing literature, this concept is known as value co-creation.

Value co-creation can be defined as the notion that customers are proactive co-creators of value, rather than passive receivers of value (Ouschan, Sweeney & Johnson 2006). Value co-creation is particularly relevant to professional services with a high degree of customer contact, such as medical services. This business methodology has been used in a number of fields including medical care, where it was shown that patients from whom feedback was actively sought, and where this process was modelled into their care, obtained more realistic and appropriate treatment, had better health outcomes and were generally more satisfied with their care (Gruber & Frugone 2011). Value co-creation can improve understanding of customer opinion and identification their needs and wants relating to a product (Ouschan, Sweeney & Johnson 2006), and thus help increase both the quality, and ultimately, the value of a service product.

Numerous business models have identified that customers who perceive more value from a service they use tend to be more satisfied with the service (Ouschan, Sweeney & Johnson 2006), and that customer satisfaction is the result of a customer’s perception of the value received (Cronin, Brady & Hult 2000). Further understanding these factors and how to implement them as part of pathology practice will not only identify areas of improvement, but also enable medical laboratories and the organisations that regulate them to set achievable benchmarks in satisfaction and key performance indicators as part of a total quality management system.
2.3 The Quality of Pathology Services

2.3.1 The Definition of Service Quality in Pathology

The assessment of quality must rest on a conceptual and practical definition of quality in the context of medical care (Donabedian 2005). Specifically relating to pathology services, Raab and Grzybicki (2008) describe quality as “the product (i.e., the diagnostic information) or service that meets the requirements of a wide number of individuals or groups, including patients, clinicians, pathologists, pathologist extenders, organizations, and regulatory agencies.” In contrast, ISO 15189 (2012, p4) describes quality as ‘the degree to which a set of inherent characteristics fulfils requirements”.

As with all areas of healthcare service, pathology can be broken down into two quality dimensions: technical and functional (Donabedian 1988). Technical quality generally includes the assurance of conformity to proper process and procedure, while functional quality is usually related to interpersonal aspects of care such as trust, communication, mutuality of goals and patient respect (Daley 2001). In healthcare it is imperative to avoid a “good technical outcome, poor service” experience (Vukmir 2006).

In Australia the quality of pathology services is considered by many to be amongst the best in the world (Isouard 2013). This is mostly driven by the high level of regulatory requirements and mandatory accreditation by external organisations such as the National Association of Testing Authorities (NATA), according to the Australian Standard for Medical Laboratories (ISO 15189:2012). From this, many have noted that quality control or analytical quality-assurance activities have become the main measure of quality (Feeney & Zairi 1994). This is further validated by the large body of literature that specifically relates to the use of internal analytical quality control (technical quality). Feeney and Zairi (1996) noted, “Pathology departments appear to be very good at quality control. This reflects a compulsion to comply with set standards laid down by various professional and accreditation bodies. There is, however, very little evidence to suggest that there are concerted efforts to move away from quality control into quality improvement.” This philosophy remains central in the current mode of pathology delivery.
Quality-control (QC) activities often entail the development of standards of acceptable performance relating to a specific task or assay (Raab & Grzybicki 2008) and often neglect non-analytical aspects of testing. This has inherently led to measures such as diagnostic accuracy, reproducibility and specimen turnaround times (TATs) to be the key indicators of the “quality” of a laboratory, yet none of these procedures assesses external components of the pathology process (Preston 2008).

Despite this, the implementation of quality standards, such as ISO 15189 and ISO 17025, and subsequent amendments, have further emphasised the importance of customer perspective in the improvement of laboratory services (Oja, Kouri & Pakarinen 2006). However, many pathology laboratories both within Australia and internationally do not address this issue, with many citing limited resources and a deficiency in knowledge of how to obtain and use customer perspectives. This is critical considering that the majority of errors are likely to occur in the pre- and post-analytical stages of laboratory testing, where such strict control mechanisms do not exist or are ambiguous. Whilst the majority of the literature relating to quality in pathology has been focussed on internal quality control, it is important to look at the provision of all medical care as a holistic process that encompasses multidisciplinary departments and staff.

Historically, professional clinical judgement was the main determinant in the quality of healthcare that a patient received, with the measurement of quality monitored by reactive outcomes such as death and infection (Brook, Cleary & McGlynn 1996). In modern medicine, where technical quality is tightly regulated, the emphasis is now turning to accurate methods of measuring functional quality.

While some have suggested that monitoring complaints may be an acceptable method of assessing functional quality and validating customer satisfaction (Vukmir 2006), it can be shown that any mechanism requiring self-reporting is likely to significantly underestimate the true prevalence of any difficulties. Additionally, a 2006 study of 7,033 nursing staff found no correlation between the number of complaints received by the laboratory and the overall levels of satisfaction with the service (Jones, Walsh & Ruby 2006).
2.3.2 Factors Affecting Quality

Chassin (1998) commented that errors in medicine “are not rare, unpredictable or inevitable concomitants....rather they are frighteningly common, often predictable, and frequently preventable”. It is estimated that in Australia alone, the annual cost of medical errors is between 1 and 2 billion dollars (Wilson, Runciman, Gibberd et al. 1996; Armstrong, Gillespie, Leeder et al. 2007). Armstrong et al. (2007) noted “Australia has not come to terms with medical error, neither recording its occurrence nor adapting systems from other high-risk industries, such as nuclear power and aviation, to reduce it.”

It is evident that over the last century medicine has undergone a paradigm shift from a simple, mostly ineffective and relatively safe discipline to a complex, effective and potentially dangerous art (Chantler 1999). This is also true of medical pathology. Over the past 30 years, technological advances, rising costs and a reduction in staff numbers have contributed to significant changes in the way clinical pathology services operate; moreover, such changes have considerable potential to affect quality (Isouard 2013).

Much of the current literature on patient safety and quality in healthcare does not address laboratory testing, despite the fact that pathology results are clearly a major component in the clinical diagnosis and monitoring of disease. While some generalised health-related quality reviews can be extrapolated to pathology-related activities, there remains a significant lack of coherence between quality activities directly relating to primary patient care and secondary-care activities such as laboratory diagnostics.

Published literature on errors or adverse events in pathology testing highlight that analytical errors in testing are by far the minority; of them, the overwhelming majority occur in the - and post-analytical phases of testing (Bonini, Plebani, Ceriotti et al. 2002). One study of 417 laboratories, including eight from Australia identified a transcription-error rate for pathology requests of 6% (Nakhleh & Zarbo 1996). When taking into account all patient information, not only the requested test, another Australian study found that the overall rate of incorrectly transcribing patient details from the paper request to computerised systems was as high as 46% (Khoury, Burnett &
Mackay 1996), suggesting that transcription error in the pre-analytical stage of testing appears to be prolific and poorly controlled.

Post-analytical errors also appear to be highly prevalent. One study from the United Kingdom showed approximately one-third of all abnormal laboratory tests are never investigated (Schuster, McGlynn & Brook 1998), while another found that 32% of adverse events in a hospital were failures to act on results of tests or findings (Leape Ll 1991). However, one Australian study assessing follow-up of microbiology test results in an emergency-department setting found the overall rate of results missed to follow-up to be 3% (Callen, Paoloni, Georgiou et al. 2010). This reduced figure may be due to the nature of the laboratory tests investigated or the introduction of electronic means of following up test results.

In an environment of dynamic technologies, laboratory quality improvement should be viewed as a perpetuating organisational process that encompasses all aspects of the provision results for medical diagnosis and monitoring. Brynat (1996) noted, “There is an unfortunate perception that pathology laboratories are only interested in performing tests, whereas, in reality, they are responsible for a cycle of activities which begin before and conclude after the actual testing.”

2.3.3 Assessing Functional Quality in Pathology Services

While a number of studies have shown technical quality to be the key dimension in service quality in healthcare settings (Carman 2000), functional quality cannot be underestimated. Functional quality, has been inherently linked in the literature to customer satisfaction, even though it can be seen that these are two distinct (although closely related) constructs. While customer satisfaction is usually related to value and price, service quality generally does not depend on price (Anderson, Fornell & Lehmann 1994), and is usually the first determinant of overall customer satisfaction (Cronin, Brady & Hult 2000). Many authors have defined service quality as “the discrepancy between customers’ expectations and perceptions” of the service (Zeithaml, Parasuraman & Berry 1990; Zeithaml, Berry & Parasuraman 1996; Conway & Willcocks 1997).
Coway and Willcocks (1997) note that ‘services are performed and experienced at the same time and although the performance of most services is aided by tangibles, what is actually purchased is the experience’. From this, two constructs can be theorised: that quality is inherently linked to the experience of the service provided, which may differ on an individual basis, and that the service provided encompasses functional components. The assessment of the functional components of service has been shown to be an important and useful quality-improvement tool for clinical laboratories (Jones, Walsh & Ruby 2006). Poor customer service in pathology has the potential for customers to question the value of the service as well as jeopardises their loyalty (Novis 2008).

In pathology the concept of quality of service is directly tied to the satisfaction of the physicians who use the service (Carter, Stubbs & Bennett 2004). Considering this, an extensive literature review was undertaken relating to the assessment of customer feedback relating to pathology services. On initial review it was evident that there was a paucity of literature in this area. This is, considering that the accreditation of clinical laboratories both nationally and internationally requires some evidence of assessment of satisfaction with the services provided (Novis 2008). Table 2.1 provides a brief overview of all published studies carried out in diagnostic-pathology settings to assess satisfaction or solicit feedback from consumers of the service. Most studies focused on the physician as consumer; however, a number also included allied health professionals such as nurses.
Table 2.1: Major Published Studies Soliciting Feedback on the Quality of Pathology Services

<table>
<thead>
<tr>
<th>Publication</th>
<th>Sample description</th>
<th>Sample site</th>
<th>Method used</th>
<th>Main finding</th>
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</thead>
<tbody>
<tr>
<td>Allen &amp; Harris (1992)</td>
<td>87 physicians from 71 general practices.</td>
<td>Three hospital laboratories within Leeds West, UK.</td>
<td>Postal questionnaire.</td>
<td>Main areas of dissatisfaction with pathology services were; communication, test turnaround time and format of reports.</td>
</tr>
<tr>
<td>Boyde, Earl, Fardell et al. (1997)</td>
<td>69 laboratories submitted data from a minimum of 25 physician clients per quarter. Final numbers not given.</td>
<td>Laboratories reporting to College of American Pathologists Q-Tracks Study.</td>
<td>Physician satisfaction survey focused on surgical pathology reports. Ordinal scale categories used.</td>
<td>Overall customer satisfaction scores in this study were high. Report TAT received the lowest scores of all parameters. There was no association between customer satisfaction and any institutional characteristics.</td>
</tr>
<tr>
<td>Steindel &amp; Howanitz (2001)</td>
<td>690 hospital laboratories submitted TAT data. 1,937 physician surveys from 552/690 institutions.</td>
<td>Data submitted to College of American Pathologists Q-Tracks program</td>
<td>Self-directed study of ED TAT over a four week period. Participants were also asked to provide a satisfaction survey for up to four ED physicians per site using a six point scale.</td>
<td>TAT for some common chemistries have not changed significantly in 10 years. ED physicians had low satisfaction rates for labs being sensitive to urgent testing needs and meeting physician needs. Many associated TAT with patient length of stay.</td>
</tr>
<tr>
<td>Zarbo, Nakhleh, Walsh et al. (2003)</td>
<td>3065 physicians assessing satisfaction with anatomical pathology in 94 laboratories.</td>
<td>Data submitted to College of American Pathologists Q-Probes laboratory quality-improvement study, 96% based in the USA.</td>
<td>Standardised survey forms with 10 elements of service and an overall ranked satisfaction rating.</td>
<td>The highest satisfaction scores were for professional interaction and diagnostic accuracy, while the lowest related to timeliness of results and poor communication.</td>
</tr>
<tr>
<td>Study</td>
<td>Number of Participants</td>
<td>Setting</td>
<td>Study Design</td>
<td>Key Findings</td>
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<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>Oja, Kouri &amp; Pakarinen (2006)</td>
<td>91 senior physicians and nurses-in-charge</td>
<td>A university hospital in Finland.</td>
<td>Satisfaction survey using questionnaire with ordinal scale categories.</td>
<td>Highest dissatisfaction rates were for the laboratory information system, turnaround times of tests and timing of phlebotomy rounds.</td>
</tr>
<tr>
<td>Jones, Walsh &amp; Ruby (2006)</td>
<td>7,033 nursing staff from 162 institutions.</td>
<td>Data submitted to College of American Pathologists Q-Probes laboratory quality improvement study, 98% of which were from the USA.</td>
<td>Satisfaction survey using questionnaire with ordinal scale categories.</td>
<td>Test-result accuracy was very highly regarded among respondents. Room for improvement was noted in several aspects of service, particularly in test turnaround time and laboratory-management accessibility and responsiveness.</td>
</tr>
<tr>
<td>Nakhleh, Souers &amp; Ruby (2008)</td>
<td>69 laboratories submitted data per quarter over the two year period. Each lab submitted 25-99 surveys per quarter from physicians using anatomical pathology.</td>
<td>Data submitted to College of American Pathologists Q-Probes laboratory quality improvement study.</td>
<td>A standardised physician satisfaction survey focused on surgical pathology reports.</td>
<td>Overall, customer satisfaction scores in this study were high, leading to the conclusion that in general, surgical pathology reports serve their customers well. Report TAT scored the lowest of the three parameters surveyed.</td>
</tr>
<tr>
<td>Callen, Georgiou, Prgomet et al. (2010)</td>
<td>7 ED physicians and 1 clinical-information system support person</td>
<td>A single Australian metropolitan teaching hospital.</td>
<td>Qualitative study design using semi-structured interviews</td>
<td>The key issue identified for ED physicians using one LIS to follow up pathology results was ensuring responsibility for test follow-up. Key suggestion for improvement was a complete integrated electronic information system with on-line result endorsement.</td>
</tr>
</tbody>
</table>
Table 2.1 highlights the following:

- There are fewer than 10 studies over a 20-year period that examines customer satisfaction in pathology services.

- Most published data comes from the College of American Pathologists Q-Tracks Study.

- The majority of studies used survey methodologies (general questionnaires), usually based on an ordinal scale such as Likert categories.

- Major recurring issues include dissatisfaction with TAT and communication with the laboratory, especially in terms of electronic interfacing and being informed of significantly abnormal patient results.

- Many of the issues are associated with the pre- and post-analytical stages of testing.

- Test-result accuracy is general highly regarded in laboratories.

- A number of questions remain unanswered regarding the perception of quality in pathology, especially in the Australian healthcare environment.

It is evident that there is much scope for further research in this area, especially in understanding the perspective of requestors in Australia. To examine this, it is first necessary to understand the concepts associated with the assessment of service quality and customer satisfaction. The following section examines this construct in the literature and proposes a conceptual framework to assess customer satisfaction in pathology services.

2.4 Development of a Conceptual Framework

A number of conceptual frameworks examine the associations between customer satisfaction and service quality. While it has been shown that service quality depends on
the ability of the supplier to meet the customer’s expectations, evidence has shown that no matter how good consumers deem the services to be, they will continually expect improvement (Padma, Rajendran & Sai 2009). Hence it is possible to speculate that customer satisfaction is influenced by a broader set of factors than those that are part of the immediate service-delivery experience.

2.4.1 Service quality and customer satisfaction

Numerous studies have specified relationships between quality, value and customer satisfaction (Cronin, Brady & Hult 2000). While a positive relationship between service quality and customer satisfaction exists, it is not the only influence on overall satisfaction. Consumer satisfaction is a multi-dimensional construct affected by many variables not directly related to the core service provision that influence an individual’s perception of service delivery (quality) (Naidu 2009). Hence, a consumer’s overall service experience is created by elements not only under, but also outside, the service provider’s control.

Social psychological theories propose that evaluations of customer service are influenced by feelings of equity in the exchange, convergence of desires and outcomes, individual preferences, social comparisons and other complex phenomena (Padma, Rajendran & Sai 2009). Others have noted that perceived service quality is greatly influenced by the interactions and relationships between buyer and supplier (Jain, Jain & Dhar 2002). From this, the customer experience of a service can be seen as a multidimensional structure involving the customer’s cognitive, affective, emotional, sociodemographic and physical responses (Tucker & Adams 2001; Verhoef, Lemon, Parasuraman et al. 2009). Relevant examples of sociodemographic variables include age, education and gender, as well as the involvement in or use of the service (Padma, Rajendran & Sai 2009). These have been termed independent variables (Tucker & Adams 2001).

While no studies have been done to investigate the influence of independent variables on the levels of satisfaction with pathology services, it has been shown that shown that general practitioners (GP’s) aged 35-44 years have the highest pathology ordering rate (30.4 tests per 100 encounters) while those aged 55 years or more are the lowest
requestors (22.0 tests per 100 encounters) (Britt, Knox & Miller 2003). This difference could be reflective of uncertainty in the diagnostic capability of younger GPs compared to their older counterparts, a change in training programs or younger GPs being more aware of the increasing spectrum of available tests. Regardless of the foundation, factors such as this have the potential to influence the overall perception of quality, and are deemed to be pre-existing contributors to an individual’s assessment of customer satisfaction.

Individual or personal factors may also influence perception of customer satisfaction at a particular time. These include influences such as the individual’s attitude or mood, whether the most recent experience with the service has been positive or negative and the individual’s level of involvement with the service itself.

2.4.2 Dimensions associated with service quality

Service-quality literature in the context of healthcare is mostly focused on the patient perspective; however, some of the inherent concepts can be extrapolated across many sectors. Many of the theories developed in the literature measuring service quality come from the seminal work of Parasuraman, Zeithaml and Berry (1985, 1988) and Zeithaml, Parasuraman and Berry (1990), who identified a number of criteria or ‘quality dimensions’ underpinning the evaluative criteria consumers use to assess service quality. This model and subsequent addenda have identified five dimensions that consumers relate to service quality: tangibles (such as personnel and equipment), reliability, responsiveness, assurance and empathy (Table 2.2).

Using this model as a framework, a number of authors have developed these dimensions specifically relating to healthcare. Padma, Rajendran and Sai (2009) validated these dimensions; however they incorporated additional factors, including corporate image, social responsibility and the trustworthiness of the hospital, as added contributors to healthcare service quality (Table 2.3).
Table 2.2: Conceptual Dimensions of Healthcare Service Quality, modified from Padma, Rajendran, and Sai (2009).

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Definition as per Zeithaml, Parasuraman &amp; Berry (1990)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangibles</td>
<td>Appearance of physical facilities, equipment, personnel and communication.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Ability to perform the promised service dependably and accurately.</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Willingness to help customers and provide prompt service.</td>
</tr>
<tr>
<td>Assurance</td>
<td>Knowledge and courtesy of employees and their ability to convey trust and confidence.</td>
</tr>
<tr>
<td>Empathy</td>
<td>Caring and the individualised attention provided to customers.</td>
</tr>
</tbody>
</table>

In the context of allied health services that deal directly with clinicians as a customer base (such as radiology, pathology and nuclear medicine) there is a gap in the literature examining the conceptual framework dimensions that are associated with satisfaction in customer service. The current study examined dimensions identified in the literature, predominately from a healthcare perspective, to determine if these could be transposed to the provision of pathology services. Table 2.3 links dimensions of service quality to comparable expectations in pathology services to assess congruency.
Table 2.3: Critical Dimensions in the Assessment of Quality of Service and Corresponding Expectations in the Assessment of Pathology Services

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Typology of dimension</th>
<th>Evidence</th>
<th>Typology of dimension specifically relating to public pathology services</th>
</tr>
</thead>
</table>
| Infrastructure/tangibles | Tangibles, facilities, physical environment and accommodation aspects.                | Padma, Rajendran & Sai (2009)  
Parasuraman, Zeithaml & Berry (1985, 1988)  
Naidu (2009)  
Conway & Willcocks (1997)  | Tangibles, facilities, physical environment, access to current scientific technology and testing.                                                          |
Padma, Rajendran & Sai (2009)  
Tucker & Adams (2001)  
Note: responsiveness identified as an individual dimension. |
| Reliability/processes | Primary quality, technical quality, treatment process and its outcome, reliability and an understanding of the illness. | Padma, Rajendran, & Sai (2009)  
Parasuraman, Zeithaml & Berry (1985, 1988)  
Tucker & Adams (2001)  
Conway & Willcocks (1997)  
| Safety indicators | Safety indicators. | Padma, Rajendran & Sai (2009) | Laboratory accreditation and adherence to regulatory requirements. |
| Trust | Patient confidence; relationship of mutual respect; includes advising patients of errors in the course of their care. | Padma, Rajendran & Sai (2009) Jain, Jain & Dhar (2002) | Trust that results are performed in an appropriate manner, and errors are rectified and the clinician informed. |
2.5 Proposed Conceptual Framework

From the dimensions identified in the literature, a conceptual framework (Figure 2.1) was hypothesised for determining requestor perceptions of overall customer satisfaction with pathology services. The framework is based on the holistic conceptualisation of customer experience, including non-core service dimensions (pre-existing influences and individual elements) as well as the dimensions that are specific to service quality. This model is considered to be dynamic in nature, due to the fact that customer experience at any time is affected by past customer experiences in a continuous manner.

