Counties Manukau District Health Board

Laboratory Health Services Plan

February 2008

1.0 Current Services

1.1 Introduction

Laboratory medicine comprises those services which provide knowledge and diagnostic information for the care of individual patients through the scientific analysis of specimens of blood, fluids, tissue and other samples. Pathology services constitute an essential element of clinical services through the contribution they make to the effective prevention, detection, diagnosis, treatment and management of disease, especially chronic disease. It is estimated that 70 per cent of all diagnoses depend on pathology, so pathology services are vital to ensure that patients are treated at the right time and in the right place.

In the modern health-care setting pathology is a clinically-led service, which includes direct patient care, execution and interpretation of laboratory tests, and clinical liaison with all health care sectors. The pathology services therefore support other clinicians and care givers, by providing guidance on appropriate choice of tests and on clinical interpretation of laboratory test results.

It is important to emphasise that pathology services can disproportionately improve the quality of care of an individual's health care encounter. Undertaking the right test at the right time allows treatment or care to be initiated before the individual has an acute or episodic event.

Pathology depends on a variety of laboratory disciplines and underpins:

- Accurate clinical diagnosis
- Management of many chronic diseases
- Recognition of harmful reactions to drugs
- Choice of treatment for some diseases
- Prevention of some cancers
- Diagnosis and counselling for families with genetic diseases
- Blood transfusion and organ transplantation
- Prevention of hospital cross-infection

Pathology services have a vital role, supporting both clinical care and public health. A range of laboratory services are provided. These include:

Biochemistry. The analysis of the chemistry of blood and other biological samples and the application of the results to clinical diagnosis and the monitoring of therapy. Biochemistry offers a wide menu including routine chemistry, hormones, proteins, hepatitis screening, HIV screening, arterial blood gases, therapeutic drugs and some drugs of abuse screening.

Haematology. The analysis of blood and bone marrow cells and their products, and the application of the results to diagnosis and treatment of diseases affecting the blood. Haematology menu includes Full Blood Counts, comprehensive coagulation analysis and specialist haematology tests including haemoglobinopathies.

Histopathology. The study of tissue samples from patients to diagnose, manage, and prevent many diseases. The department also provides an Undecalcified Bone Histology service, diagnosing, for example, metabolic bone diseases, a fine needle aspirate cytology service and provides frozen section analysis to support surgical procedures at Manukau and Middlemore sites.

Microbiology. The study of microbes which are potential human pathogens, and the application of the results to patients' treatment, the prevention of the spread of infection and to the protection of the environment eg hospitals. Microbiology offers a wide menu including examination and culture of body fluids and tissues, infectious diseases and multi resistant organism screening.

Blood Bank. Responsible for the provision of blood and blood products and the associated testing to ensure their safe and effective use

Central Specimen Registration. The area where samples are received, assessed for quality, registered, labelled and prepared for analysis by the other Laboratory departments.

Phlebotomy. Provides a comprehensive sample collection and selected cannulation service.

1.2 Current Services

Currently laboratory services are provided out of two locations, Middlemore Hospital Campus and Manukau SuperClinic/Surgery Centre with the main laboratory being located on the Middlemore campus.

The current main laboratory was commissioned in 1999. As a consequence of the location being severely constrained, the laboratory was limited to a facility that met the needs of the time with no allowance for future proofing. The current laboratory has actually survived without expansion for longer than expected due to good process design together with the replacement of old analysers with new instruments having greater processing capability. However all departments are now dealing with significant space constraints. These space constraints result in sub-optimal process flows and new equipment has to be located where ever possible. All areas are under pressure with Histology, Blood Bank and Central Specimen Reception being particularly affected. Some staff are now co-located in less than ideal conditions as this is only way they can be accommodated within the laboratory. The laboratory conference room has been sacrificed to accommodate Histology Registrars and for a service employing over 160 staff there is only minor provision for staff facilities - a lunch room that seats 4 people, a very small meeting room, and the Clinical Director and other senior laboratory staff located in the basement.

