



Queensland Audit Office
better public services

Efficient and effective use of high value medical equipment

Report 10: 2016–17



Queensland Audit Office

Location Level 14, 53 Albert Street, Brisbane Qld 4000

PO Box 15396, City East Qld 4002

Telephone (07) 3149 6000

Email qao@qao.qld.gov.au

Online www.qao.qld.gov.au



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9 February 2017

The Honourable P Wellington MP
Speaker of the Legislative Assembly
Parliament House
BRISBANE QLD 4000

Dear Mr Speaker

Report to Parliament

This report is prepared under Part 3 Division 3 of the *Auditor-General Act 2009*, and is titled *Efficient and effective use of high value medical equipment* (Report 10: 2016–17).

In accordance with s.67 of the Act, would you please arrange for the report to be tabled in the Legislative Assembly.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Anthony Close', is positioned above the printed name.

Anthony Close
Auditor-General (acting)

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Summary

Introduction

Every day, Queensland public hospitals use medical equipment to help diagnose and treat patients. As technology advances, new equipment becomes available with the potential to improve health outcomes.

Replacing existing equipment and investing in new equipment can come at a high cost in terms of purchase, installation, operation, and disposal. It is important that our public hospitals manage their valuable equipment efficiently, effectively, and economically so they can continue to meet the growing demands on our health system in a sustainable way.

Audit objective and scope

The objective of this audit was to assess whether Queensland public hospitals are using high value medical equipment cost-efficiently and realising expected benefits. It examined the process for procuring the equipment, including whether purchasing decisions addressed value-for-money considerations.

The scope of the audit included the Department of Health (the department) and each Hospital and Health Service (HHS) that provides health services across Queensland. We undertook detailed fieldwork at four HHSs, and collected information on high value medical equipment and its usage from all 16 of Queensland's HHSs. Appendix B provides more detail about the scope of our audit.

High value medical equipment

This audit focused on high value medical equipment, which we have defined as equipment with an acquisition value of \$1 million or more.

The number of items of high value medical equipment in Queensland hospitals has grown from 70 in 2006 to 134 in 2016. The 134 items are spread across 12 of the 16 HHS that provide front-line health services in various hospitals across Queensland. The 134 items have a total acquisition value of approximately \$277 million. However, the total cost of ownership of this equipment is significantly higher than \$277 million because of installation, upgrade, and maintenance costs. Medical imaging equipment, such as magnetic resonance imaging (MRI) and computed tomography (CT) scanners, make up 53 per cent of this value.

We have categorised high value medical equipment into three groups:

- replacement high value medical equipment—equipment purchased as a like-for-like replacement of existing equipment/capability
- new high value medical equipment—equipment purchased to provide additional services a HHS or hospital is not currently delivering, or to expand on current capability to deliver related medical services
- new technology high value medical equipment—medically innovative equipment that is new to Queensland, Australia, or the public health system.

Roles and responsibilities

The *Hospital and Health Boards Act 2011* (Qld) makes the board and management of each HHS responsible for delivering efficient, effective, and economical health services within their respective hospitals. The role of the HHSs is to deliver health services that meet the specific health needs of their local communities. The HHSs own and operate high value medical equipment and are responsible for its ongoing management.

The senior person in charge of running a particular service for a hospital (within the HHS) is responsible for planning how high value medical equipment is used. For example, the medical imaging director plans the use of scanning equipment. Each HHS we audited in detail also has asset managers with overall responsibility for maintaining and disposing of assets.

The department, as system manager, monitors system performance—both individual HHS performance and the health system performance as a whole. Its role includes promoting the effective and efficient use of available resources in the delivery of health services, which includes the overall effective use of high value medical equipment.

The department manages programs to fund high value medical equipment and supports the HHSs in making value-for-money purchases. The department also has a role in maintaining some of the high value medical equipment through its Biomedical Technology Services team. This is a fee-for-service arrangement.

When we use the term ‘the health system’, we are referring to the department and all HHSs collectively.