It is important to note that this framework is based on a single individual’s perception of quality and does not examine the effect of group dynamics (such as a peer groups) on the consumer that can also play a role in quality perception (Verhoef, Lemon, Parasuraman et al. 2009).
Figure 2.1: Conceptual Framework of Service Delivery in Public-Hospital Pathology.
2.6 Summary

It is evident that pathology services are undergoing a dynamic period of change in Australia, driven by government initiatives. While there is much importance placed on cost-reduction strategies, it has been shown that there is scope for improvement in identifying what functional dimensions or attributes are associated with quality in public pathology delivery.

The literature review provides a broad understanding of the concepts associated with the value and quality of pathology services, and identifies how quality from a functional perspective has been previously assessed. Internationally there have been relatively few studies that have examined the quality of pathology services from a consumer or requestor perspective. Most previous studies have originated from the USA and were obtained using a structured-survey methodology. There has only been one relevant published study in Australia over the last 20 years. This paucity of research means that there is a significant gap in the research with respect to understanding the attributes that requestors of pathology services associate with quality.

In this chapter, dimensions associated with the assessment of quality services were assessed in the specific context of pathology services. A conceptual framework was proposed, which will be used as the basis for the methodology described in the next chapter.
2.7 Research Questions and Aims

From the description of public pathology provision as outlined in the introduction and literature review, the following research questions and interlinked aims were established.

Research Question 1

Which service dimensions do requesting clinicians associate with quality in the provision of pathology in the public sector?

Aim

Ascertain the attributes that clients/requestors of services from a single large public teaching hospital pathology service associate with a high-quality pathology service.

Research Question 2

Do these attributes differ across clinical specialities, demographic groupings, involvement with the service or levels of training and experience?

Aims

Determine if desired quality attributes are common amongst requestors.

Identify whether attributes associated with quality differ on the basis of factors including clinical need, experience, expertise and training or affiliation with the pathology service.

Research Question 3

How well does the current service meet requesting clinicians quality expectations?

Aims

Assess current levels of satisfaction amongst requestors relating to quality of services and products.
CHAPTER 3

METHODOLOGY
3.1 Introduction

This chapter describes the methodologies used to answer the research questions, and links the research philosophy to the conceptual framework developed in the previous chapter. The ontology of these methodologies is predominately interpretative in nature. Figure 3.1 illustrates the research plan linked to the aims of the project, with the individual description of the methodologies to follow.

Figure 3.1: Method Summary (left) and Project Aims (right)
This chapter is structured as follows:

Section 3.2 provides a definition of the consumers of pathology services.

Section 3.3 defines who are the requestors of pathology services at the research site.

Section 3.4 describes the research methodologies employed and specifies the research philosophy as interpretivist in nature.

Section 3.5 outlines the techniques and justification of tools used for data analysis.

Section 3.6 identifies the limitations of the research methodology.

Section 3.7 discusses the ethical approval and constraints.

Section 3.8 summaries the chapter.

Overall, this chapter establishes rigor in the research methods by justifying the application of relevant research techniques at each phase using adequate logic and support from the literature.

3.2 Defining and Identifying Clients/Requestors of Public Pathology Services

A number of health professionals including allied staff such as nurses use results produced by pathology services when assessing the medical care of patients; however, clinicians are the main consumers of this service, and those for whom it is principally designed. As the majority of pathology items have a Medical Benefits Schedule (MBS) reimbursement for services performed, the best definition of who is legally eligible to order pathology services is drawn from the schedule.

Note G1.2 of the MBS (Australian Government 2012) states, “Medicare benefits are claimable only for 'clinically relevant' services rendered by an appropriate health practitioner. A 'clinically relevant' service is one which is generally accepted by the relevant profession as necessary for the appropriate treatment of the patient.”

Specifically relating to pathology services, Note P1.1 (Australian Government 2012) stipulates that these services may only be provided:
(i) in response to a request from the treating practitioner, including a participating midwife or a participating nurse practitioner, or from another Approved Pathology Practitioner and the request must be in writing (or, if oral, confirmed in writing within fourteen days); or

(ii) if determined to be necessary by an Approved Pathology Practitioner who is treating the patient.

Under the MBS there are significant limitations on the number and kinds of tests that can be ordered by a midwife or nurse practitioner. For this reason physicians (clinicians) were the focus for participant recruitment. The justification for the selection of this study population is further enhanced by the body of literature, which shows that doctors often take the role as “key opinion leaders”, this may significantly influence the way allied health professionals view particular health services (Dopson, Fitzgerald, Ferlie et al. 2002), including pathology.

3.3 Identifying Clinical Groups Who Use Pathology Services

To ascertain the main groups of clinicians who request pathology tests in public hospitals, figures from the Australian Institute of Health and Welfare (AIHW) were obtained for the most common public-hospital admissions for same-day separations for the 07/08 financial year (AIHW 2009, p221) were used (Table 3.1).

One definition of separation comes from the Australian Hospital Statistics 2007-08 (2009, p2) and refers to “the episode of admitted patient care, which can be a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay beginning or ending in a change of type of care (for example from acute to rehabilitation). ‘Separation’ also means the process by which an admitted patient completes an episode of care by being discharged, dying, transferring to another hospital or changing type of care”.

This is expanded in the National Health Data Dictionary (2010) (Version 15, p2709) where a separation is defined as “the process by which an episode of care for an admitted patient ceases”. 
A separation may be formal or statistical. A formal separation refers to the administrative process by which a hospital records the cessation of treatment and/or care and/or accommodation of a patient. A statistical separation can be defined as the administrative process by which a hospital records the cessation of an episode of care for a patient within the one hospital stay.

For each separation, patients are assigned a principal diagnosis defined as “the diagnosis established after study to be chiefly responsible for occasioning the patient’s episode of admitted patient care” (AIHW 2009, p2). The principal diagnosis is usually assigned by a disease, injury or poisoning, but can also be the specific care or service provided for a current condition (for example, dialysis for renal disease), or other reasons for hospitalisation (AIHW 2009, p205).

Principal diagnoses for 2007-08 were classified, coded and reported to the National Hospital Morbidity Database (NHMD) by all states and territories using the International Statistical Classification of Diseases and Related Health Problems (Fifth edition, 10th revision), Australian modification (ICD-10-AM) (NCCH 2006) (AIHW 2009, p205).
Table 3.1: Statistics for the 10 Principal Diagnosis Groupings with the Most Same-day Separations for Australian Public Hospitals 2007-08.

<table>
<thead>
<tr>
<th>Principal diagnosis</th>
<th>Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care involving dialysis</td>
<td>822,380</td>
</tr>
<tr>
<td>Other medical care</td>
<td>130,841</td>
</tr>
<tr>
<td>Pain in throat and chest</td>
<td>39,405</td>
</tr>
<tr>
<td>Cataract</td>
<td>37,993</td>
</tr>
<tr>
<td>Abdominal and pelvic pain</td>
<td>33,609</td>
</tr>
<tr>
<td>Adjustment and management of implanted device</td>
<td>26,269</td>
</tr>
<tr>
<td>Malignant neoplasms of the skin</td>
<td>21,334</td>
</tr>
<tr>
<td>Care involving use of rehabilitation procedures</td>
<td>18,608</td>
</tr>
<tr>
<td>Follow-up examination after treatment for malignant neoplasms</td>
<td>17,506</td>
</tr>
<tr>
<td>Diseases of the digestive system</td>
<td>16,801</td>
</tr>
<tr>
<td>Total</td>
<td>1,164,746 (49% of admissions)</td>
</tr>
</tbody>
</table>

From these figures it was possible to identify the broad groups of clinicians who tend to be responsible for the highest number of patient admissions in public hospitals, and would therefore be among the highest users of pathology services (Table 3.2).
Table 3.2: Principal Diagnoses Groupings (2007-08) with Collection and Usage Attributes as Defined by Clinical Specialities.

<table>
<thead>
<tr>
<th>Principal diagnosis</th>
<th>Collection definition and usage attributes</th>
<th>Clinical speciality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care involving dialysis</td>
<td>Where patients receive treatment in a ward or clinic classified elsewhere (for example, an Emergency Department), they are to be counted as dialysis patients and excluded from other categories. All forms of dialysis that are undertaken as a treatment necessary for renal failure.</td>
<td>Renal/ Nephrology</td>
</tr>
<tr>
<td>Other medical care</td>
<td>Care not otherwise specified, including radiotherapy, chemotherapy, blood transfusion without reported diagnosis, and preparatory care for subsequent treatment, where not classified elsewhere.</td>
<td>N/A</td>
</tr>
<tr>
<td>Pain in throat and chest</td>
<td>Any kind of inflammatory process of the tonsils, pharynx, or/and larynx characterised by pain in swallowing.</td>
<td>Emergency Medicine, Cardiology, ENT</td>
</tr>
<tr>
<td>Cataract</td>
<td>Acquired opacification of the lens or lens capsule of the eye that causes visual impairment.</td>
<td>Ophthalmology</td>
</tr>
<tr>
<td>Abdominal and pelvic pain</td>
<td>Acute and severe abdominal pain, generalised or localised with abdominal rigidity, including pain localised to upper or lower abdomen or other and unspecified abdominal pain or abdominal tenderness.</td>
<td>Emergency Medicine, Obstetrics and Gynaecology</td>
</tr>
<tr>
<td>Adjustment and management of implanted device</td>
<td>Management of malfunction or other complications of cardiac pacemaker, infusion pump, vascular access device, implanted hearing device and other unspecified devices.</td>
<td>Cardiology, Thoracic Surgery</td>
</tr>
<tr>
<td>Malignant neoplasms of the skin</td>
<td>Malignant melanoma and other neoplasms of the skin including face, scalp and neck, trunk and upper and lower limbs.</td>
<td>Oncology, Dermatology</td>
</tr>
<tr>
<td>Care involving use of rehabilitation procedures</td>
<td>Care including cardiac rehabilitation, therapeutic and remedial exercises, alcohol and drug rehabilitation, psychotherapy (not elsewhere classified), speech therapy, occupational therapy and vocational rehabilitation (not elsewhere classified), tobacco rehabilitation and care involving use of rehabilitation procedures.</td>
<td>Rehabilitation Specialists</td>
</tr>
<tr>
<td>Follow-up examination after treatment for malignant neoplasms</td>
<td>Medical surveillance following treatment including, examinations after, surgery, radiotherapy, chemotherapy or other treatments of malignant neoplasms.</td>
<td>Oncology, Haematology</td>
</tr>
<tr>
<td>Diseases of the digestive system</td>
<td>Includes the management of diseases of the oral cavity, salivary glands and jaws, oesophagus, stomach and duodenum, intestines, appendix, peritoneum, liver, gallbladder, biliary tract and pancreas, and the treatment of hernia and non-infective enteritis and colitis.</td>
<td>Gastroenterology, Upper Gastrointestinal Surgery</td>
</tr>
</tbody>
</table>
It is important to note that these figures exclude non-admitted episodes of patient care, which still constitute a high service burden. Of the non-admitted patient care in public hospitals in 2007-08 (AIHW 2009, p.xvi), the highest number of services were performed in three main groups:

i. accident and emergency (approximately 41.2 million services)
ii. specialist outpatient (approximately 16.4 million services)
iii. pharmacy, pathology and radiology and organ imaging (approximately 16.2 million services).

Considering the above and using the Australian Medical Council (AMC) List of Australian Recognised Medical Specialties approved by the Commonwealth Minister for Health and Ageing (Australian Medical Council Limited 2013), the following medical specialities which did not feature above were chosen as key clinical areas (from more than 60 listed specialties) at the institution where the study was conducted: haematology, immunology and allergy, infectious diseases, rheumatology, sexual-health medicine, general surgery and orthopaedics.

These clinical groups were then used as the basis for targeting study participants, as described in the following section.

3.4 Ascertain what Attributes Requestors Associate with Quality

3.4.1 Background

In identifying the particular attributes clients of public-hospital pathology services associate with quality it is necessary to understand this cohort’s relevant experiences and psychological influences. Considering this, qualitative research methods were used for this segment of the research. The applications of qualitative research techniques are best suited to projects that aim to explain, evaluate or understand personal experiences, and draw from a participant’s perspective or research that focuses on human-interest issues (Veal 2005, p126). This form of research tends to use words as the unit of analysis (Denscombe 1998, p174), and is often used to gain large amounts of in-depth information from a relatively small study cohort (Veal 2005, p25).
Over the last decade there has been a steady increase in the number of published studies in healthcare using qualitative methodologies (Reeves, Lewin & Zwarenstein 2006; Curry, Nemhbad & Bradley 2009). However, while qualitative research is not yet widely accepted by significant segments of the medical fraternity as, its application to understanding the individual realities and perceptions of clinical situations cannot be underestimated (Malterud 2001; Curry, Nemhbad & Bradley 2009). Further to this, it has also been shown to be as a means of enhancing the link between evidence and practice in healthcare settings (Dixon-Woods, Fitzpatrick & Roberts 2001).

Qualitative researchers are concerned with the fluctuating nature of reality created through people’s mixed experiences. Research using this methodology is an evolving reality in which the researcher and researched are mutually interactive and inseparable (Sale, Lohfeld & Brazil 2002). This is also true of this research project: the ontology of methodologies employed in this study is interpretative phenomenological in nature.

Interpretative phenomenology can be defined as a “variant of phenomenology” that “aims to explore individuals’ perceptions and experiences” (Pringle, Drummond, McLafferty et al. 2011). The objective of this methodology is to illustrate, inform and master themes by firmly anchoring findings in direct quotes from participant accounts (Pringle, Drummond, McLafferty et al. 2011). It has been used by a number of authors, usually in the form of interviews, to ascertain and understand individuals’ perspectives on a variety of topics, including many in healthcare (Dickson, O’Brien, Ward et al. 2012).

The design of this research involves a qualitative approach using semi-structured interviews as the primary method of data collection. As this research matter involves the collection of data based on emotions, experiences and feelings, interview technique can be seen as a valid and appropriate method (Denscombe 1998, p111). There are many different forms of interviews that may be used, ranging from highly structured closed questioning to unstructured open lines of questions that evolve based on the responses of subjects. This study uses a method of open-ended questions known as in-depth semi-structured interviews. In this method the interviewer has a list of predetermined open-ended questions; however, the order of topics is flexible and, most
significantly, the issues identified in the interview are allowed to develop (Denscombe 1998, p113; Fitzpatrick & Boulton 1994).

3.4.2 In-depth Semi-structured Interviews

Interviews are one of the most widely used tools in qualitative research. A number of studies have highlighted their utility in understanding the personal perspective by “reconstructing perceptions of events and experiences related to health and health care delivery” (Dicicco-Bloom & Crabtree 2006). However, most of these studies have focused on the patient perspective. A number of studies have used interviews to identify physician perceptions, including their opinions of computerised support systems (Bastholm Rahmner, Tomson, Holmström et al. 2004; Embi, Yackel, Logan et al. 2004) and of a range of medical interventions and illnesses (Loeb, Bayliss, Binswanger et al. 2012; Nichols, Holt, Shipp et al. 2009).

A number of factors need to be considered in the development of in-depth semi-structured interviews, including the role of the interviewer, criteria for selecting interviewees, collection method and data analysis, the formative questions used to shape the interview, potential limitations and ethical considerations.

3.4.3 Formative questions for in-depth semi-structured interviews

The design of the interview questions or checklist used in semi-structured interviews should be as methodical and well-constructed as any formal questionnaire (Veal 2005, p129). Questions should also be framed to obtain the highest possible reliability and validity; thus questions and prompts in this study were worded in such a way as to maximise the likelihood that the participant fully understood the meaning of the question. Some authors have also suggested that select questions be reiterated in a different context throughout the interview to check for consistency and validity (Denscome 1998, p124).

Using the conceptual framework presented in Chapter 2, the following dimensions were deemed to be essential in identifying attributes associated with quality service provision:
1. **Demographic profile** - including gender (which was ascertained from voice on audio recording) and length of time practising medicine (a surrogate for age).

2. **Training and experience** - including location and number of training institutions, medical specialisation and number of workplaces since completing training.

3. **Experiences with the service** - how often pathology services were used, the mix of public versus private services currently and previously used, the means by which the service was requested and results obtained (paper or via the hospital-based computer system) and their interpretation of the core service/technical quality of pathology.

4. **Systematisation of service delivery** - perceived conformity and consistency of results delivery.

5. **Social responsibility** - how focused the organisation was on stakeholders, especially patients and clinicians.

6. **Human element/personnel quality** - Communication/rapport with general enquiry staff, scientific staff and pathologists.

7. **Compliance with regulations** - satisfactory accreditation and compliance with regulations and Australian standards.

8. **Tangible aspects of service/infrastructure** - including laboratory information (computing) system, tangible aspects of service such as a broad spectrum of available diagnostic tests and the provision of results within clinically acceptable limits (turnaround times).

9. **Corporate image** - the perceived overall quality of the institution as a whole.

10. **Current utility of service** - how often the service was used (i.e. how often a request for pathology services was made by the clinician), and the complexity of tests requested (routine or highly specialised).

11. **Level of involvement with service** - whether the participant had direct involvement with pathology services, as is the case for pathologists and some subspecialties, or no direct involvement. Did pathology training form part of their specialist training?

12. **Experiences with current service** - positive and negative past experiences with the in-hospital service as well as other pathology providers.
To gauge current levels of satisfaction with the service and perception of the accuracy of pathology results currently received from the laboratory, qualitative questions used a 10-point scale as well as a descriptive (qualitative) component. The accuracy and reliability of this style of data collection has been validated in a number of satisfaction surveys, and allows for the collection of key information in time poor target groups (Alemi, Badr, Kulesz et al. 2008) Table 3.3 shows the list of questions in the order in which they were asked by the interviewer.
<table>
<thead>
<tr>
<th>Question</th>
<th>Quality dimension from the conceptual framework</th>
</tr>
</thead>
</table>
| What is your current position within the hospital, and how long have you held that position? | Demographic profile  
Level of involvement with service |
| Where did you complete your medical degree and what year did you graduate from medical school? | Demographic profile  
Training and experience |
| In what medical field did you complete advanced training?               | Demographic profile  
Training and experience  
Level of involvement with service |
| In which hospitals did you do your advanced training?                   | Training and experience  
Experience with other service providers |
| At which hospitals or institutions have you worked since completing training? | Demographic profile  
Training and experience  
Experience with other service providers |
| Considering your field of speciality, what percentage of your patients would you order pathology tests on? | Level of involvement with service  
Experiences with the service  
Current utility of service |
| On average how many pathology tests do you order per patient?           | Current utility of service |
| Which pathology test or group of tests do you think the most valuable or clinically relevant to you? | Current utility of service  
Tangible aspects of service/infrastructure |
| What do you think is an acceptable turnaround time for these test results? | Tangible aspects of service/infrastructure  
Reliability/processes |
| In general, what do you think is an acceptable turnaround time for all pathology test results in the patients you see? | Experiences with the service  
Tangible aspects of service/infrastructure |
| Do you order pathology tests electronically or by paper requests? If both, what percentage are paper requests? | Tangible aspects of service / infrastructure  
Experiences with the service  
Communication |
| What is the most common method in which you review patient results: for example, electronically or via paper reports? | Tangible aspects of service/infrastructure  
Experiences with the service  
Communication  
Administrative procedures |
<table>
<thead>
<tr>
<th>Question</th>
<th>Relevant Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you think there is a difference between the quality of pathology services provided within the hospital compared to the private sector? Can you say a bit more about that?</td>
<td>Social responsibility, Experiences with other service providers, Corporate image</td>
</tr>
<tr>
<td>What factor do you consider the most important in the delivery of pathology services?</td>
<td>All identified under “service quality dimensions”</td>
</tr>
<tr>
<td>What other factors are important for you? Anything else?</td>
<td>As above</td>
</tr>
<tr>
<td>In your field of speciality what percentage of your clinical decision-making is guided by pathology results?</td>
<td>Training and experience</td>
</tr>
<tr>
<td>Can you describe a time where you had a positive experience with pathology services or a specific laboratory at Royal Prince Alfred Hospital? For example a time when you got a result faster than anticipated (probe).</td>
<td>All identified under “service quality dimensions”</td>
</tr>
<tr>
<td>Can you describe a time where you had a poor experience with the service?</td>
<td>As above</td>
</tr>
<tr>
<td>Please describe a time where you have called the laboratory or pathologist regarding a test result that you have received? Can you describe the situation? (probe)</td>
<td>Level of involvement with service, Communication</td>
</tr>
<tr>
<td>On a scale of 1-10, with 1 being extremely poor and 10 being perfect, how would you rate the hospital pathology services? What makes it an x (whatever the number is)?</td>
<td>Experiences with the service</td>
</tr>
<tr>
<td>What is the most important thing that you think would improve the quality of pathology services offered at the hospital?</td>
<td>Experiences with the service</td>
</tr>
<tr>
<td>On a scale of 1-10, with 1 being totally sceptical and 10 being totally confident, how confident are you in the accuracy of pathology results at RPA? What makes it a x (whatever the number is)?</td>
<td>Experiences with the service, Safety indicators, Reliability/processes, Administrative procedures, Trustworthiness</td>
</tr>
<tr>
<td>What factors determine how confident you are in the accuracy of results?</td>
<td>As above</td>
</tr>
<tr>
<td>Compared to other hospital pathology services you have used, would you say the RPA pathology service is the same, better or worse? Why?</td>
<td>Experiences with the service, Experiences with other service providers, Corporate image</td>
</tr>
<tr>
<td>Are there any other issues or suggestions that you would like to raise regarding pathology delivery at RPA?</td>
<td></td>
</tr>
</tbody>
</table>
3.4.4 Subject Recruitment

In qualitative research the sampling methodology used has a profound effect on the results of the study, and findings may be easily biased by the study population chosen. While this study specifically targets a population of clinical staff at a single public hospital, it remains important to select subjects according to the aims of the research, and to identify participants on the likelihood that they will provide “rich” information (Schatzman & Strauss 1973). Furthermore, Rice and Ezzy (1999) state that if the aim of the study is to describe the processes involved in a particular phenomenon or situation rather than to ascertain its distribution, purposive sampling is a valid method for the recruitment of participants.