The big challenge is that the volume of work continues to grow at a substantial rate and new laboratory facilities are not expected to be provided within the yet to be built Clinical Services Block until 2013, at that point the work will have increased by over 50%. The laboratory cannot sustain service provision within its current facilities for this period of time and a solution to the current space constraints will need to be resolved within the year.

The Manukau Laboratory location is not ideally located within its current SuperClinic location in Module 2 and there are divergent demands on where it should be placed. The service provision at Manukau is limited with the majority of the work being brought back to Middlemore for processing. This limited service provision requires staffing resources to cover a multitude of tasks from blood collection to analysing samples and providing blood products. The space on the one hand needs to be located where the public can easily access facilities for specimen collection; on the other hand the location needs to be close to theatre and away from the public so that blood products can be effectively provided. Expansion of the laboratory services at Manukau will occur but not at the same rate as Middlemore as the volume drivers are on the acute site.

2.0 Key Issues

2.1 Challenges

The laboratory is faced with numerous and wide ranging challenges as detailed below;

- ***Persistent demands to expedite turnaround***. Whilst the laboratory has succeeded in improving throughput thanks to process improvement initiatives as well as technological advances, clinicians continue to demand faster turn around times. In particular, data from clinical trials continue to highlight the importance of rapid interventions for time sensitive illnesses such as acute myocardial infarction and stroke. Currently maintaining turnaround times is a challenge as a result of facilities and staffing constraints.

- ***A dearth of qualified staff***. A widening gap between the supply and demand of laboratory scientists and clinical pathologists is undercutting the ability of laboratories to meet increasingly ambitious turn around time goals. For example, while the number of medical scientist graduates sloped off dramatically in the 1980s, the average age of the laboratory workforce is creeping up – in many laboratories a high proportion of staff members are only a

few years away from retirement. At this time the numbers in training and numbers of new graduates (worldwide) are insufficient to meet future demands. The average vacancy rate in the United States of hospital scientists is 6.3%, this is above the rate of pharmacists 4.4% but below registered nurses 8.5%.

- ***Cost containment and data analysis***. The available laboratory data and statistics only reflect internal laboratory costs and the true end-to-end costs of patient care are not fully captured currently. Without such information, it will be difficult to assess the extent to which the efficiency and effectiveness of the service can be improved and whether the projected increases in future demand can be accommodated safely. The laboratory is not able to assess whether increased laboratory costs are reflected in improved patient management.

- ***Increasing demand for Point of Care (POC)***. The perceived potential benefits of POC testing are; improved outcomes – faster turnaround time, reduced length of stay and reduced mortality. Faster turnaround times should enable clinicians to determine the course of treatment almost instantaneously; thereby ensuring patients receive appropriate timely care. Unfortunately to date, expected benefits have not been shown to be delivered and therefore at this point in time the organisation has to view POC testing as an expensive commodity with limited application in more specialist areas. POC also requires already scarce clinical resources to be allocated to test analysis and the recording of results.

- ***Quality & Safety***. Approximately 60 % of laboratory errors occur in the pre-analytical phase; these include lost specimens, mislabelled specimens, wrong specimens, incorrect aliquotting and inappropriate delays. The pre-analytical phase is currently a fully manual system situated currently in less than adequate facilities for the volume which limits effective process flows and prevents changes being made to the equipment in the area as there is no free space to work with.

- ***Information Systems***. The absence of end-to-end technology including electronic ordering prevents end-to-end information technology which imposes constraints on the availability of information for management and planning purposes. It also limits the opportunity to deliver effective order communications and decision support, both of which would help to minimise inappropriate or unnecessary repeat testing.