Funding

The department provides funding to HHSs to purchase high value medical equipment via two programs: the Health Technology Equipment Replacement Program, and the Minor Capital Projects and Acquisition Program. The Health Technology Equipment Replacement Program funds replacement equipment over \$5 000 and covers various equipment categories, one of which is high value medical equipment.

HHSs pay for new and replacement equipment that costs under \$5 000 from their own operational funding. The recent introduction of the Queensland Leasing Approval Policy for public sector entities is another mechanism by which HHSs can obtain high value medical equipment using operational funding.

Performance measures

It is important to monitor the performance of high value medical equipment to ensure it is delivering value for money in meeting clinical needs. To be able to monitor equipment performance, users first need to understand what type of information they need to capture, and how they can extract and review that performance data in a meaningful way.

The lack of consistent, high quality, and reliable performance reporting in the health system was a consistent theme in a Queensland Government-initiated review of the department in 2015 (the Hunter Review). It recognised the importance of accurate data in managing performance and improving service outcomes, and specifically highlighted the differences in patient wait list data across hospitals as an inhibitor to performance measurement.

This continues to be an issue. Our audit analysis was limited by the availability and quality of data. We were unable to obtain complete and accurate data for all high value medical equipment. For example, we were only able to provide high level analysis on 25 of the 34 high value CT scanners (more than \$1 million cost) in use due to poor data quality. The data for the remaining CT scanners was either not able to be provided by the relevant HHS, or was not in a usable format.

Audit conclusions

The health system can better use high value medical equipment in providing health services to Queenslanders. By managing the use of high value medical equipment across hospitals rather than only within the hospital in which the equipment is located, the health system could more efficiently use equipment capacity to reduce patient wait lists. Our analysis showed that while some equipment is being used more than comparable local and international benchmarks, other equipment could achieve improved efficiency. For example, there is unused CT scanner capacity in metro hospitals, and patients waiting for those services at nearby hospitals within the same HHS.

There is a need to standardise the way in which equipment performance data is managed so performance can be benchmarked accurately, analysed, and improved where necessary. Without relevant performance information, the health system cannot demonstrate it is optimising available capacity before purchasing new or replacement equipment—particularly in South East Queensland, where distance and population density are not limitations to efficient use.

Queensland's 10-year health strategy, *My health, Queensland's future: Advancing health 2026*, recognises the importance of comparative reporting of clinical performance data in improving overall performance of the health system. This applies to performance data for high value medical equipment.

The HHSs are not discharging their accountabilities for managing the costs of high value medical equipment adequately. The health system cannot demonstrate that its investments in these high cost assets are yielding the expected benefits and are the most cost-effective way of delivering health services. This is, in part, because the department, when providing funding to replace high value medical equipment, is not enforcing its own policies for HHSs to develop business cases.

More often than not, when it comes to purchasing equipment, HHSs are not selecting the value-for-money option identified by the department. This means that the health system cannot demonstrate it is making cost-effective decisions about the substantial investment of public funds in these assets.

More broadly, asset planning needs to link better with service planning to ensure high value medical equipment investments are properly targeted to meet patient demand. In doing so, the health system needs to consider the socio-economic factors and complexities of delivering healthcare services across Queensland's wide geographic area, for varying population densities, and within infrastructure limitations.

Increasing demand placed on the health system, combined with inadequate asset planning, means that the current funding for health technology equipment is insufficient to meet the replacement needs of high value and other health technology equipment. To mitigate the risk of disruption to health services that use health technology equipment, there is an urgent need to conduct further analysis of the funding shortfall and explore alternative funding options, including leasing of equipment.

Audit findings

Planning strategically

The department has developed specific health service guidelines to assist HHSs plan for the number of items of high value medical equipment they need to deliver clinical services. The HHSs we audited in detail did not use these guidelines. Instead of using the spare capacity of their high value medical equipment (where possible), they were reactively planning high value medical equipment services based on the demand from fluctuating wait lists.

A lack of comprehensive planning has also meant that high value medical equipment has been purchased without due regard to the life cycle cost of the equipment. There has been a narrow focus only on the initial up-front acquisition cost of the equipment itself, rather than any analysis of the impact of the total cost of ownership on the health system.