Purposive sampling is a directed, non-random method that samples a group or setting specifically targeted to answer a research question. Patton (2002, p230) notes, “the logic and power of purposive sampling lie in selecting information-rich cases for in-depth study. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry, thus the term purposive sampling”.

A number of purposive sampling strategies have been described. Patton (1990, 2002) suggests that all types of sampling in qualitative research may be encompassed under this term, which can be subdivided into at least 16 different strategies. This study employed stratified purposive sampling, which aims “to capture major variations” even though “a common core… may also emerge in the analysis” (Patton 1990, p174; 2002, p240). This method was used to obtain variation in clinical speciality as well as select demographic factors in the target groups that were likely to yield “rich data”.

There are however, a number of limitations to purposive sampling, most notably bias to the cohort by only including participants who may be key opinion leaders in the field, and excluding lesser known participants who may provide divergent and novel information; this may result in the cohort being less representative of the wider group.

Clinical staff fulfilling the target medical specialities (as outlined in the preceding section) were invited to participate in the research by an email (Appendix A) that outlined the study proposal, nature of information sought, time commitment, the
voluntary nature of the project and the measures taken to ensure confidentiality; a copy
of the information sheet was also attached (Appendix A). Subjects who could not
participate were asked to nominate an alternate person who might be willing to
participate. If subjects agreed to participate they were asked to nominate a suitable time
using the doodle.com event scheduler. A response acknowledging the schedule and
arranging for a location for the interviews was sent by email following acceptance at the
doodle poll (Appendix A).

3.4.5 Interviewer

The interviewer is critical to the success of the information-gathering process, and must
have the necessary skills to create an environment conducive to a personal and intimate
encounter in which open, direct, verbal questions are used to elicit detailed narratives
and stories (Dicicco-Bloom & Crabtree 2006; Fitzpatrick & Boulton 1994; Britten
1995).

To ensure objectivity in data collection, as well as confidentiality for interviewees, this
study used an external interviewer. This was also reinforced by stipulations from the
approving ethical committee (Section 3.6). The use of an external assistant to conduct
the interviews ensured that the subjects did not feel inhibited in their responses due to a
perceived power imbalance. It was also seen as a means to further increase the richness
of data, as the subjects may have felt more open to express their true perceptions
compared to being interviewed by a known colleague.

The Centre for Health Initiatives at the University of Wollongong provided a research
assistant, whose role was to act as the primary contact in the organising, scheduling and
conducting the interviews. The research assistant had no role in the design of the study
or the analysis of the findings.

The interviewer was trained by the researcher to ensure she had the skills necessary for
effective interviewing; training ensured an understanding of the research (Denscombe
1998, p109), the ability to establish a rapid positive rapport with the interviewee
(Dicicco-Bloom & Crabtree 2006) and effective communication and attentiveness,
including the ability to allow silence or use prompts or probing techniques when
necessary (Denscombe 1998, p124-5; Fitzpatrick & Boulton 1994). The interviewer was
also instructed to be flexible with the planned structure of questions during the interview, because digressions can be productive as they follow the interviewee’s interest and knowledge (Holstein & Gubrium 2002, p103-119). While the interviewer used the questions as a guide and was asked to ensure all questions were posed to the subject, the interviewer was also encouraged to expand on concepts as they developed and seek clarification of responses if necessary. Common clarification statements included:

“Can you describe that a bit more for me, about what the situation was?”

“In what way?”

“How do you think that could be achieved?”

“And were you happy with the service?”

3.4.6 Informed consent

Informed written consent was sought from all participants at the beginning of the interview (Appendix A). Verbal consent to record the interview was also sought. To ensure subject confidentiality once the recording commenced, the interviewer did not use the name of the participant during the interview.

3.4.7 Recording and transcription

The recording and transcription process is critical in any project involving the analysis of spoken interactions, and can affect the quality of the data (Maclean, Meyer & Estable 2004). It is essential that the transcription is reconstructed in a way that makes sense in the written form and is intelligible to those not present at the interview (Denscombe 1998, p132).

Interviews were electronically recorded using a Philips Pocket Memo digital dictation recorder and stored in digital speech standard (dss) format on Philips SpeechExec Dictate 7.0 software.
Transcription was performed using a denaturalised approach, which is a verbatim depiction of speech with a focus on the informational content and accuracy. This is particularly relevant in variants of ethnography, grounded theory and critical discourse analysis (Oliver, Serovich & Mason 2006). Transcribed text was checked for accuracy twice by the researcher.

For the data analysis which used NVivo (Version 10) and Leximancer (Version 4), a written copy of the interviews was created with pauses and filter words such as ‘um’ removed. This has been shown to be a valid technique in processes that need to focus on the accuracy of the information content rather than the vocabulary of interactions (Maclean, Meyer & Estable 2004).

3.5 Data Analysis

3.5.1 Qualitative Analysis

Analysis of quantitative data can be performed using many methodologies. As interviews in this project were performed over a set period of time, constant-comparison analysis techniques (also known as classical content analysis) such as grounded theory were not applicable. Content from interviews was analysed both on a question-by-question basis and by unsupervised clustering of the data to identify themes and relationships. This form of analysis has the advantage over constant comparison in that it allows for the identification of a range of relationships in the data that may not be identified in coding alone (Leech & Onwuegbuzie 2011).

Qualitative data analysis was triangulated using two differing electronic analysis tools: NVivo and Leximancer. This was done to increase reliability and reproducibility in the identification of themes, as well as to reduce subjectivity as a means of decreasing process distortions and increase the validity of the findings (Karsten & Karen 2009).

3.5.2 NVivo

NVivo (Version 10; QSR International Software) was used to assign and group information provided by participants into themes or codes designated in the software as “nodes”. A node is as a name used by the researcher to place meaning or significance on different parts of the text (Leech & Onwuegbuzie 2011). Traditionally coding has
involved manual analysis of the data, with the researcher assigning and grouping common themes; however this task is now largely accomplished using software.

Interviews from participants (sources) were loaded into NVivo, and each question tagged as a parent “node”. Coding data into nodes in NVivo allows for the gathering of “…related material in one place so that you can look for emerging patterns and ideas” (NVivo, Version 10; QSR International Software). From the parent node the researcher analysed and coded responses into word modules (free nodes) that were descriptive of the information, then developed themes to form hierarchical associations (tree nodes) as the project progressed. These were then analysed within the software using node matrix queries which allowed the researcher to analyse concepts and the frequency with which they occurred based on respondent classifications.

Assigned respondent classifications were based on the demographic data obtained in the interview process, and consisted of groupings based on:

1. Years since graduation from medical school
2. Clinical speciality
3. Whether the respondents medical degree was obtained in Australia or internationally
4. Number of hospitals that the respondent worked in while undertaking advanced training
5. If the respondent had ever worked internationally
6. The number of institutions or hospitals that the respondent had worked in since completing training
7. Current position within the hospital (registrar, staff specialist, department head)
8. Time in current position
9. The percentage of patients for whom the respondent requested pathology tests on based on their clinical speciality.
10. The number of pathology test they ordered per patient on average
11. How they rated the quality of the in-hospital pathology services (out of 10)
12. How confident they were with the accuracy of results (out of 10)
The coding and analysis of data were performed in accordance with Leech (Leech & Onwuegbuzie 2011).

3.5.3 Leximancer

Like NVivo, Leximancer (Version 4) is text-mining software that analyses the content of textual documents and visually displays commonly used words to develop themes. The main difference from NVivo is that Leximancer has the capacity to automatically identify and map concepts in a text using algorithmic rules, or alternatively, researchers can manually “seed” concepts in the text to examine relationships and links. Concepts in Leximancer differ from the notion of nodes as defined by NVivo, representing related thesaurus words that can be used to form thematic maps within the text, or (as in this research) across multiple responses to a single question.

The Leximancer program highlights semantic relations and proximity between words, indicating how sentences and texts make up a structured lexical field to elicit emergent concepts from the text, which are presented in the form of a conceptual map and a ranked table of the frequency of concept occurrences (Hansson, Carey & Kjartansson 2010; Smith & Humphreys 2006). In the map, identified concepts are shown in proximity to other concepts, and are grouped into themes that represent clusters of frequently co-occurring concepts (Marta, Dirk & Jan 2012). The size of the concept point is not representative of the frequency of that concept in the text; rather, it indicates how connected they are to other concepts (Hepworth & Paxton 2007).

Leximancer has been used as a data-analysis tool in a number of qualitative research projects, including analysis of conversations between carers and people with schizophrenia (Cretchley, Gallois, Chenery et al. 2010), as well as the opinions of doctors, nurses and allied health professionals on the implementation of a patient-safety incident management system (Travaglia, Westbrook & Braithwaite 2009).

For analysis, transcripts of responses for set questions were amalgamated, and interviewer prompts removed so as not to dilute participant responses. When performing the analysis, words not directly related to a particular question (such as “things” , “possibly” and “etcetera”) were removed as concept seeds, and certain word variants for example, “experience”, “experiences” and “experienced” were merged to
simplify the findings. For visualisation of concept maps the theme size was preserved at the default of 33% to ensure comparability; visible concepts were set to 100%.

There is good evidence supporting the use of Leximancer in textual analysis (Cretchley, Gallois, Chenery et al. 2010; Hepworth & Paxton 2007; Hewett, Watson, Gallois et al. 2009; Travaglia, Westbrook & Braithwaite 2009); and it has been shown to have satisfactory validity, stability and reliability (Smith & Humphreys 2006).

3.5.4 Quantitative analysis

Quantitative (ordinal) data was analysed using IBM SPSS Version 19. Nonparametric data was evaluated using the Mann-Whitney test in instances of two independent groups, or the Kruskal-Wallis for samples with greater than two groups.

The assistance of Dr Marijka Batterham (Faculty of Informatics, University of Wollongong) is gratefully acknowledged for statistical guidance.

3.6 Limitations of Research Methodology

As noted by Pringle et al. (2011), in studies that employ interpretative phenomenology methodologies, the analysis account is, by its very nature, the interpretation of one researcher. Results obtained in this research are only reflective of consumer preferences at a particular time in a particular institution; and they may not be generalised to other organisations or populations and should be considered in context with the desired outcomes of the research.

This is also generally true of data gained from the in-depth semi-structured interview technique. Performed correctly, this methodology can provide important insights into people’s views and experiences. However, such accounts are limited by the individual’s ability to recall details and are shaped by each individual’s views, perspectives and context (Reeves, Lewin & Zwarenstein 2006). This must also be taken into account when interpreting the significance of the findings.

Ensuring good scientific rigour throughout the research process is imperative to the overall quality of the data, and thus the conclusions that can be drawn. Methodologies described here were performed in accordance with Harden et al. (2004), who identified
seven quality criteria common to good qualitative research: an explicit theoretical framework and/or literature review; clearly stated aims and objectives; a clear description of context; a clear description of the sample and recruitment; a clear description of methods used to collect and analyse data; attempts made to establish the reliability or validity of data analysis; and inclusion of sufficient original data to mediate between evidence and interpretation.

Bryman and Bell (2003, p111) identified a number of error categories that should be considered in quantitative research, including sampling error, data-collection error, measurement error, processing error and non-response error. Understanding the different aspects of each of these errors and accounting for them in the design, completion and analysis of the study as well as ensuring accurate and well-tested prototype designs, enabled their minimisation. In addition, the research fulfils the guidelines for standardisation and rigour of qualitative research in medical settings as described by Malterud (2001).

3.7 Ethics

This project was consistent with the *National Statement on Ethical Conduct in Human Research* (Australian Government 2007) definition of low-risk research being “…where the only foreseeable risk is one of discomfort. Where the risk, even if unlikely, is more serious than discomfort, the research is not low risk.” (p16). In this context discomfort is defined as “less serious than harm…which can involve body and/or mind. Discomforts include, for example, minor side effects of medication, the discomforts related to measuring blood pressure, and anxiety induced by an interview” (p16).

Despite the low risk associated with this research, a number of ethical considerations were identified and addressed. Specifically relating to the interview process, DiCicco-Bloom and Crabtree (2006) identified four ethical issues that are important to consider in the performance of research: reducing the risk of unanticipated harm; protecting the interviewee’s information; effectively informing interviewees about the nature of the study and reducing the risk of exploitation. These issues were considered in study design and performance. Further to this, this study was conducted using the ethical principles of qualitative research as outlined by Orb, Eisenhauer & Wynaden (2001).
From initial submission of the ethical application to approval, the review committee required a number of amendments to the study. Due to the potentially sensitive/unequal relationship between the position of the principal investigator (laboratory manager within the health facility in which the research was to be conducted) and the expected study subjects, it was deemed necessary that an independent research assistant organise and conduct the interviews (as described in Section 3.4.5).

The net effect of having an external research assistant was that the interviews were required to be performed in a batch over a set period of time within the constraints of the research budget. This meant that methodologies such as grounded theory could be used.

The studies methodologies were approved by the University of Wollongong Human Research Ethics Committee (Health and Medical) on 12/10/2011 (HE11/281).

### 3.8 Summary

The core objective of this chapter was to link the conceptual model as described in Chapter 2 with the research paradigm to establish rigor in research design. As part of that process, the study specified the research philosophy as predominantly qualitative with an interpretative phenomenological ontology. The predominate research method was in-depth interview technique, and the data-collection technique was stratified purposive sampling. Data analysis was also described. Chapter 4 discusses in detail the findings of the study obtained using this methodology.
CHAPTER 4

RESULTS


4.1 Introduction

This chapter evaluates the results obtained through the interpretative methodology of in-depth interviews. Analysis of results was performed through a number of methods, including both thematic and semantic techniques, and, where appropriate, statistical analysis. Findings are presented in the order in which the in-depth interview questions were asked unless there was a direct link between the analyses of responses. Outcomes of the findings are then linked with the conceptual framework to assess if findings are congruent with the quality dimensions identified in the literature. Objectives of the result analysis and a summary of the main findings of the results are then presented, and discussion points identified.

4.2 Interview Demographics

Twenty-one participants participated in the in-depth interviews (response rate 58%), with an average recorded interview time of 24 minutes (range 8-48 minutes). Nineteen participants (90.5%) were male, covering the following specialities: cardiology (1), emergency medicine (1), gastroenterology (1), general surgery(1), haematology (1), immunology and allergy (3), intensive care (1), microbiology and infectious diseases (2), oncology (1), orthopaedics (2), pathology (2), renal medicine (2) and rheumatology (1). The two female respondents were specialists in oncology (1) and sexual health (1).

Figure 4.1 shows that the majority of participants (18 out of 21 or 86%) were employed as staff specialists or senior staff specialists who self-identified under a range of titles, including; head of the department, clinical director, clinical academic and a range of honorary positions. Three were in registrar (post-graduate training) roles.

Twenty participants could recall how long they had held their current position within the hospital, with a mean of 12 and median of 11 years (SD 10 years) (Figure 4.2).
Of the 21 participants, 17 (81%) had completed a medical degree in a NSW university, one (5%) in Queensland and three (14%) at international universities, with a mean and median time of 28 years post-graduation at the time of interview (SD 12 years).

Figure 4.1: Self-reported Length of Time in Current Position at Time of Interview (in 5 year aggregates after the first year).
Note: One participant was unable to recall their time in current employment.

Figure 4.2: Self-reported Length of Time Since Graduation from a Medical Degree (in 5 year aggregates)
When recalling the number of hospitals or institutions that they had worked during their advanced (post-graduate) specialist training, five participants (24%) had trained in a single institution, nine (43%) in two, three (14%) in three and four (19%) in five or more.

Eighteen of the participants (86%) had completed advanced training at the time of the interviews, with all having been employed in at least two different hospitals in post-training roles and the majority (72%) having worked in at least three hospitals. Eleven participants (52%) had worked internationally either as part of their training or as a staff specialist.

4.3 Requesting Patterns

The majority of participants (16 out of 21, or 76%) ordered pathology tests on 90-100% of their patients, with 81% ordering an average of 1-10 tests (or groups of tests such as full blood count) per patient.

When asked which pathology test or group of tests is the most clinically relevant, most participants (57%) nominated biochemistry tests such as troponin, inflammatory markers, electrolytes and liver-function tests, together with a full blood count as the most valuable test for their clinical needs. Most designated a desired turnaround time (TAT) of between 30 minutes and four hours for these “most valuable” tests (Table 4.1).

When assessing the TAT of all pathology results, the majority of participants (76%) agreed that fewer than three days was acceptable, with all saying that results should be back within a week at most (Table 4.1). For many clinicians the emphasis was on having results returned within clinically appropriate times that were within the limitations of the test methodology used, as described by participant 1: “...I know it would be stupid to say ‘ten minutes’ but obviously I want it as quickly as possible”.

Variation in the perceived acceptable TAT was strongly linked to the clinical speciality, with those seeing patients in emergency or intensive care settings such as cardiovascular, renal and emergency medicine and intensive-care all demanding a quick TAT. Interestingly, methodological advances in testing seemed to drive even shorter TAT expectations: for example, improved access to point-of-care (POC) testing is likely
to drive the demand for rapid TAT to allow for the prompt diagnosis of patients who are critically ill (participant 42).
Table 4.1: Respondents’ Medical Speciality and Most Valuable Pathology and Turnaround Times (TATs)
FBC= full blood count, EUC = Electrolytes (Sodium/ Potassium/ Chloride)/ Urea/ Creatinine, LFT = liver function tests.

<table>
<thead>
<tr>
<th>Interview</th>
<th>Speciality</th>
<th>Most valuable test (or group of tests)</th>
<th>Acceptable TAT for most valuable</th>
<th>Acceptable TAT for all pathology results</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Immunology and immunopathology</td>
<td>Immunology</td>
<td>48 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>12</td>
<td>General physician and general pathology</td>
<td>Genetic testing</td>
<td>May take months</td>
<td>1 week</td>
</tr>
<tr>
<td>13</td>
<td>Immunology and immunopathology</td>
<td>Inflammatory markers</td>
<td>24 hours</td>
<td>2-3 days</td>
</tr>
<tr>
<td>14</td>
<td>Cardiovascular medicine</td>
<td>Troponin</td>
<td>&lt;4 hours</td>
<td>2-4 hours</td>
</tr>
<tr>
<td>15</td>
<td>Renal</td>
<td>EUC</td>
<td>30-60 minutes</td>
<td>48hrs-1week</td>
</tr>
<tr>
<td>17</td>
<td>Immunology and allergy</td>
<td>FBC</td>
<td>4 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>18</td>
<td>Renal medicine</td>
<td>EUC</td>
<td>30 minutes</td>
<td>1-1.5 hours</td>
</tr>
<tr>
<td>22</td>
<td>Emergency medicine</td>
<td>Haematology and biochemistry</td>
<td>1 hour</td>
<td>1 hour</td>
</tr>
<tr>
<td>24</td>
<td>Orthopaedics</td>
<td>Haematology and biochemistry</td>
<td>2 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>25</td>
<td>Orthopaedics</td>
<td>Haematology and biochemistry</td>
<td>24 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td>26</td>
<td>Medical oncology</td>
<td>FBC, EUC, LFT</td>
<td>20 minutes-2 hours</td>
<td>&lt;8 hours</td>
</tr>
<tr>
<td>No.</td>
<td>Department</td>
<td>Tests</td>
<td>Time Frame 1</td>
<td>Time Frame 2</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------</td>
<td>----------------------------------------</td>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>27</td>
<td>Medical oncology</td>
<td>FBC, EUC, LFT</td>
<td>1 week</td>
<td>1 week</td>
</tr>
<tr>
<td>31</td>
<td>Gastroenterology</td>
<td>Patient-dependant. Did not specify test.</td>
<td>24 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>32</td>
<td>Immunology and haematology</td>
<td>FBC</td>
<td>30 minutes</td>
<td>2 hours</td>
</tr>
<tr>
<td>34</td>
<td>Rheumatology</td>
<td>Inflammatory markers, autoimmune serology and vitamin D level</td>
<td>2-3 days</td>
<td>2-3 days</td>
</tr>
<tr>
<td>40</td>
<td>Pathology and internal medicine (infectious diseases)</td>
<td>Microbiology</td>
<td>&lt;8 hours</td>
<td>&lt;8 hours</td>
</tr>
<tr>
<td>41</td>
<td>General practice and sexual health</td>
<td>Microbiology and immunology</td>
<td>&lt;1 week</td>
<td>&lt;1 week</td>
</tr>
<tr>
<td>42</td>
<td>Intensive care</td>
<td>Blood gases</td>
<td>5 minutes</td>
<td>1-2 hours</td>
</tr>
<tr>
<td>45</td>
<td>Infectious diseases and microbiology</td>
<td>FBC and C-reactive protein</td>
<td>1 hour</td>
<td>1 hour</td>
</tr>
<tr>
<td>46</td>
<td>Biochemistry</td>
<td>Lipids</td>
<td>3-4 hours</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>47</td>
<td>General surgery</td>
<td>Anatomical pathology</td>
<td>5 days</td>
<td>1-7 days</td>
</tr>
</tbody>
</table>
4.4 Methods of Ordering Pathology Tests

When asked the method by which pathology tests were ordered, 14 (67%) participants used paper requests only, three (14%) used electronic ordering and four (19%) used a combination of paper and electronic processes.