- ***Future service delivery planning***. Lack of inclusion of laboratory considerations into clinical service planning leads to unexpected, unplanned and unresourced demands being made on the laboratory. In particular unexpected high increases in demand adversely impact upon the more manual areas of the laboratory especially Microbiology and Histology. Some of this unexpected demand is as a result of immediate changes in practice to accommodate Multi-Resistant Organisms (MRO's). This affects both Middlemore Hospital and Manukau Campus and cannot be readily planned. Much of the unexpected demand on the laboratory comes from the clinical services expanding without the laboratory's involvement or knowledge.

3.0 Trends and Future Directions

3.1 Key Trends

Trend 1

Increasing use of methodologies such as six sigma and lean thinking to improve turn around times, maximise flow, eliminate waste and reduce inventory/supplies and costs.

Trend 2

Resurgence of local laboratories – American trends point to a change in going back to local hospital laboratories rather than Super/Factory style Laboratories. Hospital laboratories are increasingly undertaking community testing. "The Report of the review of NHS Pathology services in England" noted that there is an optimal level of organisation and also noted that in the US the factory style

laboratories had passed beyond the point of positive economies of scale with increased quality and safety issues, poor revenue return and poor pathologist support.

Trend 3

Importance of two way communication between electronic medical records and Laboratory Information Systems: Information systems that create end to end connectivity to enable order communications and decision support to be put in place nationally across the different health provider sectors and to support other demands on pathology such as health protection, disease surveillance and the management of long-term conditions and chronic disease

Order communications are important because they give notice of workload demands and therefore enable resources to be managed proactively and cost effectively both within and outside laboratory services.

Trend 4

Emphasis on outcomes seen in laboratory accreditation programmes: Overseas there is a trend to complying with ISO standards. New Zealand already has to comply with these standards. Continuous changes to standards will continue to have an impact.

Trend 5

Skilled labour crisis: In the US in 2000, 13% of the US laboratory workforce was over 55 years old. By 2010, 17% will be over 55 years old. The youngest baby boomers were born in 1964. The age profile of the NZ laboratory workforce has a higher percentage of staff over 55 and is more adversely affected by the baby boomers ageing. In the United Kingdom the number of medical scientists in the UK in 1990 sat around 20,000; the number has remained virtually unchanged for 17 years. Yet, over that same period, there has been a steady increase in both the number of laboratory tests on the menu and the volume of laboratory specimens tested. These facts demonstrate how the laboratory profession has managed to sustain laboratory services by using automation, new technology, and quality management methods to squeeze every bit of productivity out of laboratory resources. Areas of laboratory such as Biochemistry and Haematology are already highly automated services; in the future it will be difficult to significantly reduce the requirement for additional staff to meet increasing volumes by increased automation.

Trend 6

More automation, including histology solutions: Automation is steadily advancing in sophistication and usefulness. Automation is also moving into new areas of the laboratory. Examples of automation and the consequent benefits include:

- Pre-analytical sample recognition and preparation in biochemistry
- Rapid tissue processing systems, automated embedding systems and block identification systems in Histology.
- Greater use of automated urinalysis and molecular testing systems in microbiology
- Paperless Microbiology systems
- More automated serology testing
- Integration of similar analytical systems across disciplines
- Specimen handling systems including aliquotting, tracking and automated storage
- Automated storage of slides and tissue blocks
- Use of digital imaging to complement or replace conventional microscopes

Benefits of the above would include; reduction in lost samples, reduction in sampling errors, reduction in use of qualified staff time, reduction in overall test turnaround times, reduction in sample retrieval time.

Trend 7

Fewer laboratory information system upgrades because laboratories opt for middleware. Middleware (i.e. expert decision making software) can provide an efficient system that decreases turnaround time, allows staff to focus on critical patient results for rapid response to clinicians, reduces potential for medical errors, improves patient safety, and eliminates process delays to create a queueless laboratory with efficient sample tracking. Middleware adequately mediates between laboratory instruments and the laboratory information system. Shortages of skilled laboratory labour, more sophisticated use of laboratory automation, and the need to more closely manage work processes are all contributing factors likely to result in a steady increase in the use of middleware in future years.