For example, we found that a linear accelerator (used for radiation oncology), originally purchased for \$4 million, has a forecasted life cycle maintenance cost of \$4.7 million (119 per cent of its acquisition cost) over its 10-year lifetime. HHSs have not routinely factored this type of life cycle costing analysis into their high value medical equipment planning and procurement processes.

We acknowledge that one HHS has recently developed an asset management framework that includes a three-year infrastructure plan and investment management framework for strategically managing its assets.

Managing high value equipment

The health system manages high value medical equipment in an uncoordinated way, using a patchwork of various asset management systems and approaches. There isn't a single source of reliable information with a complete and accurate picture of high value medical equipment statewide. This limits the ability of the department's health planners to effectively plan at a state level for high value medical equipment services now and into the future.

The data disparities in the department's various asset management systems also create ongoing risks for how high value medical equipment is maintained. For example, our high level analysis of the systems indicated that some HHSs may be paying maintenance fees on equipment they don't own or no longer use.

The health system can only determine the potential impact of this situation once there is a more complete understanding of the entire high value medical equipment fleet.

Funding replacement medical equipment

HHSs need to replace high value medical equipment once it reaches the end of its useful life so hospitals can continue to safely provide the associated clinical services. This audit identified significant concerns about future funding for high value medical equipment replacements.

The funding amount for the replacement of equipment, and the methodology used to derive it, has not changed since 2008. Therefore, the funding arrangement has not taken into account the large increase in the medical equipment fleet in the intervening period. As such, current funding arrangements will not meet the ever-increasing costs of replacing the fleet commissioned since that time.

According to the department's Financial Accounting and Materials Management Information System, the shortfall in funding for the 2016–18 funding period (assuming no prior deficit) for what needs to be replaced versus the funding available, is \$131 million. If the deficiencies in the current funding arrangement are not remedied, based on the expected rate of equipment replacement, we estimate that by the 2018–20 funding cycle, the cumulative shortfall between equipment replacement costs and available funding will be approximately \$390 million.

We understand that the department has taken some preliminary steps to investigate the extent of the funding shortfall and to identify alternative funding options. This will require the department and the HHSs to work together to accurately record, monitor, and continue to update high value medical equipment records to meet future demand without disrupting clinical services.

Monitoring performance

There are no specific performance targets for CT scanner and MRI scanner usage. Nor are there recommended minimum data reporting requirements that establish the information that HHSs must capture about the use of these machines. Without specific targets or performance monitoring requirements, the type of data being collected by HHSs varies significantly.

This means HHSs are unable to effectively monitor how well they are using their high value medical equipment. It also means the department, from a system perspective, cannot monitor the performance of high value medical equipment.

The ability to monitor how well equipment is being used is also hampered by inconsistencies in how HHSs record the steps required to provide clinical care for a patient, resulting in different definitions for procedure start and finish times. This creates difficulties in benchmarking HHSs' use of equipment across the state, in identifying potential performance improvements, and in understanding how high-performing hospitals are maximising the use of their equipment.

We benchmarked at a high level how well a selection of CT and MRI machines are performing when compared against some other jurisdictions. We identified some significant variations in the level of throughput (number of individual instances of service) from machine to machine, both for CT and MRI.

Eleven of the 25 CT scanners had above average throughput compared to comparable local and international jurisdictions. Half of the remaining 14 CT scanners were used much less than both the state and international averages. This indicates there may be an opportunity to better use these machines.

The selection of Queensland CT machines we analysed had a 25 per cent higher average usage rate than Victoria per CT machine. These results should be interpreted with caution, as there are a number of limitations with the data. A high average throughput does not necessarily mean that each machine across the state is well used.

For MRI scanners, 60 per cent of the audited sample had throughput that was below the benchmark averages. As with the CT scanners, the analysis suggests there are opportunities to better utilise MRI machines in some HHSs.