The Kruskal-Wallis Test showed no statistical associations identified between the method of ordering pathology tests and the demographic characteristics, including time since graduation from medical school, time in current position, if the participant had ever worked internationally and the number of hospitals or institutions that the participants had worked during training or since completing training (see statistical analysis in Appendix B).

Many participants who used paper-based methods of ordering felt the need to justify or rationalise this approach: comments included:

“Because there’s no mechanism for me to – to do it electronically that I’m aware of.” (Participant 17)

“I don’t order anything by computers ever, I’m a Luddite, I hate computers. If it has to be done in the hospital [and] it has to be ordered electronically, I have minions to do that. I’ve never made an electronic order in my life; I will go out of service never having made an electronic order.” (Participant 24)

“…using paper, which actually suits me fine because I think the – it takes me three seconds to order a paper test and when you’re really busy…having gone through the system of electronic ordering it looks pretty laborious and…clunky at times…and if your computer, for various reasons, it just stops working, you find that you can’t do your job because you’re completely dependent on if the computer server’s up or down.” (Participant 26)

“It’s easier on paper – yeah. The patient can then carry the paper with them and normally if the online ordering is done by my team; my registrar or my interns. And I’m used to doing it on paper.” (Participant 34)
“The junior staff order things electronically… I order everything on paper. I’ve tried to order things electronically on the wards and I haven’t been able to do so. I think it’s just the lack of training.” (Participant 45)

For participants who used both means of ordering, generally paper requests were only used when there was a specific reason why the order could not be performed electronically:

“About 90% electronically and about 10% of them are paper… generally it’s because electronics – electronic stuff isn’t utilisable... it might be that the form needs to go with the bloods, et cetera, because I’m collecting them myself and I can’t – like there’s no printer down in recovery. So it’s a process, so if I can I use electronic, and there’s only those times when I can’t use electronic, that I go and use paper.” (Participant 18)

Even for those who solely used the electronic system there were still issues in a completely paperless system:

“[I order] electronically. There is still paper but the problem is with the daft electronic system that they put in. So we order electronically and the result comes back electronically but we have to print out a copy of the order to accompany the blood tubes so that the specimen collection lab can sort out which tests or which tests that that tube was supposed to be for. So for a paperless system we still need a piece of paper in the middle of it so that the collection dispatch area up in biochemistry that sorts out stuff to go to biochemistry and stuff that goes to haematology, stuff that goes to immunology or wherever, so that they can work out which tube is for which test.” (Participant 42)

A semantic analysis of responses identified a number of themes in addition to “paper” and “electronic”, including “form”, “hospital” and “time”. These themes encompassed many interrelated concepts, mostly relating to the apparent restrictions or shortcomings
of the hospital-based computer systems, and also highlighted the processes that many respondents had been using for years that they perceived to be the most uncomplicated and time-effective means of ordering pathology tests.

The combination of both analysis methods identified the importance of the computer interface as a key determinant in the uptake of electronic means for ordering and viewing patient results. In this cohort it is evident that both a lack of training and the ability to integrate computer-based tasks in to current work practices was an issue that had not been overcome. This was further compounded by the limitations of the interface software at the study site, which at the time of analysis did not allow for electronic ordering in many outpatient areas.

4.5 Methods of Reviewing Pathology Results

When asked how they reviewed pathology results, six clinicians (28%) reviewed results by paper, two (10%) both electronically and by paper, and 13 (62%) by electronic means alone. A significant increase was noted in the utility of the electronic interface in reviewing results compared to ordering (p<0.05) (students T-Test), though no significant differences were associated with demographic groupings and the use of electronic interfacing for reviewing results using the Kruskal-Wallis Test (Appendix B).

Most respondents agreed that the electronic interface allowed for easier review of patient results compared to paper. The main advantages of electronic review included the ability to look at multiple results at the one time and as well as view results in a longitudinal manner, which most users preferred.

“So for any hospital results I’ll view electronically, outside labs tend to get paper…our patients tend to, you know, live geographically quite diverse, some of them are in rural New South Wales so it’s not really feasible for them to have pathology tests here. I try to encourage them to get them done here just because it makes life easier - you can track their results on the computer.” (Participant 15)

Despite this, there were still a number of respondents who solely used paper review, or used paper as an adjunct to the electronic system. The main reason given for this was
that it formed part of longstanding processes that allowed for the rapid identification of abnormal results.

“Well it’s just what I’m used to and I have an inbox and everything sits there, but it’s also very quick to look at because they’re screening tests: abnormal results come up as a highlight black or it’s in bold or there’s an asterisk next to it. I can quickly scan down and see which ones are abnormal, are they very abnormal, and it’s really very very quick for me to do that…. If I had to look up each patient individually on the computer system through here I think it would take me about 10 times longer and that wouldn’t be efficient for me.” (Participant 25)

A number of requestors also saw results from external laboratories that were not in the electronic system as an issue, with difficulties in obtaining results from external providers.

“Well, if they’re registered in the hospital system I tend to look online, and if they’re not registered in the hospital system I sometimes have to try and find them… [I] think it is unfortunate that there is such a heterogeneity of labs and reporting systems around…it is frustrating and if it were possible to have it all on one electronic record that would be the preferred outcome.” (Participant 27)

The difference in the uptake of the electronic system for reviewing, as opposed to ordering results highlights that clinicians in this work environment can adapt work processes when they see an advantage to doing so. The main disadvantage noted by many respondents was the inability to access results from locations outside the hospital.

The means of both ordering and reviewing pathology test results highlight that there is significant scope for improvement in the capabilities of the electronic interface. There also appears to be a clear breakdown in communication with the end users of the interface, with little scope for bidirectional interaction between those who build the electronic interface and those who manage it.
Training was also identified as a major issue, with a number of respondents emphasising their lack of proficiency in certain aspects of the laboratory information system (LIS). It is evident that little ongoing education and training within the system takes place. This lack of training appears to be persisting, with many of the junior clinicians expressing similar sentiments to their senior counterparts.

4.6 The Use of Pathology tests for Clinical Decision Making

Twenty participants nominated an approximate figure that they considered the degree to which pathology services influenced their clinical decision-making. Figures varied from less than 5% to 100%, with an average result of 60%. Surgeons nominated the lowest extent to which pathology tests guided their clinical decision-making, saying radiology and other imaging were more important for their clinical needs. Specialities such as immunology, haematology and intensive care were guided by pathology results in more than 95% of their clinical decisions.

Many respondents noted that the utility of clinical decision-making was also influenced by whether they were seeking a diagnosis for the patient or monitoring disease. For the latter it was noted that although fewer pathology tests were ordered the value of results was greater:

“For monitoring...in many cases whether you do nothing or you do something is very much based on a pathology test result.” (Participant 11)

4.7 Quality of In-hospital versus Private-sector Pathology Services

When asked if there was a difference in the quality of pathology services provided in the public system compared to the private sector, two participants did not routinely use private pathology services and indicated they were not in a position to comment. Of the 19 participants who answered, two felt that there was no difference between pathology services provided publically or privately, especially in routine automated tests. One participant who had no strong opinion regarding the sector noted that there were vast differences in the quality of specific laboratories, and that these differences were not sector-dependant.
“I think there’s great variation in both [the] public and private sector in terms of pathology, in the quality of the pathology. So there will be some pathology practices where it would be comparable and other where it wouldn’t be comparable, and there would be some public pathology practices where it would be comparable to [the] private sector, so there’s no uniform pattern, I don’t think.” (Participant 12)

The remaining 16 (58%) felt that there was a difference between the services, with five stating that the quality of pathology services was higher in the private sector, four favouring the public system and seven noting that both types of pathology services had positive and negative attributes.

“... so in some ways the private sector is more responsive to unusual things, but in the end you can get any test you need here (in the public system), whereas in the private sector that might involve a conversation with a pathologist and a whole heap of running around. So there is less high-level intervention needed here to get something odd done. So you know they’re just different. So, say, infrequent low-volume tests that might be batched across Sydney, here I can just send it off and they’ll sort it out, in the private system I’d have to talk to the pathologist about getting it sorted out. So in one sense that’s a better system because it means I have interaction with a senior pathologist to make sure that I’m properly educated about the test, but here it’s painless, it’s really different but not necessarily better or worse.” (Participant 42)

Five participants felt that in terms of automated tests there was no difference between the two sectors; however, two of these also highlighted that specific laboratories, such as anatomical pathology, were considered to be superior in the public sector.

There was no statistical difference between participants’ demographics and their preference for public or private pathology, with the exception of length of present employment (Appendix B). Participants who had worked in their current (public) position for more than 10 years were significantly more likely to express positive sentiments regarding the public system than those who had worked in their current
position for fewer than 10 years (p=0.02) according to the Kruskal Wallis Test (Figure 4.3).

Figure 4.3: Respondents’ Length of Employment in Current Position versus Preference for Public or Private Pathology
Respondents who felt private pathology quality was superior in terms of quality are shown in dark blue, public in light blue and both good in specific in green.
Where private pathology services were considered to provide a higher-quality service, the following attributes were identified as being superior: faster TAT (six participants); results more reliable (two participants); reporting better or more detailed (two participants); appear to have more funding/available money for resources (two participants); a better system for accessing and displaying patient results (two participants); easier for patients to access for collection (two participants) and being more responsive to customer needs (one participant).

Common perceptions of the private sector are summed up in the following statement:

“The actual performing of the assays, a lot of it is automated and a lot of it is fairly standardised but certainly the private labs because they’re servicing more of a GP referral base that they need to value add quite a lot more, so there will be a lot more commenting and interpreting and looking at results....” (Participant 46)

Participants who deemed public pathology services better highlighted the following attributes: faster TAT (four participants); results more reliable (three participants); more pathologist and laboratory interaction and availability (three participants); more complex tests performed (three participants); preferred the electronic records of the hospital based system (two participants); more care taken in issues around testing (two participants); accessible 24 hours (one participant); easier to have unusual tests performed (one participant) and a greater repertoire of tests (one participant)(Figure 4.4 shows the NVivo coded concepts). Common statements that highlighted these responses include:

“So if I’ve got an exotic test I’d much prefer to speak to the pathologist in the lab who’s doing the test not the one who referred it on.” (Participant 17)

“The pathology department can’t know whether we need them quickly so they have to provide the results in a timeframe which is the worst possible timeframe for the patient, you know if...if they presume that the patient results need to be there really quickly, even if they don’t need to be, so the hospital gets them here very quickly.
And certainly from my point of view I get pathology results very quickly.”
(Participant 24)

Semantic analysis identified a number of concepts and themes, especially when discussing “public” and private”, which were overlapping. Private pathology was seen as providing “extra” “value” mostly for the sake of general practitioners (“GPs”). “Difference” was also identified as a major theme, especially relating to the “tests” provided by the two services, as well as the “turnaround time”. Semantic analysis also revealed that for hospital patients there was an association with “access” to results and blood tests (Figure 4.5). This appeared to encompass both physical access to collection centres as well as electronic access to patient blood results.
Reasons given by respondents for their evaluation of if differences exist between the pathology services provided within the hospital compared to the private sector in terms of quality.

Figure 4.4: NVivo Nodes Regarding Respondents' Perceptions of the Quality of In-hospital versus Private-Sector Pathology Services
The figure is divided into concepts based on the respondents' views of whether pathology services provided within the hospital (public) or private sectors were superior. The number of respondents for whom the concept was identified (n) is shown for each in descending clockwise order.
Semantic analysis of responses to the question “Do you think there is a difference between the quality of pathology services provided within the hospital compared to the private sector, and if so why?”

Figure 4.5: Semantic Concepts Associated with Perceived Higher Quality in Public versus Private Laboratories
Themes are shown in red; associated concepts in black. “Private” and “Public/Hospital” were identified as major themes. The theme “Difference” was closely related to "Private”, and encompassed concepts such as differences in tests offered and turnaround times.
4.8 Important Factors in the Delivery of Pathology Services

When asked what factor was considered to be the “most” important in the delivery of pathology services a number of respondents identified two or three important factors. From the 21 respondents 34 concepts were identified as being the “most” important; these were grouped into seven themes: timeliness, reliability and accuracy, quality factors, the ability to discuss the result with laboratory staff, communication of abnormal results, appropriate and robust methods and patient access to collection centres (Table 4.2).

When the results were combined with the next question, which asked respondents to list all the factors they considered important in the delivery of pathology services, an additional 12 concepts were identified: good electronic access, knowing who to talk to about the results, good interpretation of results, pre- and post-analytical quality, having a broad repertoire of tests, convenient collection times, sufficient staff numbers and training, attention to detail, cost, appropriate financial and administrative infrastructure, having links with research and a sufficient volume of requests to make testing appropriate and with clinically acceptable turnaround times (Figure 4.6).

When assessing which factors were important many respondents felt that aspects such as reliability and accuracy were automatically at the highest possible level due to the various legislative and accreditation bodies that oversee pathology.

“Things like accuracy and stuff like that we all just would take for granted, so the stuff that the pathology providers spend a lot of time themselves getting NATA approval for - their accuracy and stuff - something beyond us.” (Participant 42)

“Well, reliability, but I assume that all labs are reliable so the speed is the most important thing.” (Participant 31)

Many of the other identified factors were based on clinical needs such as if the respondent was treating acutely sick patients or more chronic illnesses. Many were prepared to trade one quality factor for improved service in another area:
“So it’s got to be accurate and I would trade accuracy for turnaround time, you know, in my practice, because of the nature of my practice. Because I’m not in the emergency department dealing with hyper-acute patients and it’s far more important that that it’s accurate to me than if it comes today versus tomorrow morning.” (Participant 17)

“You need the access to the results, and in fact I use the hospital pathology less for my outpatients then I used to because they don’t just send me the results, and I think they’re equally important, and in fact I might accept the slight reduction in quality of results for easier access. Nothing gets missed that way.” (Participant 34)

A similar range of themes was generated using semantic analysis, with importance of quality results seen as a key. “Time” as a concept and theme was closely related to this concept, as were themes relating to communication, such as knowing which staff to contact regarding pathology results. The map demonstrates that the theme of “people” links closely to “contact”, “problem” and “question”. The “interpretation” of “tests” (knowing who to talk to regarding a result and how to contact them) were also highly prevalent in responses (Figure 4.7).

Table 4.2: Concepts Identified when Respondents as the Most Important in the Delivery of Pathology Services. From 21 respondents, 34 concepts were identified.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Number of respondents who identified the concept as the “most important” quality factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeliness</td>
<td>14</td>
</tr>
<tr>
<td>Reliability and accuracy</td>
<td>9</td>
</tr>
<tr>
<td>General quality</td>
<td>4</td>
</tr>
<tr>
<td>The ability to discuss the result with laboratory staff</td>
<td>2</td>
</tr>
<tr>
<td>Communication of abnormal results</td>
<td>2</td>
</tr>
<tr>
<td>Appropriate and robust methods</td>
<td>2</td>
</tr>
<tr>
<td>Patient access to collection centres</td>
<td>1</td>
</tr>
</tbody>
</table>
Factors identified as important in the delivery of pathology services

Figure 4.6: Directed NVivo Nodes Showing Factors Identified as Important in the Delivery of Pathology Services.

In total 19 factors were identified as quality indicators, with “timeliness” the most commonly identified (14 respondents). Factors are shown in descending order clockwise, with n being the number of respondents for whom in which the concept was identified.
Semantic analysis of all factors associated with quality in the provision of pathology services.

Figure 4.7: Semantic Analysis of Factors Associated with Quality in the Provision of Pathology Services
Themes are shown in red and associated concepts in black. Results show the word associations between strongly linked concepts and themes. “Important” quality factors were identified as the main theme, which was closely linked with themes relating to “time” and “staff”.

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4.9 Positive Service Experiences

When asked to describe a time in which respondents had a positive experience with the hospital pathology service, the most common response related to being phoned by a pathologist or scientist with a markedly abnormal result:

“There are a number of occasions over the years where a pathologist has rung me in my office about a certain result, whether it be histopathology or even a blood result, and I am always absolutely delighted if someone rings me with an abnormal or a strange result, and I am very happy that they feel they can ring me and give me that information. I’m just absolutely delighted if someone was to ring me if something is a bit skeewiff. I think it’s fantastic and I love that.”

(Participant 25)

Obtaining results that strongly correlate with the clinical presentation of the patient, fast turnaround time and repeating results quickly if queried/asked were the next most commonly described scenarios (Figure 4.8).

The semantic analysis using Leximancer was highly comparable with the thematic analysis, with many common themes identified. Concepts relating to the notification of “abnormal” patient results being relayed “quickly” were seen as helpful and an essential service component, as was “time” in the theme of results (Figure 4.9).

These descriptions highlight the importance that users of pathology services place on non-analytical components of testing, especially in issuing results. Descriptions relating to contacting or being contacted by laboratory staff or a pathologist accounted for the majority of themes identified relating to positive service experiences. Concepts concerning TAT were also prevalent in respondents’ descriptions, and often associated with positive service outcomes.
Concepts associated with positive experiences in the delivery of pathology services

![Diagram showing themes associated with positive experiences in pathology services]

Figure 4.8: Directed layout of NVivo Nodes Showing Themes Associated with Positive Customer-service Experiences with Pathology
The most common description of positive experiences related to being phoned by a pathologist or a scientist/technician in the laboratory to be informed of a highly abnormal patient result. Concepts are shown in descending clockwise direction, with “n” being the number of respondents for whom the theme was identified.
Semantic analysis of respondents description of a positive experience with pathology services or a specific laboratory at the study site.

Figure 4.9: Semantic Analysis of Factors Associated with Quality in the Provision of Pathology Services
Themes are shown in red and associated concepts in black. Descriptions of relaying “abnormal” results were seen as helpful and important to patient care if notification was done “quickly”.

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4.10 Poor Experiences with the Service

Twenty of the 21 participants were able to describe what they felt was a “poor service experience” relating to pathology. There was great diversity in responses, with 15 different concepts identified (Figure 4.10). The largest group of poor experiences related to a delay in testing or testing not being performed within clinically relevant timeframes; this was particularly relevant to tissue (anatomical) pathology. Factors relating to pre-analytical errors and lack of communication were also prevalent in responses.

“The biggest problems are always delays in getting the results or the blood wasn’t taken or it was taken, but the sample, something has happened to the sample. And to be notified of that early is really important.” (Participant 14)

Like thematic analysis, semantic evaluation showed considerable variation in the concepts identified by participants. Interestingly, not “thinking” of the net consequence of actions was shown to be a major theme with respondents. Examples included not thinking outside established protocols when rejecting a sample that may have been difficult to collect, or not thinking about the end user in methodological changes:

“I think the poor experiences are really related to samples that might not have been optimally collected and where they are just discarded without thinking about “well, could [it] be still usefully processed”- you know, some of those situations, I think. They’re trying to adhere to standards but without, perhaps sometimes, always recognising how difficult it was to get the sample…” (Participant 17)

“I guess recently the microbiology department has basically picked a chlamydia and gonorrhoea testing kit to use which although it may be better, for us - for self-collection with patients, it’s really, really difficult and...we now have to buy the swabs and they’re very expensive...we weren’t told any of that. It was just ‘we’re moving over to this new kit’. So that’s been a really negative experience from my point of view.” (Participant 41)
Other themes included not being informed of “reasons” for delays in testing or cancelling samples, issues associated with turnaround times, not meeting clinical needs, and times when the incorrect test was performed on blood samples (Figure 4.11).
Concepts identified in response to the question “Can you describe a time where you had a poor service experience with the internal pathology services within the hospital?”

Figure 4.10: Directed layout of NVivo Nodes Showing Themes Associated with Poor Service Experiences with Pathology.

The most commonly identified theme amongst responders related to issues with “preanalytical errors” (n=12) which encompassed a number of concepts, delays in testing being the second most common theme. Themes are shown in descending clockwise direction, with “n” being the number of respondents for whom the theme was identified.
Semantic analysis of responses to the question “can you describe a time where you had a poor service experience with the internal pathology services within the hospital?”