Trend 8

Patient continuum - Laboratory services need to be managed as an end-to-end clinical service, both as a provider of optimal laboratory based services and as a core contributor to the clinical aspects of the patient's journey.

Trend 9

Knowledge – Unnecessary demand stems from a lack of appreciation on the part of the requesting clinician about the appropriateness of particular tests and the usefulness of the information obtained from the test result. As laboratory medicine becomes more sophisticated it is inevitable that the knowledge gap between the requester and the pathologist grows wider. The knowledge gap highlights the clinical contribution which laboratory medicine can make to the treatment and care of a patient and the desirability of dialogue between the pathologist and the clinician. There is a need to improve the level of understanding of pathology services among doctors and other staff using these services. Improved understanding should help users ensure that they are ordering the right tests, providing the right supporting information and correctly interpreting results.

Trend 10

Pushing laboratories to reduce costs / generate revenue
Internationally Laboratories are being pushed to increase volume to reduce the costs inpatient test by expanding into the community laboratory provision. This trend needs to be read in conjunction with Trend 2.

Trend 11

Point of Care (POC) Testing
Organisations are continuously electing to introduce point of care equipment in emergency, acute and clinic settings. Point of care diagnostics come in two basic forms: bedside testing e.g. glucose level testing for diabetics and near patient testing e.g. unit based blood gas analyser. The potential benefits of POC testing are:

- Improved outcomes – faster turnaround times should enable clinicians to determine the courses of treatment almost instantaneously, thereby ensuring patients receive appropriate timely care.
- Decreased length of Stay (LOS) – expedited laboratory results can shave several minutes or hours from a patient's stay.
- Improved workflow – Clinicians can manage patients in fewer steps, minimising wait times for laboratory results and improving productivity.

POC is undoubtedly faster than the central laboratory however frequently the results provided by POC are less accurate than those generated by central analysers. POC testing has a mixed record in terms of impact on clinical outcomes. The accuracy of results is often dependent upon the knowledge and experience of the operator.

Study	POC Test	Impact on Turnaround Time	Impact on LOS	Impact on Mortality
Sands, et al. (1995)	Chemistry, glucose, blood, urea nitrogen, haematocrit	⇩	⇩	N/A
Parvin, et al. (1996)	Chemistry, glucose and blood urea nitrogen	⇩	⇔	N/A
Kendell, et al (1998)	Haematologic, biochemical and blood gas tests	⇩	⇔	⇔
Van Heyningen, et al. (1999)	Whole blood electrolyte analyzer	⇩	⇔	N/A

Decreasing ⇩ No change ⇔

Hospitals pay a premium to perform tests at the point of care and the promise of LOS reduction has not materialized in practice. Internationally the expected rapid adoption of POC equipment has not occurred and is not perceived to be likely to occur in the near future. Even in the most aggressive organisations only one out of every ten tests are performed at the point of care and mainly only in EC, ICU and Theatre.

To extend POC within the organisation would require additional resource to oversee the quality control and training aspects required to meet mandatory compliance standards. Resources would also need to be reallocated in clinical areas to conduct the tests and upload the results.

3.2 Workforce Implications

One of the drivers of pathology modernisation is staff shortages coupled with increasing workload. Modernising pathology services emphasises the need for a strategic workforce plan at the local level, specifically designed to meet the local service requirements.

Both nationally and locally within CMDHB the age profile of the laboratory staff in increasing, this is also in line with experience internationally. The major concern for CMDHB has to be with the volume projections tracking above demographic increases we can predict major staff shortage in 10 to 15 years time even if significant automation and process improvements are achieved. Particularly in regards to Scientists, the number of new graduates is not keeping pace with forecast demand. Students are not selecting to study scientific subjects as these are not seen as fashionable or highly paid.

National Age Profile									
	20+	**25+**	**30+**	**35+**	**40+**	**45+**	**50+**	**55+**	**60+**
Scientist	2%	9%	10%	10%	17%	16%	15%	13%	7%
Technician	1%	5%	7%	12%	12%	19%	18%	18%	7%

CMDHB	Age Group				
	20-30	**30-40**	**40-50**	**50-60**	**60+**
SMO	0%	19%	44%	19%	19%
Scientist	15%	16%	39%	25%	5%
Technician	27%	10%	37%	24%	2%
Phlebotomist	0%	43%	35%	17%	4%
Admin	29%	0%	14%	43%	43%

The employment market for scientists and pathologists is global and certainly the salaries achievable overseas are far beyond what New Zealand can realistically match, this combined with a greater interest in working in new countries leads to a drain on New Zealand resources. It is extremely difficult for New Zealand to recruit overseas trained health professionals especially those with compatible qualifications.

Over the last 5 years there has been an amalgamation countrywide of private and public laboratories and some geographical areas are serviced for both hospital and community laboratories by a single service provider. The reduction in number of laboratories has decreased the number of medical laboratory scientist training positions available especially where private laboratories are the sole provider for the region. All the New Zealand training institutes have had to resort to training some of their students at overseas locations; these students often stay in their country of training.

The laboratory urgently needs to develop a workforce plan that looks at how it can recruit, retain and where necessary retrain staff. Workforce planning will need to estimate the future requirements to meet future staffing demands and the development of strategies to meet that need. The workforce plan will identify both the current and future situations where the shortages will be defined, the workplace organisation, tasks and roles, establish workforce education and training needs, and ensure that there is a process for systematically addressing the factors that are influencing workforce and workplace change.

Strategies developed need to be particularly focused at bringing in a steady stream of new graduates, this includes attracting local students into health professional study programmes and assisting students will sponsorships and summer vacation jobs.

Professional demarcations – With the advances in science and technology there appears to be a blurring of boundaries between some disciplines/specialities which would lend itself to the introduction of greater service and workforce flexibility which is generally not being exploited. The reduction in available skilled resources will necessitate a review of all scopes of practice from pathologist to technician to ensure that scarce resources are most effectively focused on the areas where there knowledge and experience is most required. With the further introduction of technology and automation it is likely that the scientist roles will extend into some of the existing pathologist roles and pathologist will increase their scope into more and more direct contact with the clinical areas. Automated machines are likely not to require the skills of a scientist to operate or oversee. Changes in scope of practice will need to be included in the laboratory workforce strategy.

3.3 Growth in Demand

New Zealand has a growing and ageing population with population projections showing a continuation of an ageing population trend. Counties Manukau population will grow from 440,600 in 2006 to 590,300 in 2026, whilst the population will remain younger than the New Zealand population there will be major increases in the proportion of the population over 65 years of age

The impacts of population based issues on the laboratory are:

- the organic growth of the population
- an ageing population with increasing pathology
- prolonged survival of patients with previously untreatable diseases, with the ongoing requirement of monitoring disease status and response to treatment
- growing population of patients of diverse ethnicity with specific genetic disorders

- areas with disadvantaged populations with increased incidence of diseases usually associated with developing countries and increased expectations of the population from the District Health Boards, e.g. fine needle aspirate service at peripheral clinics, rapid diagnostic service, direct access testing demands for specific or complex testing.

	2004/05*	2005/06*	2006/07*	2008	2009	2011	2016	2021	2026
Biochemistry	1,707,604	1,881,906	1,866,151	1,998,648	2,140,552	2,455,301	3,459,808	4,875,278	6,869,842
Blood Bank	79,347	67,790	68,361	71,783	75,372	83,098	106,057	135,358	172,755
Haematology	299,868	320,935	314,495	327,075	340,158	367,915	447,624	554,604	662,594
Histology	139,878	143,976	163,575	174,535	186,228	212,019	293,222	405,526	560,842
Sendaways	20,473	19,378	20,994	21,624	22,273	23,629	27,392	31,755	36,813
Microbiology	107,217	111,676	121,627	129,184	136,548	152,558	201,284	265,574	350,397
Total	2,354,387	2,545,661	2,555,203	2,722,849	2,901,131	3,294,520	4,535,387	6,268,095	8,653,243
% change from 06/07				6.5	13.6	29	81.4	145.3	239