Figure 4.11: Semantic concepts of Factors Associated Poor Customer Service Experiences. Themes are shown in red, and concepts in black. A wide variety of concepts were identified in respondents descriptions. Main themes associated with poor service included not “thinking” about the net consequences of actions, delays in “time” taken to produce results and not informing the clinician of the “reason” for delays or problems in testing.
4.11 Communication with a Particular Laboratory or Pathologist Regarding a Test Result

When respondents were asked to describe a time where they had called the laboratory or a pathologist regarding a test result, 20 (95%) could describe such a situation. The most common scenario was to obtain or clarify a result, with many saying that it was an essential part of the service to have an “expert” or “someone who actually performs the test” on hand to discuss the result. Many also felt it was important to have an existing relationship or line of communication with the person they contacted to fully gauge their level of expertise and understanding:

“Yes, absolutely, and I think that’s a really important part of the service that, a very important part of the service is to have someone educated who can shed light on an abnormal result....” (Participant 14)

“I mean I’ve called often enough about pathology results...it’s always been a positive experience. And I’ve even called them about a result that I received outside because I’m not sure what it means...We have real rapport with the units here, we have people who are fantastic in their field and running quality service whether they be microbiology, biochemistry, haematology. So the quality of the service is excellent.” (Participant 34)

Other reasons that were nominated for needing to contact the pathology service (in order of frequency) included: to report an error with a result; to discuss the clinical implications of a result; to get tests added-on; to enquire about a delay or expected turnaround time; to ask for an urgent result; and to ask if the result could be reviewed together with a pathologist. These themes were also identified in the semantic analysis. Figures 4.12 and 4.13 show the NVivo and Leximancer analyses respectively.

These results suggest that the ability to effectively interact with laboratory staff and/or pathologists allows for the communication of problems to be fed back to the service, as well as ensuring that the needs of consumers are conveyed. It is interesting to note the
number of respondents who preferred to speak to someone with substantial knowledge of the service rather than a centralised call area such as specimen reception.
Concepts identified in response to the question “can you describe a time where you had a poor experience with pathology services or a specific laboratory within the hospital?”

Figure 4.12: Directed Layout of NVivo Nodes Describing Respondents’ Contact with the Laboratory or Pathologist Regarding a Test Result

Commonly identified themes included contacting the laboratory to obtain or clarify a result (n=11) or to discuss the clinical implications of a result (n=3). Within these groups it was also noted that respondents preferred to speak to someone who was an expert in the area or someone who actually performed the test to get an expert opinion/interpretation. Themes are shown in a clockwise direction, with “n” being the number of respondents for whom the theme was identified.
Semantic analysis of responses to the question “please describe a time where you have called the laboratory or pathologist regarding a test result that you have received?”

Figure 4.13: Semantic Analysis of Respondents’ Descriptions of Contacting a Laboratory or Pathologist
Themes are shown in red, associated concepts in black. The map demonstrates that the concept “talk” links closely to requesting “add-ons” and discussing “tests” specifically relating to problems, which indicates they were all used close together.
4.12 Factors that Influence Respondents’ Rating of the Quality of Pathology services

When asked to rate the quality of the in-hospital pathology services (on a scale of 1 to 10), respondents’ ratings had a mean and median value of 8 (range 3-10). There was no statistical significance between rating and demographic factors, according to the Kruskal Wallis Test (Appendix B).

When respondents were asked to elaborate on what factors contributed to the rating score, approximately half of all responses were related to descriptions of previous negative experiences, while the other half related to positive associations/encounters with the service (Figure 4.14). The most common theme was the feeling that turnaround times were good, which enhanced the clinical utility and thus the quality of the service; however, interestingly, the second most common response was the opinion that turnaround times needed improvement.

“Oh, you know, considering the volume that they do I think the turnaround and reliability of results is great.” (Participant 22)

“I think in general it’s good, and the only way that it could be sort of better would be if the results were relatively faster, but that’s about the only thing.” (Participant 24)

Four respondents said that “there are always things you can improve” when questioned as to what their rating was based on, but most were able to describe specific factors or situations that directly related to their ratings. Many acknowledged that their “inside knowledge” or experience with the service guided their rating, and noted that others who did not have the same level of familiarity might not assess the service in the same positive light:

“You know, I think they’re outstanding. From the perspective of people trying to use them from outside the hospital, you know, GPs or whatever else trying[to] access them and getting results et cetera, I don’t think they [are] necessarily quite
as favourably viewed. So if they know the system well...then they have a happy experience, but if they try to get through the hospital switchboard and then get redirected to, you know, enquiries, and then get redirected to the laboratory and then get redirected to the technician, the scientist who does the test will then redirect them to the pathologist who isn’t there that morning.” (Participant 17)

Other factors that were also seen to influence overall satisfaction rating included the ability to access results electronically, correlation of results with the clinical picture, reproducibility and reliability of results and availability of clinical and scientific staff.

Semantic analysis revealed a similar spectrum of results with “turnaround” time and factors internal to the “lab” such as the ability to “ring” “people” to ask for their “perspective” on a test. “Results” was also a central theme that encompassed “access” to results, especially relating to hospital patients (Figure 4.15).

This reiterates the importance of appropriate and prompt TAT in testing as being key to the satisfaction of those who use the service. This, combined with factors that are inherently linked with aspects of customer service such as the availability of staff, especially pathologists, to take telephone enquiries and good access to the LIS, are key to ensuring satisfaction with pathology services in hospital environments.
Self-reported concepts that affect the rating of the quality of pathology services

Figure 4.14: Directed Layout of NVivo Nodes Showing Attributes Associated with Perceptions of Quality in Pathology Services

Concepts were broken into positive attributes of the service and negative experiences that were perceived to influence the assessment quality. A number of respondents also noted that regardless of how good the service, there was always the potential for improvement. Concepts are shown in a descending clockwise direction, with “n” being the number of respondents for whom the theme was identified.
Semantic analysis of responses of self-reported concepts that affect the rating of the quality of pathology services

Figure 4.15: Semantic Concepts Showing the Factors that Influence Perceptions of Quality in pathology Services
Themes are shown in red, associated concepts in black. Analysis shows main themes identified in responses including “turnaround”, “lab” aspects of service and factors associated with the provision of results, such as ensuring they are “correct” as well as having a wide “range” of pathology tests available.
4.13 Confidence in the Accuracy of Pathology Results

When asked how confident respondents were with the accuracy of results provided by the current in-hospital pathology service (on a scale of 1-10), all indicated high levels of confidence in results, with a mean and median rating of 9 (range 7-10). There was no statistical significance between ratings and demographic factors (Appendix B). The majority of respondents (72%) gave a statistically higher rating using the Paired Samples Test for confidence in the accuracy of results compared with the rating given for overall service quality (p=<0.05) (Figure 4.16); 14% gave the same rating while the remaining 14% gave a lower rating (Appendix B).

The overall quality rating of the service versus rating of the accuracy of the service

Figure 4.16: Respondents ‘Ratings of Overall Quality versus Accuracy for Pathology Services’
Both ratings were on a scale of 1-10. Most respondents (15/21) gave the accuracy of results a higher rating than overall quality of service, six gave both the same rating and three gave accuracy a lower rating.
The main theme that emerged though both thematic and semantic analysis of the factors that influenced respondents’ assessment of accuracy was their previous experiences with the service (Figures 4.17 and 4.18). Concepts such as low error rates, correlation with clinical presentation and longitudinal consistently in results for the same patient were seen as being good indicators of accuracy.

“I think the clinical picture tends to mirror pathology, or pathology mirrors the clinical picture - the results always seem to be what you’d expect for your patient and they’re consistent over time.” (Participant 15)

A close working relationship with technical staff such as scientists as well as the pathologists was also highly prevalent in responses. Common illustrative responses included:

“Well, I know the processes that are involved in the laboratory and I know the quality of the staff, the quality of the pathologists, and I feel confident the service offered is a high-quality service with a good accuracy of the results.” (Participant 12)

“I know the pathologist, I know the tests, I have access to blood tests for the people I’ve referred. I’ve actually compared with other laboratorie’s tests results and I’m much more confident about [the in-hospital pathology services’] tests.” (Participant 34)

A number of respondents noted that there was a “quality culture” within the hospital that influenced their perceived assessment of how accurate the results were, and also their perception of quality in pathology as a whole:

“So the doctors that I know, that are in the lab are, you know, people that I respect and have a great deal of faith in. And I assume they run a tight ship and I assume the people that - you know - the scientists that they get to run the lab are similar, so I think it’s part of the culture of the place.” (Participant 22)
While the concept of “quality control” was mentioned by six respondents, only one mentioned accreditation requirements as affecting their overall assessment of accuracy:

“I’m aware of the NATA requirements and the reference lab requirements and I know that they’re pretty diligently adhered to, so I’m pretty confident the results are appropriate…. I have a superficial understanding of the way that they have to go through regulatory hoops to remain accredited.” (Participant 42)

Many respondents also acknowledged that there was always going to be the possibility of errors, especially in the pre-analytical components of testing, though as confidence in accuracy increased along with the degree of automation.

These findings challenge the preconceived notion held by many laboratories that assessment of accuracy in testing is largely related to accreditation and analytical quality control. While these are exceedingly important in ensuring suitable testing practices, a focus on internal assay control negates the pre- and post-analytical testing components that also play an important role in the overall assessment of how consumers rate the accuracy of the service. This echoes the need to ensure total quality management of pathology services, rather than solely emphasising quality control.
Self-reported concepts that influence the rating of the accuracy of pathology services

Figure 4.17: Directed Layout of NVivo Nodes Showing Concepts Influencing Perceptions of Quality in Pathology Services

Concepts that were deemed to be associated with experiences of the service featured frequently in responses, as did the use of quality control material by the laboratory. A number of respondents also noted that the potential for errors in testing must always be accounted for. Concepts are shown in a clockwise descending order, with “n” being the number of respondents for whom the theme was identified.
Semantic analysis of the factors that influence how confident respondents were with the accuracy of results from the in-house pathology service.

Figure 4.18: Semantic Analysis of Factors Influencing Confidence in the Accuracy of pathology results.
Themes are shown in red with associated concepts shown in black. How ‘confident’ respondents were with “results” was closely linked to “quality” and “experience”. There was also a link with the ‘clinical’ presentation of patients as well as low “error” rates.
4.14 What Would Improve the Quality of In-hospital Pathology Services?

Twenty respondents were able to nominate one or more aspects of the pathology service that they felt could be improved to enhance quality. While 13 individual themes could be identified (Figure 4.19), two themes were common to the majority of users: the need for results to be performed according to consistent, rapid timeframes; and the need for improvements in the electronic ordering system, especially in relation to the notification of results when they become available, and tracking mechanisms to ensure that all abnormal results have been seen by the requesting clinician.

“I think there’s a capacity, a bigger capacity, for missing things and error in there. I think that’s one thing I would really like to see in that, that those results, you know, ‘whoosh’ to the requester so that they have to - physically have to tick them off to say that they’ve actually reviewed those results.” (Participant 13)

There were also a number of comments related to having greater capacity for clinician interaction with the pathology service, including having enhanced teaching of new graduates and trainee doctors:

“...we get 100 junior doctors float through here every year on various terms and so they see lots of physiology and lots of biochemistry that they wouldn’t normally see, and so having better interfaces with the laboratory services to educate them [about] what the laboratory services are for and what they can do and stuff like that would be good. And also stuff around educational links with the service would be useful.” (Participant 42)

Semantic analysis revealed the “time” taken to provide “results” and “having” good “access” to “tests” and results as the central themes that were identified (Figure 14.20). “People’s” involvement in ensuring communication of abnormal results or problematic samples was also identified:

“...if there was a dedicated person to communicate all the abnormal results it would just add another safety net I guess, so that if the residents, the registrar are busy doing something that an abnormal results not missed, and I guess if results
are cancelled someone communicates, you know, lets us know what’s happened or why, why not and things like that.” (Participant 18)

Concepts identified in response to the question ‘what would improve the quality of pathology services offered at the hospital?’

Figure 4.19: Directed Layout of NVivo Nodes Showing Areas that Respondents Felt Needed Improvement in the In-hospital Pathology Service
Consistent and fast turnaround times was the most commonly identified theme, while enhancements to the current electronic interface with pathology services was seen as substandard by many. Concepts are shown in a clockwise descending order, with “n” being the number of respondents for whom the theme was identified.
Semantic analysis of responses to the question ‘What would improve the quality of pathology services offered at the hospital?’

Themes are shown in red, associated concepts in black. Analysis also identified the “time” taken to provide “results” and “having” good “access” to “tests” and results as the central themes. Other factors, such “people” who were available to phone about abnormal results and “efficient” “laboratory” services, were also mentioned.

Figure 4.20: Semantic Analysis of Improvements Needed in In-hospital Pathology Services
4.15 Assessment of the In-house Pathology Service Compared to Other Services Participants Have Used

Twenty respondents were able to ascertain if the current in-hospital pathology service was better, worse or the same as other pathology services they had used. Of these, 55% felt that the in-hospital pathology service was better than any other pathology service they had used, 35% said it was the same and 20% said it was the same in some aspects but worse in others. A breakdown of factors associated with comparative judgements of the service is shown in Figure 23. There were no statistical associations with comparative rating of pathology services and any demographic factor, or with the overall rating of the service in terms of quality or accuracy.

When analysing participants’ reasons for suggesting that the in-hospital pathology service was better than others they had used, no major themes emerged from the concepts. Reduced turnaround time and access to laboratory staff and pathologists were the two most cited reasons, each of which was mentioned by a small number (three respondents). An illustrative response is shown below.

“Probably better. I think the turnaround is faster and generally people are approachable and available and they’re quite helpful. Whereas in other places the turnaround is definitely slower, and it’s harder to get in contact with people. In the UK it’s much – well it was when I worked there it was much slower and – and it was all paper and hopefully it’s changed now. So [this hospital is] probably the best place I’ve worked in [for] pathology.” (Participant 15)

Semantic analysis identified factors relating to staffing or “people” within the laboratory as the major theme that a number of clinicians considered fundamental in why they viewed the in-hospital pathology service as better than other pathology services (Figure 14.21). This, however, was also identified as a potential liability for the service in terms of the aging workforce with the potential to lose key staff without an adequate knowledge transfer:
“So you know there is vulnerability if you’ve got people who’ve been there for 30 years or whatever. Eventually they leave and services, you know, unless they really train people and built up their knowledge base...they can get into deep water. So I think that’s one of our risks in...pathology services...there’s many of them who may not be still doing it in five years’ time.” (Participant 17)

Even respondents who felt the service was the same as others they had used identified workforce issues as major theme:

“So I think there’s been a bit of dumbing down at the hospital and therefore the level of expert knowledge, both in the labs and clinically, I think has been greatly eroded over the last few years, so I think now it’s one of many hospitals. Whereas I think some time ago it had more investment in [pathology] and probably had more able people around in it then it now has.” (Participant 27)

Two respondents felt particular laboratories or aspects of the service were as good as, if not better than, others, but particular aspects or departments were worse. For example, the Leximancer analysis shows the association with the words “lab” and “different” (Figure 14.22).

“The problem is, pathology services encompasses a whole whack of different services, so if you look at biochemistry and haematology, their services are as good as anywhere. If you look at microbiology their service is pathetic.” (Participant 42)

“As far as the quality of reports goes, it’s better than every other place that I’ve worked. As far as the time of turnaround, it’s probably the same [as] or worse than most places I’ve worked. It’s the same as Toronto, which was the benchmark for badness and slowness,s and it’s worse than some of the other places I’ve worked where the turnaround time was much faster.” (Participant 47)
Concepts identified in response to the question ‘Compared to other hospital pathology services you have used, would you say the RPA pathology service is the same, better or worse and why?’

Figure 4.21: Concepts Associated with Perceptions of the Quality of the In-hospital Pathology Service
Concepts are shown in a clockwise descending direction, with “n” being the number of respondents for whom the theme was identified.
Semantic analysis of responses to the question ‘Compared to other hospital pathology services you have used, would you say the hospital pathology service is the same, better or worse and why?’

Figure 4.22: Semantic Analysis of Perceptions of the In-house Pathology Service Compared with Other Pathology Services.
Themes are shown in red, associated concepts in black. Results highlight the importance of “people” within the organisation as well as time factors, the quality of “results” and the overall “quality” of “service”.

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4.16 Final Comments and Suggestions

When given the opportunity to broach any issues or suggestions about pathology services, 16 participants raised a number of issues, many of which reiterated the deficiencies of the service. However, a number of new concepts emerged: issues with turnaround times, including the need for this to be a priority for the service; concern that changing funding structures may result in amalgamation of services, which could affect turnaround times; the need to improve processes, especially relating to phlebotomy collections in wards; and having greater links with clinical research.

Three main themes emerged from the majority of comments: the need for improved access to the electronic interface from remote locations (44% respondents); the necessity for more interaction between the pathology service or laboratories and other departments within the hospital, as well as the wider medical community, along with increased involvement in the training and education of doctors (38%); and issues relating to workforce (31%).

Respondents felt the electronic interface was substandard in two main aspects: the availability to access results from an external location, and the difficulty in knowing when results would be available. Frustration with the current system was evident in a number of responses:

“It’s – I know it has to be – do a lot of complex things but I think if we can send people to the moon and send probes to Mars I think we can come up with a better laboratory information system. It can’t be that complicated. It’s essentially a database, it can’t be that complicated.” (Participant 45)

The desire for greater interaction between pathology and other departments as a whole showed an interesting dynamic in the way the service has changed over the years from small boutique laboratories with a high level of clinical interaction to larger, high-throughput facilities with much less clinical consultation.

“I suppose one of the things which is – maybe a sign of a super-specialisation, but nevertheless is a bit of a loss- is that I don’t know who the people are behind some
of the laboratory services, whereas in days gone by I did know because they were not only more visible...they were more influential I think in Grand Rounds and things like that...I think the opportunity to meet the people who are on the end of the telephone, if you want [to] have – has actually reduced and I think that’s a loss because - and the MDTs - which is a very fashionable term, the Multidisciplinary Teams - usually don’t have laboratory people represented there, and often there were lots of people there, you wonder why the hell they are there but - so I think that...some of the trends in the means of delivery of care have excluded the laboratory’s knowledgeable people, and I think that’s a loss.” (Participant 27)

There was also concern that the lack of engagement extended past internal relationships and was a systemic issue with external stakeholders:

“In broad terms, as I’ve said, we get a fantastic service, and I guess the service isn’t particularly good at promoting itself or highlighting the fact that it is at an extraordinarily high standard...Other hospital-based pathology services...have a much bigger - both within institution and outside-institution - profile than ours does...See, our services are relatively under-hyped, they’re not promoted in a way that this level of service would justify.” (Participant 42)

Two major concepts related to workforce issues emerged: funding models and their potential to reduce staff numbers, and the future of the workforce as many members of the profession, especially in senior scientific positions, are approaching retirement:

“Well, I mean the general comment I make, the last one, that’s the most important one: that the service is very dependent on the expertise, you know, of key members. And maintaining that into the future is going to be a challenge because of workforce issues generally in pathology, particularly at the scientist level, so there isn’t a large pool of people with the level of knowledge necessary to build and improve the standards, let alone maintain them...” (Participant 17).
4.17 Linking of Results with Conceptual Framework

Results from this study have identified a number of concepts that are associated with the assessment of quality pathology services. Section 2.4 describes the conceptual framework that was used as the basis for the formative in-depth interview questions, and shows the quality dimension from the conceptual framework together with the study findings.

All dimensions identified in the conceptual framework were either partially or completely identified as being important in the assessment of service-quality in pathology. Factors identified with service quality dimensions were seen as the most important indicators of overall quality, followed by personal factors and pre-existing contributions. Each dimension and the corresponding evidence from the results are shown in the following table.
Table 4.3: Dimensions Proposed in the Conceptual Framework Associated with the Overall Perception of Quality In Pathology Service Delivery
Dimensions are broken down into pre-existing (individual) contributors, service-quality dimensions and personal factors. The table also indicates whether the dimension was identified in the current research.