Notes

- *Actual volumes*
- *Projected volumes based on individual department average growth from 2000 through to 2007. Rate of expected increase varies per department*

Demand across virtually all disciplines of pathology has been rising at an average of 5.8%. This is lower than statistics internationally, the “Report of the review of NHS Pathology Services in England” chaired by Lord Carter of Coles documented that the average increase in tests volumes was 10 % with Biochemistry demand increasing by 18%. Average demand is predicted to grow at the same pace in the future.

Any change in the provision of community testing that brings in work from the primary care sector into the hospital laboratory setting would impact upon laboratory volume expectations and this has not been factored into the laboratory volume projections detailed in this section.

Biochemistry

Biochemistry volumes have grown historically above demographic projections and this growth trend is expected to continue. Based on the actual growth percentages experienced between 2000 and 2007, Biochemistry volumes are expected to increase by 7.1% per year. The impact of the growth will be significant with volumes increasing by 300 % by the year 2026. Although this area is highly automated already the investment requirement for new space and equipment will be significant. By 2012 - 2015 a combination of volume and workforce issues will necessitate a full laboratory automation (pre-analytical through to post analytical storage) system.

While the number of samples received is expected to increase in line with patient volume projections, the number of tests per sample will probably continue to increase. The number of tests per sample is affected by the increasing use of diagnostics in clinical care, new test availability, and increased prevalence of chronic diseases.

Blood Bank

Blood is supplied by New Zealand Blood Service which also determines the pricing structure of blood products to DHBs. Historically pricing has exceeded CPI growth annually and the implications of this on the budget are significant. The majority of the volume comes from acute services and thus future volume growth will continue to primarily be derived from the Middlemore site.

Projection volumes are expected to be just above demographic growth (5%) partly as a result of more complex births, increasing elective surgical volumes and increased prevalence of chronic disease in particular renal failure. Growth in the number of patients requiring blood as a result of renal disease is expected to have a significant impact.

The requirement for increased volumes of blood at Manukau Surgery Centre will continue to grow and the existing facilities will need to be upgraded to cater for the increased demand and complexity of surgery. This will likely require the presence of dedicated blood bank resources beyond the current storage and issuing system.

Haematology

Workload is expected to increase by 4% pa, primarily as a result of demographic growth rather than by increases in test menu. To accommodate this projected increase additional cell counters, automated microscopy systems, more automated coagulation analysers and tracking systems would be required. An increase in staff numbers will be required. Numbers will depend upon the degree and scope of automation available. Additional Haematologist input will be necessary to cope with the proposed increase in volume and projected increase in haematology patients.

To accommodate the above a reasonable amount of extra space would be required.

Histology

Projections (6.7% pa) are above the rate of demographics this growth is influenced by the number of investigations per sample increasing in particular by the increasing use of immuno-histochemistry for tumour diagnosis.

This high volume increase will have a large impact on resources both from a facilities and a workforce perspective as this still a highly manual area. Automation is coming but is still limited in its scope and coverage.

In the future a cytology service will be required.

Microbiology

Projections (5.7% pa) are above the rate of demographic influenced by the growth in multi resistant organisms. Increasing numbers of immuno-compromised patients is increasing the complexity and number of tests per specimen and organisms previously considered to be benign are recognised as pathogens.

Increased awareness of health and safety issues will result in the majority of specimen processing being performed in Biological Safety Cabinets.

The paperless version of the present Laboratory Information System will increase efficiency and productivity.

As with Histology, increasing volumes will have a large impact on resources both from a facilities and workforce perspective. Much of Microbiology will remain as manual processes in the near future. There will be increasing use of molecular techniques, the use of automation in dedicated applications and the development of instrumentation focused on the elimination of manual processes.

Sendaways

The volume of sendaways is expected to remain constant as tests are repatriated when they move from specialist to main stream tests as clinical demand and expectations change. The costs of these tests is expected as per previous trends to increase at a greater rate than the volume increase as more sophisticated tests are developed, this is especially the case around molecular and genetic testing.

3.4 Model of Care/Workflow Changes

In the future the CMDHB laboratory, in particular related to the Middlemore site will need to focus on productivity through matching the workforce not only to activity and workflow but also to the roles and functions that are needed to deliver it; through improving systems and processes and realising the benefits of new technology with faster adoption.

The drivers for change are:

- To reduce costs and manage demand more effectively
- The need to improve service efficiency and productivity
- The impact of the workforce recruitment/retention problems
- The impact of facility constraints
- The introduction of new technology

The strategies to reduce costs, manage demand more effectively, and improve service efficiency and productivity will overlap.

The total cost of diagnostics is only partly controllable by the laboratory and thus previous attempts at cost containment and reduction have been focused on reducing costs within the laboratory itself and have had limited success. It must be noted that increasing the cost of diagnostics may conversely reduce the cost of total patient care; if care can be more effectively directed and applied. In the future significant studies will need to be undertaken into discovering whether the clinical services under or over order diagnostic laboratory tests. This will be a large body of work requiring dedicated resources with relevant experience.

The laboratory will take a future role in ensuring that clinical staff are fully conversant with which tests to order and when, this educating the workforce will be achieved by developing a knowledge dissemination programme based on clinical best practice to enhance the accurate and appropriate ordering of tests and interpretation and use of results. The laboratory will need to lead this education provision by getting out to the ward areas and reviewing and providing feedback on laboratory ordering as it happens. How this will be achieved requires further investigation.

To effectively manage demand the laboratory will need to manage in and outflows and this will require the implementation of service order management. A laboratory service order management system containing effective decision making software would ensure that tests recently ordered are not reordered unless necessary and would provide better clinical particulars of interest to be sent to the laboratory.

This DHB needs to ensure that its patients are supported across the Care Continuum. Regardless of whether there are one or several providers of hospital and community laboratory services for the CMDHB population, and regardless of who those providers are, there must be appropriate end-to-end laboratory information systems that are accessible to eligible health care professionals. This is required to avoid duplication of testing, clinical delays or inappropriate patient treatment. Currently information is limited to a central results repository which holds the information from the three Auckland region hospitals and the community laboratory provider.

Taking a leaf out of Toyota's book an increasing number of hospital laboratories are radically restructuring their workflows to remove unproductive steps out of the process, eliminate unwarranted variation, and identify more efficient methods for dealing with problematic situations. The results in some hospital laboratories have been impressive, with turnaround times and error rates reaching previously unheard of levels. The opportunities for change in this area are exciting as the methodologies utilised involve staff to identify the gaps and proposes changes to practice. Laboratory staff will need to be familiar with and able to use the lean thinking tools and methodologies, this will require an initial significant investment in training and education but the results should more than pay for the initial investment.

An in-depth methodical review of current work processes allows for the elimination of practice/process variation.

Changes will require consultation with key stakeholders to test the optimal configuration including the necessary workforce change with clear processes bridging from initial request to communication and interpretation of the test result; developing business cases for investment in new technology including automation and improved operations based on defined service levels and supported by appropriate management information flows

To be explicit at this point about the future configuration/service delivery models is difficult because of the paucity of supporting evidence/data. Lord Carter of Coles in the final review report indicated that this paucity of information is also a problem for the NHS.

There are currently significant constraints on existing workflows due to space configuration and limited space. In particular it is difficult to redesign workflows around the central specimen area as there is no space to reconfigure bench space or equipment.

The laboratory of the future will require large fully integrated analysers to accommodate the volume and be run by a minimum number of operators. Contrary to popular belief newer analyser are often larger than their predecessors but they do accommodate a far greater workload.