<table>
<thead>
<tr>
<th>Level of the dimension</th>
<th>Dimension</th>
<th>Conceptual-framework dimension</th>
<th>Dimension identified in the current research</th>
<th>Evidence in research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-existing contributors</td>
<td>Demographics</td>
<td>Sex and length of time practicing medicine (a surrogate for age).</td>
<td>No</td>
<td>Insufficient number of female participants to draw conclusions regarding sex differences. No associations between any aspects of service-delivery preference and age.</td>
</tr>
<tr>
<td>Pre-existing contributors</td>
<td>Training and expertise</td>
<td>The location and number of training institutions; medical specialisation; and number of workplaces since completing training.</td>
<td>Yes</td>
<td>Medical specialisation influences number of tests requested per patient, most “valuable” test and the extent to which clinical decision-making relies on pathology results (Sections 4.3 and 4.6) Length of time in current employment is significantly associated with the preference for private or public pathology service (Figure 4.3).</td>
</tr>
<tr>
<td>Pre-existing contributors</td>
<td>Experiences with other service providers</td>
<td>How often pathology services are used; the mix of public versus private services currently and previously used.</td>
<td>Yes</td>
<td>Exposure to a mixture of services allowed for comparison and judgement of quality of in-hospital service versus private organisations and laboratory services in other hospitals (Sections 4.6 and 4.15).</td>
</tr>
<tr>
<td>Service-quality dimensions</td>
<td>Infrastructure/ tangibles</td>
<td>Tangibles, facilities, physical Environment; access to current scientific technology and testing.</td>
<td>Yes</td>
<td>Access to collection centres (Sections 4.7, 4.8 and 4.14). Repertoire and complexity of tests (Sections 4.7, 4.8 and 4.12). New testing technology available (Section 4.9).</td>
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<tr>
<td>Service-quality dimensions</td>
<td>Personnel quality</td>
<td>Human element of service delivery; interpersonal communication.</td>
<td>Yes</td>
<td>Being informed of a markedly abnormal patient result (Sections 4.8 and 4.9). The importance of pathology and laboratory interaction and availability (Sections 4.7, 4.9, 4.11, 4.12 and 4.14). Availability of someone to discuss results (Section 4.8 and 4.9). Knowing whom to talk to about results/personal relationship (Sections 4.8, 4.11 and 4.13). Sufficient staff numbers and training (Sections 4.8 and 4.14). Preferential treatment (Section 4.9).</td>
</tr>
<tr>
<td>Service-quality dimensions</td>
<td>Reliability/Processes</td>
<td>Technical quality; reliability, accuracy of results.</td>
<td>Yes</td>
<td>Reliable, accurate, consistent and reproducible results is identified as an important factor in the delivery of pathology services (Sections 4.7, 4.8, 4.12 and 4.13). Results fitting with clinical presentation (Sections 4.9 and 4.13).</td>
</tr>
<tr>
<td>Service-quality dimensions</td>
<td>Responsiveness</td>
<td>Willingness to act on additional requests and provide prompt service when required.</td>
<td>Yes</td>
<td>Consistency and rapid TAT identified important and an indicator of quality service (Sections 4.7, 4.8, 4.9, 4.10, 4.12 and 4.14). A delay in testing is highly related to poor service experience (Sections 4.10 and 4.14). Performing urgent requests and being responsive to requests when required are linked with superior service (Sections 4.7).</td>
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</tr>
<tr>
<td>Service-quality dimensions</td>
<td>Communication</td>
<td>Effective communication of results and interpretative comments; ability for bidirectional communication between the pathology provider and requestor.</td>
<td>Yes</td>
<td>Electronic interfacing – especially in relation to access and usability of system (Sections 4.3, 4.4, 4.5, 4.7, 4.8, 4.9 and 4.14). Communication of highly abnormal results strongly valued as a quality indicator (Sections 4.8 and 4.9).</td>
</tr>
<tr>
<td>Service-quality dimensions</td>
<td>Administrative procedures</td>
<td>Non-human element of service-delivery; turnaround-time and ability to access results.</td>
<td>Yes</td>
<td>As per responsiveness and communication.</td>
</tr>
<tr>
<td>Service quality dimensions</td>
<td>Safety indicators</td>
<td>Laboratory accreditation and adherence to regulatory requirements.</td>
<td>Yes</td>
<td>Good-quality systems (Section 4.12). Knowing accreditation requirements (Section 4.13). High level of quality control (Section 4.13).</td>
</tr>
<tr>
<td>Service-quality dimensions</td>
<td>Corporate image</td>
<td>Image, reputation and branding.</td>
<td>Yes</td>
<td>Preferences for public or private pathology based on factors relating to image and reputation, such as the reliability of tests and the quality of staff (Section 4.7). Branding consistent with time in employment at the study organisation (Figure 4.3).</td>
</tr>
<tr>
<td>Service-quality dimensions</td>
<td>Social responsibility</td>
<td>Social responsibility; focus on stakeholders (both patients and clinicians)</td>
<td>Yes</td>
<td>The “quality culture” of the organisation is linked to the assessment of the accuracy of results (Section 4.7). Not “thinking” of the patient (in terms of blood samples or collection criteria) described frequently in poor service experiences (Section 4.10) See also responsiveness.</td>
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<tr>
<td>Service-quality dimensions</td>
<td>Trust</td>
<td>Trust that results are performed in an appropriate manner and any errors rectified and the clinician informed.</td>
<td>Yes</td>
<td>Linked to reliability/processes and communication Concepts of broken trust linked to poor service experiences (Section 4.10).</td>
</tr>
<tr>
<td>Personal factors</td>
<td>Level of involvement with the service</td>
<td>Level of involvement with service - does the participant have direct involvement with pathology services, as is the case with pathology and some subspecialties, or does the requestor have no direct involvement? Was pathology training part of their specialisation training?</td>
<td>Partially</td>
<td>First-hand knowledge of the staff who work in the laboratories (Section 4.13) The ability to talk to an expert or someone who actually performs the test is more important than direct involvement in testing (Section 4.11).</td>
</tr>
<tr>
<td>Personal factors</td>
<td>Recent experiences with the service</td>
<td>Recent positive or negative experiences with the service.</td>
<td>Yes</td>
<td>Positive and negative experience with the service are the main determinant of factors that affect the rating of the quality of pathology services (Figure 4.14) and confidence in accuracy (Figure 4.17).</td>
</tr>
<tr>
<td>Personal factors</td>
<td>Current utility of the service</td>
<td>Experiences with the current service as well as other pathology services.</td>
<td>Yes</td>
<td>Allows for the assessment of both good and poor aspects of the current service (Sections 4.7 and 4.15)</td>
</tr>
</tbody>
</table>
4.18 Summary

The core objective of this chapter was to explore the findings of the study. The results presented here highlight a number of identifiable factors that are strongly associated with the perception of quality in the delivery of public pathology services. Comparison of results shows robust links with the proposed conceptual framework, demonstrating that, as in other service-delivery industries, customers’ perceptions of quality in pathology services are a multifaceted combination of the individual, tangible service delivery dimensions and the utility of the service.

A number of key concepts were detected frequently across the spectrum of questions: the importance of fast, clinically relevant turnaround times; the electronic interface; and factors associated with the overall total quality management system, such as consistent and reproducible results and good communication between laboratories or pathologists and requestors, especially in relation to abnormal results.

Questions relating to the judgement or rating of service quality and accuracy show that pre- and post-analytical areas of testing make up the majority of a consumer’s psychological assessment of the pathology service. Pre-analytical factors, such as ensuring the correct collection of samples and performing the test as requested, featured highly as important considerations. In relation to the post-analytical phase of testing, communication of results and the availability of pathology staff to aid in the interpretation of results were seen as key to quality. This shows that non-analytical aspects of the service are important considerations to those who use public pathology services.

An in-depth discussion of these results and their implications in terms of theory, methodology and practice will be presented in Chapter 5: Discussion and Chapter 6: Conclusions.
CHAPTER 5

DISCUSSION
5.1 Introduction

The aims of this thesis (as outlined in section 2.9) were to identify the key attributes that requestors associate with quality in the provision of public-hospital pathology and to assess the current level of satisfaction in relation to these quality dimensions at a single tertiary referral metropolitan teaching hospital. This was performed through interpretative phenomenological methodologies: specifically, in-depth interviews with clinicians who use the service. Formative questions were based on the hypothesis of quality dimensions as established in the conceptual framework.

This chapter will explore the main attributes identified in the results section and integrate the findings with current literature. Dimensions associated with the assessment of quality as described in the conceptual framework will be appraised in the context of the findings.

5.2 Summary of Findings

As outlined in the results section, analysis of the in-depth interviews identified four main domains as major recurring themes in requestors’ assessment of the quality of pathology services:

Section 5.3 explores the concepts identified with the electronic interfacing of pathology services.

Section 5.4 outlines the importance of timeliness in the provision of results as a key determinant of quality.

Section 5.5 addresses the crucial role of verbal communication in the provision of pathology results.

Section 5.6 establishes the importance of total quality management in pathology provision.

These four findings are remarkably consistent with a Finnish study that assessed the levels of satisfaction with pathology services of 91 senior physicians and nurses-in-charge using survey methodology (Oja, Kouri & Pakarinen 2006). In this study the highest levels of dissatisfaction with service provision were related to not being able to
find test results, issues the laboratory information system and the turnaround times for patient test results. From this, it would appear that these issues are common in first-world medicine and have been poorly addressed over a protracted amount of time.

5.3 Electronic Interfacing of Pathology Services – Pitfalls and Opportunities for Improvement

When describing a “poor service experience” and nominating “what would improve the quality” of pathology services, many participants designated better electronic access to results as one key area for improvement (Sections 4.10 and 4.14). Many felt that the hospital-based electronic medical record (EMR) and corresponding laboratory information system (LIS) were difficult to navigate, and accessing the system especially from remote locations was problematic.

The utility of hospital-based LIS’s is often compromised by the fact that it accounts for only a small proportion of the IT requirements of a hospital-based electronic health record (EHR). These systems encompass a variety of tasks the most important of which is to record and manage clinical information on patients. The ability to request and review medical investigations such as pathology and radiology and electronic medication administration are often considered peripheral functionalities (Hoonakker, Cartmill, Carayon et al. 2011), and as such the investment in these areas is often not as great.

Electronic medical records (EMRs) have become the mainstream for recording patient information at both a community (general practice) and hospital level. While, the benefits from the introduction of EMRs are often difficult to quantify, they have been shown offer process improvements, decreased prescribing errors, increased adherence to guideline-based care and clinical decision support, resulting in improved disease monitoring (Collin, Reeves, Hendy et al. 2008; Hoonakker, Cartmill, Carayon et al. 2011; March, Steiger, Scholl et al. 2013).

In spite of this, the evidence-based benefits associated with the introduction of electronic systems has not shown as much promise as would be expected, especially in large hospitals that provide acute care and often-complex outpatient services from diverse clinical specialties (Collin, Reeves, Hendy et al. 2008). Reasons for this include
a lack of sensitivity to the needs of users and the significant modifications in work practices that the technology change induces and requires (Hoonakker, Cartmill, Carayon et al. 2011).

The implementation of electronic interfacing specifically in pathology services has been shown to have benefits, less reordering of previously completed pathology tests when previous results are electronically displayed, and reducing errors by eliminating illegible orders (Greenes, Fleisher & Kohane 2000; Hoonakker, Cartmill, Carayon et al. 2011). In addition, Ash et al. (2004) also noted that electronic interfacing of pathology results also has the potential to improve communication to requestors, support the tracking of orders and aid in checking the appropriateness of orders and can be used as an interface to remind professionals of actions to be undertaken.

Although there are numerous benefits to the introduction of these systems, a number of studies have also highlighted problems termed “unintended consequences” (March, Steiger, Scholl et al. 2013). It appears that these frequently occur during implementation, where the complexity of the new systems is often underestimated (March, Steiger, Scholl et al. 2013). Examples of these unintended consequences include factors effecting patient safety and the quality of patient care, such as missing or misinterpreted of results (Hoonakker, Cartmill, Carayon et al. 2011). In addition, added work tasks created by the introduction of these systems have also been shown to have negative effects on job characteristics that ultimately affect performance outcomes, including job satisfaction and personal stress (Hoonakker, Cartmill, Carayon et al. 2011).

These issues have significant implications for government policy, especially the Pathology Funding Agreement (2009), which listed the “the implementation of electronic requesting and reporting of pathology across the sector” as a key initiative. Considering the national and international drive to move towards fully electronic health records, understanding the limitations of electronic systems and ways they can be overcome will be essential (Harrison & McDowell 2008). This move also underscores the importance of being able to tailor elements of pathology service delivery to meet prequestors’ varied clinical needs, especially relating to electronic medical records.
The lack of utility in the electronic ordering and reviewing of results identified in this study is surprising in a tertiary referral hospital setting (Sections 4.3 and 4.4). Many respondents perceived deficiencies in the system that hindered its application; these deficiencies featured prominently when assessing negative aspects of the service.

Across the spectrum of interviews, three key concepts were identified relating to electronic interfacing: complications in accessing the system, especially from remote locations; problems with the integration of electronic interfacing into current work practices (linked to the concept of change management); and a lack of training.

5.3.1 Issues Relating to the Access and Utility of the Electronic Interface

Errors relating to the electronic interfacing of pathology can be separated into two processes: information entry and retrieval, and communication and coordination processes (Ash, Berg & Coiera 2004). Errors in either of these phases can affect patient care. Ash (2004) notes, “Professionals need fast access to data that are relevant to the case at hand. Simultaneously, they need to be able to record a maximum amount of information in a minimum amount of time and in such a way that it is most useful to other health care professionals involved in the handling of this patient’s trajectory.”

In the context of pathology, errors with entering information into the electronic system from a clinical perspective generally involves entering the incorrect test in the system or not being able to find the appropriate test. In the cohort in this study there were also significant issues with the time needed to enter information into the electronic interface. Many commented that electronic ordering took far more time than conventional paper-based methods, and a number of respondents saw it as “a waste of time” unless it was performed by someone whose time was seen as less valuable such as a “registrar or intern” or “junior staff” (Section 4.3).

In contrast, most clinicians accessed patient results electronically, though a number mentioned that they also relied on the paper-based system as a “double check” to ensure no abnormal results were missed. Some also commented that it was easier for nursing staff to access results via paper:
“Basically all our results are reviewed by nursing staff and then the abnormal paper results are followed up by the doctors…” (Participant 40)

Retrieving pathology reports from the electronic interface was noted by many participants as the area needing the most improvement, especially in relation to the management of abnormal results (Section 4.14). Issues with the follow-up of abnormal pathology results, especially in hospital-based settings, have also been identified in a number of other studies (Boohaker, Ward, Uman et al. 1996; Poon, Gandhi, Sequist et al. 2004; Oja, Kouri & Pakarinen 2006; Casalino, Meltzer, Dunham et al. 2009; Singh, Thomas, Sittig et al. 2010). Rates of missed abnormal pathology results have been shown to be as high as 75% for positive pregnancy tests in emergency-department settings (Greenes, Fleisher & Kohane 2000). However, across a variety of medical specialities the rate of failures to report or document abnormal results has been shown to be approximately 7% (Casalino, Meltzer, Dunham et al. 2009).

Many clinicians lack effective mechanisms for following up abnormal results, especially in emergency-department settings, where patients are often discharged before pathology results are available (Block, Laloum, Rajs et al. 1996; Greenes, Fleisher & Kohane 2000; Callen, Georgiou, Prgomet et al. 2010; Callen, Paoloni, Georgiou et al. 2010). In this study although the majority of requestors accessed results by electronic means, a number still relied solely on paper-based systems or used paper reports in addition to electronic checking, to ensure abnormal results were not missed.

Some authors have favoured the transmission of results by more than one method as a way of reducing missed results (Callen, Georgiou, Prgomet et al. 2010), but others have shown this to be ineffective (Casalino, Meltzer, Dunham et al. 2009). It has also been noted that paper-based systems are ineffective at catching events such as a patient’s noncompliance with having a test performed (Poon, Gandhi, Sequist et al. 2004).

As entering and retrieving electronic health information on patients becomes increasingly commonplace for a variety of health workers, it is imperative to ensure that the robustness and structured formatting of the system are not overshadowed by the complexity of its use, and that users key requirements are met.
5.3.2 Integration of the System into Current Work Practices

The difficulty in integrating the electronic system into well-established individualised clinical processes was highly evident. Many respondents expressed difficulty in incorporating electronic means of requesting and reviewing pathology tests. This is especially significant considering that other authors have shown that physician investment of human resources for result management is already considerable (Poon, Gandhi, Sequist et al. 2004). Often clinicians have spent a substantial amount of time perfecting a personalised system of reviewing results, whether this is paper-based or electronic: their reluctance to try alternative methodologies is understandable.

Many requestors felt that that the use of electronic interfacing overall took more time and involved a transfer of clerical duties to the clinician.

“If I have to go to a computer and type all that in that would take quite a few minutes – my time is worth – to have a secretary to transcribe the letter, to send the letter out, to pay the postage is cheaper than wasting my time filling out a computer. It’s absolutely a waste of time to me.” (Participant 24)

Data entry, especially for those with limited computer literacy and a lack of typing training, can take substantially longer than completing information on paper-based systems, and many respondents saw it as less “effective”. Work tasks now required of clinicians that were previously seen as clerical duties have been recognised as an unintended consequence of the use of information technology in health care (Ash, Berg & Coiera 2004), with implications for both time management and fiscal wastage.

IT implementation can have a major impact on the way work is organised (workflow) and how people experience their work (satisfaction levels). The introduction of such systems can have adverse effects on both communication and established routines (Hoonakker, Cartmill, Carayon et al. 2011). From this, some suggest that the implementation of electronic systems in workplaces, particularly hospitals, must be viewed as a process involving organisational change and must be managed to reflect this view (Dykstra 2002).
There is vast scope to improve the uptake of effective electronic ordering, tracking and reviewing of results that may ultimately improve time usage for clinical staff at this site. This too has been previously identified in the literature. One study found that physicians on average reported spending more than 70 minutes per clinical day on test-result management, and additionally many designated a staff member to screen test results for abnormalities to ensure none were missed (Poon, Gandhi, Sequist et al. 2004). The intervention of electronic tracking, though initially time-consuming in the implementation stage, has the potential to improve the amount of time spent on reviewing test results, and may reduce the risk of abnormal results being missed.

When discussing the introduction of computer-based systems in medical settings, Hoonakker (2011) notes, “End user involvement in the design and implementation of a new technology is a good way to help ensure a successful technological investment.” It appears that the cohesiveness and involvement of clinical staff in the implementation and ongoing changes to the interface was fundamentally lacking in the cohort interviewed in our study.

Whilst the overall sentiment from respondents was that electronic ordering of tests was time-consuming, there is few empirical studies that support this. One randomised controlled trial assessing the impact of the introduction of direct physician order entry found that little, if any, additional time was required of physicians, and that experience with the system ultimately saved time (Dykstra 2002). This highlights the importance of conveying the potential benefits of such as system to clinicians and suggests that an emphasis on training is warranted.

5.3.3 Training

Ongoing education of clinicians, especially for those who have held their current position for a long time, was shown to be an area of concern in this study. It was evident that many respondents had not been fully trained in the utilisation of the electronic system and there was no evidence of ongoing training being undertaken. This lack of training appeared to be self-perpetuating in the context of the clinician as trainer, with doctors who graduated medical school fewer than six years ago sharing many similar opinions as clinicians in senior roles (Section 4.3 and 4.4). Additionally,
enhancement of trainee doctors’ education was also highlighted as a factor that would improve the quality of pathology services offered at the hospital (Section 4.14).

Many respondents expressed feelings of awkwardness and embarrassment about not knowing specific features of the system. When discussing the choice of paper-based systems for ordering and/or reviewing, a number admitted that they were not proficient in the electronic alternative.

“...I think you can do it electronically...I’m just not sure about the logistics of doing it because it’s outpatients.” (Participant 46)

“I’ve tried to order things electronically on the wards and I haven’t been able to do so. I think it’s just the lack of training.” (Participant 45)

March et al. 2013 (2013) noted, “...as even more healthcare systems transition to EHRs, there will be an increasing need for the development of new methods to effectively train healthcare providers, particularly with respect to maximising the functionality of the EHR as a clinical tool.” How this is to be done in an effective manner remains unclear.

Lack of proficiency in the use of many of the tools or features of the electronic system was also evident in participant responses. Many features within the electronic system for which respondents expressed desire at the time of interview were already capabilities within the system. A number of clinicians complained about the inability to track or manage patient results, with many saying they used written lists to track patient results, despite the fact that an electronic equivalent existed. This is similar to results obtained by Callen et al. (2010), who found that only 28% of clinicians using the same hospital-based LIS as those in our study group used the personalised patient-list feature. This is also consistent with other recent studies estimating that only one-quarter to one-third of physicians use the technological solutions available to them, and less than 5% use all features available in these systems (Venkatesh, Zhang & Sykes 2011).

Despite the fact that all clinicians with access to the hospital LIS were required to undertake training before being granted access, it is evident that additional education is
required, especially as new features are added. However, other studies have shown that training may not be the only hindrance for clinicians using electronic systems. In a simulated experiment looking at ICU patient results on an EMR system, Marsh et al. (2013), found poor clinical performance in observing and acting on abnormal results regardless of the level of expertise, despite all of the participants having received general training with the EMR and having used the system for more than one year. They concluded that “…it appears that a major stumbling block is the physician interface with the EHR as opposed to a pure knowledge deficit”.

Interestingly, examining the effect on mortality outcomes related to the introduction and use of computerised physician order entry in intensive-care settings have yielded conflicting results. Han et al. (2005), demonstrated an increase in mortality from 2.8% to 6.57% with the introduction of such a system, and identified the profound alteration in patient-care workflow processes as the likely cause. However, a number of recent studies have not replicated this finding, with most showing no increase in mortality (Keene, Ashton, Shure et al. 2007; Brunette, Tersteeg, Brown et al. 2013). Most acknowledged careful preparation, tailoring to the specific needs of the department, and extensive training and technical support as essential components in ensuring effective and safe change.

Elaborate training in new systems is however not a luxury that is typically available to healthcare professionals, often due to the 24-7 nature of providing healthcare in hospital settings (Venkatesh, Zhang & Sykes 2011). Even when training is available persuading clinicians to attend has been problematic in analogous situations. A New South Wales based study looking at training in an electronic health-safety system found that doctors as a group were more negative compared to nursing and other allied health staff when it came to attending training, completing the course with non-clinical staff and identifying ways to apply the skills learned (Westbrook, Braithwaite, Travaglia et al. 2007). It addition, they also disliked the lack of an evidence base for many components of the training (Braithwaite, Pawsey, Westbrook et al. 2007; Westbrook, Braithwaite, Travaglia et al. 2007; Travaglia, Westbrook & Braithwaite 2009). Interestingly, doctors along with other medical professionals thought more people should be trained, though were less likely to recommend training to a peer (Westbrook, Braithwaite, Travaglia et al. 2007).
5.3.4 Opportunities for Improvement in the Electronic Interfacing of Pathology Results

Despite huge technological advances in many aspects of healthcare delivery, electronic records and LIS appear to pose many of the same problems and concerns for clinicians that have been highlighted in the literature for more than a decade. Poon et al. (2004) concluded, “... much work remains to be done to ensure safety, effectiveness, and timeliness in the test result management process.” However it appears that little has changed. While healthcare providers are increasingly using electronic data systems, progress has been slow compared with other industries (Bates, Winkelman, Brennan et al. 1997), and much capacity for developments in functionality remains.

When asked what would improve the quality of the in-hospital pathology services offered at the research site, improvements in the electronic interfacing were highlighted (Section 4.14). These findings emphasise that there is a substantial gap between the capabilities of the LIS used at the study site and the knowledge of these capabilities in those that use it: these shortcomings need to be addressed.

In this study, respondents saw on-line electronic endorsement and acknowledgement of test results as an essential requirement of the system. This was also documented by Callen, Paoloni, Georgiou et al. 2010 who concluded. “Electronic result delivery, with electronic endorsement to indicate follow-up of test results, should be investigated as a way of improving patient outcomes and closing patient safety gaps.” This is further endorsed by the results obtained here. In a study of 262 physicians working in 15 internal-medicine practices affiliated with two large urban teaching hospitals, Poon et al. (2004) identified that the most desired features of an electronic result-management system were tools to help physicians generate result letters to patients, prioritise their workflow and track test orders to completion.

At the time of the interviews, on-line electronic endorsement and acknowledgement of test results were not available on the LIS; however, it has been shown in a previous study that high-end users such as emergency-department staff would be generally be comfortable moving to some form of integrated clinical information system with a
complete electronic test-result follow-up system (Callen, Georgiou, Prgomet et al. 2010). This has been shown to be robust in ensuring that patient results are not missed and that appropriate follow-up is documented (Casalino, Meltzer, Dunham et al. 2009). Failure to ensure this has significant medico-legal implications, with a number of litigation cases stemming from a failure to respond to abnormal laboratory results in a timely fashion (Greenes, Fleisher & Kohane 2000). The integration of electronic means of identifying abnormal results, especially in patients who have been discharged from hospital before results are available, removes the onus from the individual clinician to have a set process in place.

Many of the factors identified in this study suggest there are fundamental issues with the “usability” of the electronic system. Hoonakker et al. (2011) noted that the usability of a system is a multi-dimensional construct that include: learnability, efficiency, memorability, a low error rate and overall satisfaction with the system. Incorporating these aspects into the design and training needs of the system will allow for greater user satisfaction (Ash, Berg & Coiera 2004; Hoonakker, Cartmill, Carayon et al. 2011).

The findings present in this dissertation suggest the need for better interface design to visualise certain types of alerts more effectively, such as those with a higher priority (e.g. critical alerts). Previous work shows that warnings (alerts) are useful only when they communicate information of high importance, and overload of information can lead to alert fatigue (Hysong, Sawhney, Wilson et al. 2011).

In addition to this, many authors have identified electronic interfacing as an important way for laboratories to communicate with their requestors by means of decision support on the appropriateness and cost of tests, and optimisation of test order and ordering screens, which can be structured to improve the collection of clinical information (Westbrook, Georgiou, Dimos et al. 2006).

Consistent with other studies, this research demonstrates that development of training policies using an approach that addresses organisational, personnel and workflow aspects is essential to ensure the uptake of electronic systems in pathology and increase their meaningful use for clinical staff (Schwartz RJ 2011; Venkatesh, Zhang & Sykes 2011). In particular, this study has highlighted physicians’ differing requirements of the
LIS system, which are driven by clinical need. The importance of engaging a wide variety of clinical specialties and end users in the design and implementation of systems, as well as keeping them abreast of changes and new features, is critical to the ongoing success of the system.

With the government push toward investment in and deployment of electronic healthcare systems, it is imperative to understand the factors that drive such systems (Venkatesh, Zhang & Sykes 2011). Despite the obvious efficiencies of computer-based systems, much work still remains in optimising effectiveness in hospital-based settings. We concur with Westbrook, Georgiou, Dimos et al. (2006), who note that evaluations of LIS’s should “assess the ways in which systems integrate, or fail to integrate, with clinical work practices, including the impact of system use on test order preparation, processing, and the time taken to respond to results.”

5.4 Timeliness in Resulting

The importance of clinically relevant TATs in testing was recognised as a recurring theme in many of the dimensions explored in this study. It was identified as an important concept in areas including differences in quality between public and private pathology providers (Section 4.6); important factors in the delivery of pathology services (Section 4.7); descriptions of both “positive” and “poor” service experiences (Sections 4.8 and 4.9); and the factors that influence the quality rating of pathology services (Section 4.12). It was also identified as the most important item that would improve the quality of pathology services offered at the hospital (Section 4.14). This underscores the importance clinicians place on rapid TATs and highlights it as a major attribute associated with a quality pathology service.

The ability to provide results within clinically relevant time frames was often described as an essential component of a quality pathology service. In this study, most subjects (76%) agreed that fewer than three days was an acceptable turnaround time for all pathology tests (Table 4.1), with all saying that results should be back within a week at most. These figures are consistent with one other study that assessed this in a general-practice setting (Allen & Harris 1992).
Discontent in the actual TAT of tests was readily identified; this correlates highly with the majority of previously performed studies assessing customer satisfaction, which indicate laboratories do not meet clinicians’ expectations in regards to TAT (Allen & Harris 1992; Nakhleh & Zarbo 1996; Boyde, Earl, Fardell et al. 1997; Steindel & Howanitz 2001; Zarbo, Nakhleh, Walsh et al. 2003; Jones, Walsh & Ruby 2006; Nakhleh, Souers & Ruby 2008). These publications identified TAT as a major source of dissatisfaction not only among physicians but also allied health professionals such as nurses.

Other studies have revealed that departments that demand a high level of service from laboratories such as intensive-care units and emergency departments are often the least satisfied with the levels of service they received compared to areas such as psychiatry and surgical units with a relatively low usage of pathology services (Jones, Walsh & Ruby 2006). While this study was not sufficiently powered to address this, respondents from these high-demand areas all suggested that TAT of results was the area requiring the most attention, and where their highest levels of dissatisfaction occurred (Table 4.1).

TAT is the most commonly used performance indicator to objectively quantify pathological services (Breil, Fritz, Thiemann et al. 2011), and has been used as a measure of the effectiveness of services in terms of both process and outcome (Novis 2008). Despite this, the definition/measurement spectrum of TAT varies greatly within the literature. In the context of pathology services, TAT may include only the time from receipt in the laboratory until the availability of tests, or alternatively may encompass all pre- and post-analytical components and be a measurement of time from physician request to the time the result is viewed (Breil, Fritz, Thiemann et al. 2011). The second interpretation would seem most appropriate, as it has been shown that the majority physicians define TAT as the time from request until receipt of results (Steindel & Howanitz 2001). In either measurement, the TAT of any given test comprises an assay-dependant (fixed) component, being the analytical time required to examine a specimen, and a variable component, which includes the pre- and post-analytical processes as well as time spent in the laboratory awaiting performance (Westbrook, Georgiou, Dimos et al. 2006).
Considering that TAT is not a standardised measure, and that the clinical need for prompt reporting varies according to the severity of the patient condition, an acceptable TAT for each analyte and laboratory should, therefore, be developed in consultation with requestors. Indeed, this is a recommendation in many Medical Laboratory Standards employed nationally and internationally (International Organization for Standardizations 2012). Bewtra (2003) states that instead of further reducing TAT, a reasonable limit should be agreed on, because often patients do not benefit from the reduced TAT, and it may even have negative effects on quality, teaching needs and the welfare of laboratory personnel. Additionally, it has been shown that for anatomical pathology specimens, laboratories with specific TAT goals had better overall physician satisfaction with their services (Zarbo, Nakhleh, Walsh et al. 2003). This is further endorsed by other authors who have advocated outlier percentages of predefined TATs as a better method of benchmarking laboratory performance (Holland, Smith & Blick 2005), and a better overall indicator of quality.

It is also worth noting that TAT can be a surrogate for more-specific causative factors of delays such as staffing levels, laboratory throughput capabilities, highly complex samples types, being in a teaching environment and geographical location of the laboratory, which may affect transport time (Steindel & Howanitz 2001; Patel, Smith, Kurbatova, et al. 2012). These are also important considerations in the provision of pathology services, and more-thorough investigation in these areas may identify areas where significant time savings may be made. Previous studies have shown that for routine chemistry tests the pre-analytical phase accounted for 7-17%, and the post-analytical phase 64-88%, of TAT (Boyde, Earl, Fardell et al. 1997). In addition, the introduction of electronic ordering and resulting has been shown to have significant positive effects, with up to a 21% reduction in laboratory TAT (Westbrook, Georgiou, Dimos et al. 2006).

The extent to which improvements in laboratory TAT enhances patient outcomes remains controversial, especially in community/general practice: however, some authors have shown clear advantages. Clinical benefits such as reductions in treatment time, mortality, morbidity and length of stay in hospital have all been associated with a reduction in laboratory TAT (Barenfanger, Drake, Leon et al. 2000; Holland, Smith & Blick 2005; Blaya, Shin, Contreras et al. 2011).
This study and previous works highlight the importance of clinically relevant TATs in pathology reporting. With clinicians under more pressure than ever from patients to provide timely answers, this will remain an important and persistent consideration (Nakhleh & Zarbo 1996; Howanitz & Howanitz 2001). This is also a factor in the drive towards point-of-care testing (Section 4.3). Increasing in this form of testing, further highlights that the demand for rapid TAT and the prompt diagnosis of patients, especially in those whom are critically ill can be more imperative from a clinical perspective than the cost and analytical reliability of the test (Howanitz & Howanitz 2001).

Effective management of TAT to meet clinical need has been shown to be an essential yet under addressed element of pathology service delivery. To meet the varied clinical needs of requestors it is important to have well delineated consultative goals that are monitored and evaluated as part of continuous improvement processes. We concur with Howanitz & Howanitz (2001) who conclude “now is the time to improve timeliness not only as a strategy but also as a duty to all of our customers, clinicians and patients alike. There are constant pressures to make trade-offs, to compromise, and to change strategy. Timeliness of results reporting is too important an issue to fall prey to these pressures”.

5.5 Communication

The concept of “communication” was identified as an essential service component (Section 4.7). This predominately encompassed the need for verbal transmission of highly abnormal results and the availability of scientists and pathologists to give clinical guidance and interpretation of results. These elements were seen as paramount requirements for many clinicians using the service.

When describing a positive service experience, communication of significantly abnormal results was highlighted as the main by theme by 38% of respondents (Figure 4.8). Many considered this to be a critical part of the service, and commented that they were “exceeding pleased” to be phoned about a result that potentially affected patient care. It was also shown to be an important factor in the assessment of whether public or private pathology services were better, with many respondents noting better availability of pathologists/scientists and more laboratory interaction and availability as being
factors in why some perceived public pathology services as superior (Figure 4.4). This was also replicated in respondents who deemed the in-hospital pathology service as better compared to other pathology providers (Figure 4.20).

Conversely, a lack of communication was also identified as a theme when respondents were describing a negative experience with the service (Figure 4.10). “Not being informed” of critical information, such as a delay or an error in testing, inability to process a sample or the need for a consultation regarding a methodological change, were recounted by a number of respondents.

Zarbo and colleagues (2003) also identified verbal communication as an important factor in the delivery of quality pathology services. In their study they identified that laboratories with a documented policy for alerting requesting physicians of critical values had higher levels of positive feedback from those using their services in regards to the notification of significantly abnormal results compared to those that did not.

When describing a time when participants had called a laboratory or pathologist within the service, a key finding was not only respondents’ desire for the availability of someone to talk to, particularly with questions, but the importance of the person being personally known to the clinician (Section 4.11). Familiarity was seen as important, as the clinician was able to “gauge the level of experience and expertise of that person” and have a clear understanding of exactly what their interpretation meant in clinical situations.

In one study assessing GP satisfaction with pathology services, communication was found to be the largest problem, with many expressing difficulty in getting through to the “right person” in the laboratory (Allen & Harris 1992). The main complaint was the amount of time taken to get through the hospital switchboard. This was also acknowledged in this study:

“From the perspective of people from outside the hospital...you know GPs or whatever else...trying access them and getting results et cetera, I don’t think they’re necessarily quite as favourably viewed, and that relates to response to queries and seeking results and - you know - delays just getting through switchboard or whatever else. So if they know the system well, and they ring the
right lab at the right time to get the results if they’re trying to track down the results from the Emergency Department that weren’t reported at the time the patients discharged correspondence being written....That sort of thing. If they go to the absolute, follow things correctly, and go to the right department first go, then they have a happy experience. But if they try to get through the hospital switchboard and then get redirected to- you know- enquiries, and then get redirected to the laboratory and then get redirected to the technician...the scientist who does the test will then redirect them to the pathologist who isn’t there that morning.” (Participant 17)

Communication systems within hospitals are notoriously poor (Allen & Harris 1992). Having clear procedures and easily identifiable means of contacting scientists and pathologists within laboratories is an essential component of service, though often this is overlooked and under-acknowledged by those in the laboratory. The ability of a doctor to contact the laboratory has been recognised previously as an important quality indicator (Carter, Stubbs & Bennett 2004).

Consistent with these findings, it is import for laboratories to have clearly defined polices regarding indications for informing clinicians of medically relevant information, such as when samples cannot be processed, and for relaying critical results. In addition, it is necessary that staff are aware of the importance of being available for consultation and to provide information to clinicians when required. This is also consistent with the requirements imposed by ISO 15109 (2012) (Section 4.7), which necessitates that laboratories establish arrangements for communicating with users specifically relating to the choice of examinations, advice on individual clinical cases, professional judgements on the interpretation of results, promotion of the effective use of pathology services and consultation on scientific and logistic matters such as instances of failure of samples to meet acceptance criteria.

These factors again highlight the importance of a total quality management system for pathology service and continual feedback from requestors to ensure that their requirements in this area are being met.
5.6 Continuous Improvement and the Multidimensional Aspects of Quality

In pathology, quality is often associated with the test result as the final product and less emphasis is placed on the quality dimensions that encompass the service as a whole. While many laboratories focus on quality assurance, the overall perception of laboratory quality was shown in this study to be multidimensional. Many respondents noted that analytical quality was perceived to be at the highest level that it could be and rated the accuracy of the service highly (Section 4.12). Despite this, as shown in Figure 4.16, many respondents rated the overall quality of pathology at a significantly lower level, suggesting that although the quality control of results was seen as excellent, the overall quality of the system was not at the same level. This result is similar to that of Jones et al. (2006), who showed that despite strong confidence in the accuracy of pathology results, many other aspects of the service, particularly TAT and laboratory management accessibility and responsiveness, indicated overall quality perceptions.

A main determinant of respondents’ perceptions of quality appeared to be previous experience with the service (Figure 14.4). This was a combination of poor-quality outcomes, mostly related to pre-analytical errors such as tests not being done, and positive experiences, mostly relating to TAT. An inherent link between the assumption of quality and personal relationships was also identified in the analysis. Respondents often noted that “knowing” the pathologist(s) or scientist(s) who were in charge of laboratories or performing tests, and understanding their adherence to quality procedures and methodologies, was a key indicator in how confident clinicians were in their assumption of quality (Section 4.12 and 4.13).

Interestingly, laboratory accreditation and its link with quality were mentioned by only two respondents. As a whole, “internal quality control” was not frequently identified as an important factor, though accuracy and reliability, which can be seen as surrogates for internal quality, were frequently mentioned and identified as the second most important feature of quality pathology (see section 5.7.1). Linking results with clinical outcomes was also seen as a quality indicator by many respondents; however, shortages in time, staffing and expertise mean that this is infrequently executed in routine diagnostic laboratory settings.
It is often evident to those working in the field of pathology that laboratory technicians, scientists and, to an extent, pathologists are often driven to produce “the end result” without consideration of the pre- and post-analytical factors that have been shown to be critical to the quality of the service. Other studies have also reflected this attitude, which considers those who are performing tasks, even at management level, as often “too busy” to engage in tasks or research that are not “core” activities (Forsman 1996).

Only one previous study has thus far looked at the perceptions, practices and suggestions for improvements in following up test results in an emergency department (Callen, Georgiou, Prgomet et al. 2010). This Australian study used quantitative methods to assess physicians’ practices and perceptions in relation to test-result follow-up. Their evaluation, which involved analysis of interviews with seven ED physicians and one clinical information-system support person, identified the key role of the electronic information system, especially in the management of results. Their study highlighted the complexity of the test-result follow-up process, especially in ED settings, and the importance of engaging clinicians in devising solutions for improvements to ensure their needs are being met.

5.7 Links with the Aims

The subsequent section links the aims and research questions (as outlined in Section 2.9) with the findings obtained the study.

5.7.1 Attributes Respondents Associated with a High-quality Pathology Service

The aggregated results of this study identified the following factors (in order of frequency) as the attributes that clients within our organisation associated with high-quality service:

1. *Fast turnaround times for results.* Concepts within this include clinically acceptable turnaround times, sufficient volume of requests to make testing appropriate and performing or repeating tests quickly when requested.

2. *Reliable, accurate, and reproducible results* - Concepts within this include appropriate and robust methods and a fit between pathology results and the clinical presentation.
3. *Bi-directional communication and the ability to contact the laboratory or pathologist easily.* Concepts within this include alerting the requestor of significant or highly abnormal results, the ability of the requestor to talk to the laboratory/pathologist about a result; good interpretation of results on reports and knowing who to talk to about results and getting guidance for an unusual test result.

4. *Usable and accessible electronic interface.* Concepts within this include good access to the interface internally and externally, ability to find results easily, all results available in the system, electronic endorsing of results, electronic ordering, sufficient training and allowing for adaptability of the system to suit clinical need.

5. *Pre- and post-analytical quality.* Concepts within this include good sample tracking and collection, correct requests being performed, good report practices (also incorporated under communication) and a low error rate (transcription and sample errors).

### 5.7.2 Similarities and Differences in Individual Respondents’ Identification of Quality Attributes

This study found that overall respondents’ identification of attributes they associate with quality were congruent. The only statistically significant association between attributes and respondents’ demographics was that those who had worked in the study institution for more than 10 years had a greater predilection for public pathology services, while those who had worked for fewer than 10 years considered the quality of private pathology providers to be higher.

### 5.7.3 Current Levels of Requestors’ Satisfaction with Service Quality

While requestors were highly confident in the accuracy of results, many were less satisfied with the overall quality of the pathology service (Figure 4.16). This, again, highlights the multi-conceptual nature of quality in this setting. It is evident that requestors at the study site viewed the accuracy, and thus the analytical quality, of results highly; however, there is significant room for improvement in the functional
components of the service as contributors to overall quality. Addressing issues identified in this study and placing greater emphasis on the attributes associated with a high-quality pathology service as identified by this cohort should close this quality gap.

5.8 Links with the Conceptual Framework

The purpose of this research was to better understand the quality attributes contained in a consumers’ perception of quality. What we found was a sophisticated and multidimensional understanding of what constitutes quality for this cohort. Table 4.3 shows dimensions identified in the conceptual framework, with the evidence from the current research that supports or refutes the finding. From these findings, all conceptual-framework dimensions proposed, with the exception of demographics as a pre-existing contributor to the overall assessment of quality, were confirmed. However, due to the low female representation in this study, this factor cannot be accurately discredited.

As expected, respondents most frequently identified service-quality dimensions as predicting quality. In order of frequency they were:

1. Administrative procedures
2. Reliability/processes
3. Communication
4. Infrastructure/tangibles
5. Personnel quality
6. Responsiveness
7. Social responsibility
8. Safety indicators
9. Corporate image

From this analysis it can be shown that consumers do not appear to segregate dimensions of service quality from technical quality, rather assessing the quality of service on all testing processes. It is also important to note in this context that service delivery in the context of pathology is in most cases a continual process (i.e. involves the delivery of numerous patient results per day) with the potential for variation in each experience. Thus, the factors and influences that affect the evaluation of service quality
are also dynamic. Hence the assessment of service quality must be seen as a fluid process that may rapidly yield differing perceptions in response to good or poor service.

5.9 Conclusion

This chapter outlined the major findings of the research in the context of current literature. This study identified that a key number of quality dimensions are associated with the perception of quality service. Healthcare organisations often struggle to provide good customer service because of the unique demands of providing medical care (Kurtenbach 2000). Despite this, it is evident from this study that many of the issues respondents raised are not unique, but universal across a range of medical specialities.

Jain, Jain & Dhar (2002) note “delivering the services, which meet or exceed customer expectations, is the key to winning customers.” In pathology the concept of quality of service is directly tied to the satisfaction of the physicians who use the service (Carter, Stubbs & Bennett 2004). This study and many others in the literature show that the greatest opportunity for improvement lies not with professional competence but communication (Zarbo 2006). This includes both electronic and verbal communication, the most noteworthy of these being dissemination of relevant information, especially significantly abnormal results.

This study highlights the importance of understanding clinicians’ needs and desires in relation to pathology services, and actively soliciting opinions and feedback to enhance value co-creation in this service. As part of this process it is also important to note that when problems or shortcomings are identified they should be acknowledged, addressed, and reassessed (Zarbo 2006).