The design of the laboratory in the Clinical Services Block will require a great deal of work to be undertaken to define future workflows to ensure effective space utilisation. The growth rate of the laboratory volumes will require a degree of future proofing and design flexibility. Failure to do this will adversely impact upon workflows in the future as new technology and equipment may not be able to be adequately accommodated.

Despite significant technological breakthroughs in laboratory automation over the past three decades, many areas of our hospital laboratory remain labour-intensive workshops that rely on staff to perform manual tasks. However things are expected to change over the next three decade as new technological advances become available and mainstream.

By creating a seamless link between the pre-analytic instruments (sample manager, centrifugation, labeller, decapper, aliquotter) the analysers, and the post-analytic storage units with a tracking system, total lab automation will eliminate the need for staff to transport specimens through the diagnostic cycle. In addition to reducing staff time devoted to menial tasks, a fully integrated system avoids the time delays that inevitably occur when staff get distracted or caught up on a problematic specimen. Despite recent improvements in the size and flexibility of automated systems, they still require substantial investment in space to be effectively implemented.

Microbiology in the near future is likely to remain as predominantly manual processes. Instrumentation will be partly focused on the elimination of manual processes and for faster screening of negative cultures and specific organisms. There will be increasing use of molecular techniques and the use of automation in dedicated applications.

Automation in the histology will significantly change workflows by the addition of high speed tissue processors linked with automated embedding centres. This will eliminate much of the menial work within the department. Technological advances such as virtual colonoscopies have the potential to reduce the number of tissue specimens submitted to histopathologists for review.

"Medicine is entering the genomic age. Daily we learn of new discoveries about DNA, RNA, and proteins that promise to transform vast swaths of clinical care. These breakthroughs are likely to cause radiologists, pathologists, and other physician specialists, to come together and practice an integrated form of medicine totally unlike what we know today. One of the world's biggest corporations in imaging and radiology, Siemens, has spent billions buying laboratory testing companies and is now promoting the message that diagnostic medicine's future lies in the integration of molecular imaging (in vivo) with molecular diagnostics (in vitro). Already some radiologists and pathologists are crossing traditional boundaries as they take early steps to integrate molecular imaging and molecular diagnostics. These first movers in their fields are showing the power of integrated diagnostics to provide physicians with powerful new tools to detect and treat a growing number of diseases. As laboratory medicine moves into the bold new world of genomic medicine, molecular technologies will lead the way."(Ref Dark Daily 13/12/07).

4.0 Key Directions

- ✓ Continued growth in volume of laboratory investigations above demographic/service growth levels.

- ✓ Focus on improved productivity through matching workforce to activity, improving systems and processes, and through realising the benefits of new technology.
- ✓ Development of new facilities configured to optimise productivity and address current constraints.
- ✓ Electronic service order management to avoid duplication of tests with resultant patient and cost benefits.
- ✓ The CMDHB Laboratory, supported by an end-to-end Information System, will operate as an end-to-end clinical system and be a core contributor to the clinical aspects of the patient's journey.
- ✓ Addressing the increasing knowledge gap between requester and the pathologist as the result of laboratory medicine becoming more sophisticated. The Laboratory service will provide supporting information and education to help users to ensure they are ordering the right tests and correctly interpret results.
- ✓ Increasing laboratory automation with potential total laboratory automation in some service areas. In addition to major clinical quality benefits of reduction in errors and improved timeliness of results, are potential cost savings.
- ✓ Adoption of Middleware (i.e. expert decision making software) to provide an efficient system that increases response and improves clinical quality.
- ✓ Expansion at Manukau Campus to support major growth in elective surgery and development of new services (e.g. Rehabilitation, Mental Health and Mental Health Services for Older People) on the Manukau site.
- ✓ Development of Point of Care testing in healthcare provider locations where this is appropriate, supported by evidence, and when the process can be quality controlled.
- ✓ Develop workforce strategies to manage high rates of attrition of an ageing scientific/technical workforce.