In the context of service industries, customers continually expect more and better service (Piccoli, Brohman, Watson et al. 2009). It is important to note that achieving and maintaining customer satisfaction in any industry is a self-perpetuating and continuous process that should be considered part of total quality management processes.

Pathology services are one of a number of allied health services that provide diagnostic services to clinicians. It could be argued that some of these findings have a wider significance than to pathology services alone. The next chapter provides a summary of
the implications of the research, both academically and professionally and addresses limitations. Further areas of research and conclusions based on the findings will also be addressed.
CHAPTER 6

CONCLUSIONS
6.1 Introduction

The purpose of a Doctor of Business Administration (DBA) is to make a significant contribution to professional practice and highlight the managerial implications of the research findings (Perry & Cavaye 2004). As well as making a contribution to knowledge of practice, research undertaken as part of a DBA is expected to show that the research has had an impact on professional practice (Bourner, Ruggeri-Stevens & Bareham 2000). The findings presented in this study fulfil these requirements, which will be described in the following chapter.

These findings are particularly apt given the dynamic state of public pathology in NSW, as well as Federal policy changes, which have had a significant impact on the way pathology services are delivered. This work provides further evidence that there are significant gains to be made from understanding the needs of consumers in terms of improving the quality and value of the service.

Table 6.1 summarises the research contributions, with emphasis on the requirements for a doctorate of business administration (DBA) dissertation. Following from this, the chapter outlines a number of academic and professional contributions in terms of methods, theory and practice, examines the limitations of the study and suggests further research that may follow from this dissertation.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Explanation</th>
<th>Contributions of the Study</th>
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<tbody>
<tr>
<td>Contribution to knowledge</td>
<td>Extended knowledge in the domain of the provision of pathology services.</td>
<td>This study extended service-quality research in pathology services by developing a conceptual framework for a service quality-model and examining public-hospital pathology services.</td>
</tr>
<tr>
<td>Research theme</td>
<td>Expanded on the topic of service delivery in pathology services</td>
<td>Quality in pathology service provision is an exciting theme for knowledge extension. This study focused on unique methodologies and dimensions of service quality, and identified deficiencies in service provision from a direct consumer viewpoint.</td>
</tr>
<tr>
<td>Theory</td>
<td>Used theories from IS and reference disciplines to explain relationships among the variables in the research model.</td>
<td>See the conceptual model, which is based on theories from service quality, marketing and healthcare literature (Chapter 2).</td>
</tr>
<tr>
<td>Research design</td>
<td>Rigor in research methodology and findings.</td>
<td>See Research Methodology (Chapter 3) and Results (Chapter 4).</td>
</tr>
<tr>
<td>Logical rigour</td>
<td>Established tight, logical flow of ideas with clear ties between literature review, theory and methodology.</td>
<td>Synthesised the gaps and findings in the literature (Chapters 1 and 2) This study developed a conceptual framework for a multidimensional pathology service-quality model (Chapter 2). To validate the model, the study designed its research methodology (Chapters 3) to establish rigor in research findings (Chapters 4 and 5).</td>
</tr>
<tr>
<td>Coverage of key literature</td>
<td>Discussed relevant literature and identified where deficiencies in knowledge exist.</td>
<td>See Introduction Literature Review (Chapters 2 and 3).</td>
</tr>
<tr>
<td>Contribution to practice</td>
<td>Emphasis on the managerial and service implications of the research.</td>
<td>See contribution to practice (Chapter 6: Conclusions).</td>
</tr>
<tr>
<td>Methodology</td>
<td>Established novelty in data collection and analysis.</td>
<td>Using interpretative phenomenological methodologies and dual text mining software novel findings were elucidated (Chapters 3 and 4).</td>
</tr>
<tr>
<td>Sampling</td>
<td>Findings based on rich information yielded by in-depth, semi-structured interviews.</td>
<td>See Research Methodology (Chapter 3).</td>
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6.2 Academic Contribution

As stated previously, the intent of this research was to explore the key attributes that requestors associate with quality in public pathology. Using an in-depth interview technique, we examined this question by understanding positive and negative experiences; assessing current levels of satisfaction with the accuracy and overall quality of the service; identifying the ways the requestors communicate with the service in terms of both ordering and viewing results, as well as verbal means of contacting pathologists or laboratories; and understanding where variation occurs across pathology providers.

This work is expected to contribute to academic research in several ways. First, it provides a conceptual framework and methodology for understanding the subject matter and identifies qualitative research methods as an appropriate and robust means of eliciting information in this context. Thus, focusing on quality in public pathology, this study identified a set of quality dimensions for a new health-service setting. According to Whetten (1989), “the common element in advancing theory development by applying it in new settings...that is, new applications should improve the tool, not merely reaffirm its utility.”

Secondly, it enriches understanding of the factors that clinicians associate with quality in the provision of public pathology in Australia. The ISO 15189 (2012, p4) defines quality as “the degree to which a set of inherent characteristics fulfils requirements”. This study has thus identified a quality gap in the service provided, highlighting that many recognised characteristics do not meet user requirements.

The advantage of this study compared with most published literature is the in-depth understanding of subject matter, as opposed to survey-based studies, which involve the recognition and rating of specific pre-identified themes. Using this methodology, we identified not only that factors such as the electronic interface were an area of dissatisfaction for requestors, but also recognised the underlying issues such as access and training as being important in the delivery of pathology services. An in-depth understanding of the subject matter allows for a clear direction in the quality-improvement activities required in these areas (Boulton, Fitzpatrick & Swinburn 1996).
This is consistent with Fitzpatrick and Boulton (1994), who note that “...qualitative methods have enormous potential to illuminate how health care currently operates” and “qualitative methodology will be essential to give us models of how organizations change and innovate to adopt quality in health care”.

Many of the issues brought to light in this study will likely apply to other large, hospital-based pathology services, and may provide insight into potential deficiencies and areas for improvement in those services also. This study also presents novel findings relating to wider issues within hospital healthcare, such as electronic medical records and access to patient information. These results highlight issues that have a commonality with other allied health services such as radiology and other forms of imaging which have similar processes to that of pathology (Lindsay et al. 2011).

Finally, this work adds to the body of knowledge related total quality management in pathology management. Specifically, this work responds to continuing calls in prior research to extend the focus of quality management in pathology beyond technical quality and highlights the importance of functional quality to those who use the service.

6.3 Professional Contribution

As government agencies enact policy with the intention of cost containment and increasing competition among pathology providers, it is more important than ever to have a robust understanding of physicians’ perception of quality. Furthermore, when deficiencies are identified in these areas it is the responsibility of policy-makers and governing organisations to ensure these inadequacies are acknowledged and reflected in policy and initiatives. Considering this, the research presented here can be used for benchmarking future studies on satisfaction with services and perceived quality of pathology provision, and identifies where current issues lie.

A major factor identified in this study was the lack of sufficient initial and ongoing training in the use of electronic records and pathology information systems. The findings of this study suggest that several strategies are required to address this on both an organisational and national level. Ideally, the results of this study will give further impetus to healthcare organisations involved in the provision of pathology services to
make the necessary investments to address the prevalent problems in test-result management.

In the context of our institution, work completed as part of this doctorate fulfils the requirement of ISO 15189 (2012), which states, “The laboratory shall seek information relating to user perception as to whether the service has met the needs and requirements of the users.” By identifying where the deficiencies in our work processes lie we have been able to establish areas of priority, and have begun the process of organisational change to rectify these issues, especially in areas where small changes can have significant impacts. Process mapping to identify areas of significant delay in specimen processing is currently underway as a means of reducing TAT.

We will continue to regularly monitor clinician satisfaction as part of the cycle of continuous quality improvement and assessment. As acknowledged in the conceptual framework the assessment of quality perception by consumers is dynamic, as assessments such as the one presented here must be seen as perpetual.

It is also evident from this body of work that commitment to customer service must be seen and communicated as a priority for the organisation. From work in management and social sciences it is imperative that this commitment permeates the organisation from senior management to front-line staff (Kurtenbach 2000). Elucidation of the results of this study across the organisation further the commitment to ensuring quality in service provision for our customers.

6.4 Limitations of the Research

This study has several limitations. It was conducted in a single tertiary care institution; thus, its findings may not be generalisable to other healthcare settings, and are reflective only of practices in that institution. Despite this, strong ties with current literature suggest that the issues highlighted here are analogous and recognised by comparative national and international research.

Targeting specific clinician disciplines may have biased the study population by excluding individuals with divergent opinions, or practitioners from clinical minorities. Despite this, the inclusion of a range of experience and medical specialities allowed us to investigate whether identified concepts were common in diverse clinical settings. In
addition to this, the homogeneity identified for the majority of concepts was congruent with the small number of other published studies investigating similar phenomena. This suggests that issues with pathology services identified here would be similar across Australia and other developed countries. The conceptual framework developed for the study was novel in design due to the subject matter. Critical realists accept that the scientific observations are fallible as they are shaped by the conceptual frameworks within which scientists operate (McEvoy & Richards 2003). When a researcher builds a conceptual model it is only partially representative of reality, as it also reflects the perspective of the researcher. Despite this, identified quality and individual dimensions were derived from the literature, and have been proven to be reliable and reproducible in previous research. The framework was further validated by the consistency of results obtained.

The study cohort consisted of 21 individuals, which may be considered under-powered in positivist methodologies; however, as the aim of this study was to elicit rich information from a small, purposive cohort rather than use respondents who are representative of a larger group, as is the objective of quantitative projects (Sale, Lohfeld & Brazil 2002; Pringle, Drummond, McLafferty et al. 2011), this cohort was appropriate to the needs of the study. Other authors have also highlighted the optimal number of interviews in qualitative research generally ranges from 20 to 30 participants (Patton 2002).

As described, the results of this study are based on qualitative methodologies from an interpretative phenomenological ontology. While some have argued these methods lack the same rigour as quantitative investigations (Reeves, Lewin & Zwarenstein 2006), textual interpretation differs from statistical analysis in terms of the type of data used and questions to be answered, and thus can be seen as a valid and reproducible means of eliciting rich information (Malterud 2001). This is further discussed in Section 3.5.

### 6.5 Future Research
The authors acknowledge that the analysis of the results of this research raised many additional questions during and at the completion of the study. Several areas for future research were identified.
1. The extension and validation of these finding through survey-based methodologies could determine if the findings of this study hold in larger physician populations, as well as populations of other allied health professionals who use pathology services, such as nurses.

2. An assessment of which of the attributes identified here are replicated by requestors, such as GPs, who use private pathology and who have differing demands and requirements to hospital based physicians, could expand on the generalizability of this study’s findings.

3. Research into clinically relevant timeframes for the delivery of test results based on clinical need rather than physicians’ preference could contribute to the development of appropriate guidelines in this area for specific chemistries at both an institutional and governmental level.

4. In this study a clear deficiency was identified in the training in, and subsequent uptake of electronic methods of, ordering and review of patient results. Further work could be done to measure the effectiveness of training and education in these areas on tangibles such as time saving and rates of missed pathology results. Further to this, understanding clinicians’ feelings of apprehension in regards to information technology would allow for the development of strategies to increase utility in line with government policy.

5. Additionally, this study was conducted at a single time point and did not involve an intervention and re-evaluation period. The performance of such an evaluation may further illuminate the areas that significantly affect the overall assessment of quality in physicians who use pathology services.

6.6 Conclusion

The goal of our study was to identify attributes that requestors associate with a high-quality pathology service, and to assess if they are common among a variety of clinical
groups. In addition we also undertook to assess current levels of satisfaction amongst these requestors and identify areas for improvement in the service currently provided.

Using a conceptual framework established though the literature, timeliness in returning results, reliability and accuracy and open lines of communication between the laboratory and the requestor were the most important factors in the delivery of pathology services. Factors associated with pre- and post-analytical components of testing featured highly when respondents described poor service situations, highlighting that this service must view quality processes in the same manner that the consumer does. This process thus begins from the moment a clinician orders a pathology test until the time the result is seen or communicated.

The results of this study highlight a disconnect between the analytical quality and functional service quality in public pathology provision. While all clinicians who were interviewed held the reliability of results in high regard, all had a lower assessment of the overall quality of the service, revealing that factors such as the electronic interface, availability of pathologists and laboratory staff and timeliness of results were major indicators of overall quality perception. These findings suggest that pathology providers’ view of what is important in the provision of their service is not necessarily shared by customers.

As pathology services in Australia move towards an open and competitive market, customer service will be a major indicator of quality, especially in laboratories where there is little variation in technical quality, such as routine biochemistry. This research shows that in this setting there is real and significant drift between the strategic goals and actual customer service.

Jain, Jain & Dhar 2002 note that “a poor understanding of customer expectation leads to many gaps in the process of delivering good quality services and may have disastrous consequences”. Soliciting feedback from requestors should be seen as an essential element in the provision of pathology services, and should be considered an important parameter. Understanding requestors’ experiences and their underlying beliefs and attitudes allows for the identification of service-quality gaps and thus enhanced service quality.
This also highlights the importance of a consultative approach when designing and monitoring pathology interfaces, as well as an understanding of the complexities that clinicians (and, by association allied health professionals) face when using these systems. Our study has highlighted the complexity of the test-management process and the importance of engaging the users in any design and implementation of new systems.

Education of newly qualified or newly employed doctors, along with continuing training of currently employed doctors, should be a paramount consideration, as it can offer many potential benefits, including time efficacy, improved patient care and a reduction in duplicate pathology ordering. Given the large overall benefit that could be achieved with the introduction of a number of minimal-cost changes to the way pathology services are provided to requestors, it is evident that further research is justified.

In conclusion this thesis has made a contribution to the literature regarding quality perception in public health-pathology laboratories, as well as identifying areas that will lead to improvements in overall quality management in these organisations. It highlights that clinician satisfaction is a multi-dimensional construct affected by many variables. Thus, to provide high-quality pathology services, organisations must become responsive to consumers’ needs and implement ways to recognise and improve inadequacies.


Collin S, Reeves B, Hendy J et al. (2008). "Implementation of computerised physician order entry (CPOE) and picture archiving and communication systems (PACS) in the NHS: quantitative before and after study." BMJ **337**: a939.


Pathology Services Accreditation Act (1984) (Cwlth)


APPENDIX A:
Interview Documentation
Email Sent to Potential Interview Subjects

Dear Dr ***,

I am currently undertaking a research project to investigate what factors are perceived to influence the quality of service relating to public pathology delivery and the ways in which the service can be improved to meet the needs of requestors. As you are one of our key stakeholders your opinion will be of great value to this study.

I would greatly appreciate if you would agree to participate in a one-off meeting with Susan Claessen, an external interviewer with the Australian Health Services Research Institute, who will ask your opinion on 25 questions which will take approximately 20-30 minutes. Your responses will be de-identified; however, with your permission, the interview will be audiotaped for transcription and analysis.

Susan will be conducting interviews in the week 14-18th November 2011 and would like to schedule an appointment with you. If you are willing to participate and are available could you please nominate a time and suitable location on the following link

http://www.doodle.com/rvg6bypmnhm386s2

Your participation in this research is strictly confidential and will only be available to Susan Claessen.

A participant information sheet is attached that further outlines the project and contact details of the research team should you have any questions.

Thank you for considering this project,

Regards,

Louise Wienholt
Email Sent to Interview Subjects Once they had Confirmed Attendance via Doodle Scheduler

Dear Dr ***,

Thank you for agreeing to participate in the project looking at quality service provision in public hospital pathology

I have you confirmed for Monday the **th of November at **am/pm.

Could you please let me know the most convenient location for you to conduct the interviews? I am happy to attend your office or alternatively I have an office located in the Immunology Laboratory on Level 6, Building 77 (above RPA specimen reception).

I will explain the basis study, gain consent and ask you 25 questions which will take approximately 20-30 minutes. I have attached a copy of the consent form will be used on the day for your interest.

Should you have any queries or wish to withdraw your participation at any time please contact myself or one of members of the research team.

Again I thank you for your time and valuable input,

Regards,
PARTICIPATION INFORMATION SHEET FOR CLINICIANS

TITLE: Identifying Key Attributes that Requestors Associate with Quality Service Provision in Public Hospital Pathology

PURPOSE OF THE RESEARCH
This is an invitation to participate in a study conducted by researchers at the Sydney Business School, a faculty of the University of Wollongong (UoW) together with the Pathology Department at Royal Prince Alfred Hospital. The purpose of the research is to investigate what factors are perceived to influence the quality of service relating to pathology delivery and the ways in which the service can be improved to meet the needs of requestors.

INVESTIGATORS
Professor John Glynn
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Dr Stephen Adelstein
Department Head
Clinical Immunology, RPAH
(02) 9515 8783
stephen.adelstein@email.cs.nsw.gov.au

Ms Louise Wienholt
Laboratory Manager
Clinical Immunology, RPAH
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lee542@uowmail.edu.au

Professor Don Iverson
Pro Vice-Chancellor Health, UoW
(02) 4221 5010
don.iverson@uow.edu.au

Dr Steve Andersen
Honorary Clinical Associate Professor UoW
(02) 4221 3920
steve.andersen@uow.adn.au

METHOD AND DEMANDS ON PARTICIPANTS
If you agree to be included, you will be asked to participate in a one-on-one meeting with an external independent interviewer at a time and place that is convenient to you. At this visit the researcher will conduct a 20-30 minute interview, which will be audiotaped, to ascertain your experiences in using public hospital pathology services and factors which you believe influence the clinical utility of this service. The interviewer will ask you questions regarding your clinical training and specific questions about your interactions with the pathology service.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS
Apart from your time for the interview we foresee no risks to you. Your involvement in this study is voluntary and you may withdraw your participation or any data that you have provided at any point.

FUNDING AND BENEFITS OF THE RESEARCH
This study is funded by the Sydney Business School, UoW. This research will allow us to identify the factors that are important to clinicians in requesting pathology tests and help us improve the service offered. Findings from the study will be disseminated as part of a thesis report and possibly published in peer reviewed journals and presented at conferences. Confidentiality is assured, you will not be identified in any part of the research.

ETHICS REVIEW AND COMPLAINTS
This study has been reviewed by the Human Research Ethics Committee (Health and Medical) UoW. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UoW Ethics Officer on (02) 4221 4457.

Thank you for your interest in this study.
Consent form for the Project: Identifying Key Attributes that Requestors Associate with Quality Service Provision in Public Hospital Pathology

I have been given information about this project and discussed the research project with Louise Wienholt who is conducting this research as part of a Doctorate of Business Administration supervised by Professor John Glynn in the Sydney Business School at the University of Wollongong and Dr Stephen Adelstein, Department Head of Clinical Immunology at Royal Prince Alfred Hospital (RPAH).

I have been advised of the purpose of this study and understand the minimal potential risks and burdens associated with this research. I have had an opportunity to ask Louise or a member of the research team questions about the research and my participation.

I understand that my participation in this research is voluntary, I am free to refuse to participate and I am free to withdraw from the research at any time. My refusal to participate or withdrawal of consent will not affect my relationship with the Pathology Department at RPAH or my relationship with the University of Wollongong.

If I have any enquiries about the research, I can contact Louise on (02) 9515 7096 or Professor John Glynn on (02) 42215522; if I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on (02) 4221 4457 or the RPAH Ethics Officer on (02) 9515 6766

By signing below I consent to participate in a 20-30 minute interview that will be audiotaped, to ascertain my experiences with the services provided by the hospital pathology department and factors that I feel influence the clinical utility of this service.

I understand that the data collected from my participation will be deidentified and stored in a confidential manner; however, I may request to view this information at any time. I understand that the data collected will be used primarily for a Doctoral thesis, but may also be presented in summary form at conferences and in journal publications, and I consent for it to be used in that manner.

Signed

Date

.............................. ...................................... ......./...../......

Name (please print)

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APPENDIX B:
Statistical Analysis
## Difference Between the use of Electronic System for Ordering Pathology Tests and Demographic Factors

**Kruskal-Wallis Test**

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a. Kruskal Wallis Test

b. Grouping Variable: Method for ordering pathology tests
Difference between the use of electronic system for reviewing results and selected demographic factors (Kruskal-Wallis Test)

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a. Kruskal Wallis Test  
b. Grouping Variable: reviewing results
Difference in Method of Ordering versus Method of Reviewing Pathology Tests (T-Test and Wilcoxon Signed Ranks Test)

### One-Sample Statistics

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### One-Sample Test

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176
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| Sum of Ranks | 171.00 | 60.00 |

- a. Method of reviewing results < Method of Ordering
- b. Method of reviewing results > Method of Ordering
- c. Method of reviewing results = Method of Ordering

### Test Statistics<sup>b</sup>

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- a. Based on positive ranks.
- b. Wilcoxon Signed Ranks Test
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a. Kruskal Wallis Test
b. Grouping Variable: Positive about public pathology
## Overall Rating of Pathology Services versus Demographics (Kruskal-Wallis Test)

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### Test Statistics$^{ab}$

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a. Kruskal Wallis Test

b. Grouping Variable: Rate pathology services (minimum)
## Overall Rating of Pathology Services versus Demographics (Kruskal-Wallis Test)

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b. Grouping Variable: Rate pathology services (minimum)
Confidence in the Accuracy of Pathology Results versus Overall Rating (Paired Samples Test)

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