We also looked at the performance of radiotherapy machines. The Radiation Oncology Jurisdictional Implementation Group recommends the number of annual courses of treatment that should be delivered by linear accelerators (LINACs). We identified some spare capacity in 11 of the 16 LINACs we analysed, equating to approximately 700 available courses of treatment for the 2015 calendar year.

In one HHS we analysed, neither of its LINACs were operating at recommended capacity, but there was no evidence to suggest demand was not being met. The spare capacity could be intended to be used to meet future projected demand for the service. However, our findings suggest there is opportunity to undertake further demand analysis to better optimise the future placement of LINACs across the state.

These results reinforce the need for HHSs to establish a means to monitor the performance of individual machines to ensure they are meeting performance expectations. This will enable HHSs to better plan for future demand.

Managing purchases

The department's Health Technology Equipment Replacement Implementation Standard requires HHSs to prepare a business case for all purchases greater than \$1 million through the Health Technology Equipment Replacement Program. Despite this requirement, HHSs have not been consistently preparing business cases for high value medical equipment purchases.

Of the 17 high value medical equipment replacement purchases undertaken in the 2014–16 program, only one business case was produced. This makes it difficult to determine if HHSs have done proper due diligence before investing public funds in high value medical equipment.

In most cases, HHSs do not have sufficient documented information about high value medical equipment purchases to provide assurance that they:

- follow departmental and state procurement policies
- understand the full cost over the life cycle of the asset
- consider alternative service delivery or purchasing options
- quantify the expected benefits.

Of the 17 equipment replacements made in 2014–16, the Health Technology Equipment Replacement Program team was able to provide eight instances where the value-for-money option was not selected. In the remaining nine cases, there was no documentation as to whether the value-for-money option was selected.

More broadly, a lack of proper planning and evaluation documentation is a missed opportunity for the department and HHSs to capture information on what high value medical equipment has previously performed well and why. It is these insights that should inform future procurement decision-making and ultimately create long-term value in the high value medical equipment procurement process.

The fact that the department has not been enforcing its own procedural requirements for HHSs to provide a business case for Health Technology Equipment Replacement Program requests means it is not effectively fulfilling its purchasing control function as system manager.

The department's approach to purchasing and managing new technology—as opposed to replacement technology—is better because it has established an advisory committee for new technology (the Queensland Policy and Advisory Committee for new Technology). This commenced in 2009, and the process it follows incorporates elements of better practice procurement and evaluation of high value medical equipment.

There is potential for this process to be adapted and applied to the procurement processes for replacement and new high value medical equipment to enhance overall governance.

Recommendations

We recommend that the Department of Health:

1. leads a comprehensive stocktake of the high value medical equipment fleet across the health system to establish and maintain a complete, accurate register of the state's high value medical equipment (Chapter 2).

The analysis should include a review of the completeness and accuracy of the relevant asset information systems used by the health system for financial reporting and asset maintenance.

2. investigates, in consultation with the Hospital and Health Services, options to aggregate data across the health system asset management systems in a way that provides meaningful decision support information for assets across their life cycle (Chapter 2).
3. undertakes a review of the Health Technology Equipment Replacement Program with a particular emphasis on:
 - identifying the most suitable funding arrangements for replacing high value medical equipment as it becomes obsolete. The funding review should consider options for at least a 10-year equipment replacement horizon (Chapter 2)
 - identifying whether aspects of the Queensland Policy and Advisory Committee for new Technology process should be applied to the Health Technology Equipment Replacement Program process to increase transparency and rigour in how high value medical equipment replacement decisions are made (Chapter 4).

We recommend that the Hospital and Health Services:

4. develop or augment their strategic asset management plans according to the specific needs of their operational environment (Chapter 2).

We recommend that the Department of Health and Hospital and Health Services collaborate to:

5. develop guidelines to strategically plan for high value medical equipment assets, addressing key elements of the asset life cycle (Chapters 2, 4)
6. consider standardising wait list templates so all Hospital and Health Services are capturing and reporting on the same information—to enhance high value medical equipment planning (Chapters 2, 3)
7. standardise definitions for key data points (such as start and completion times) when using high value medical equipment (Chapter 3)
8. identify key baseline performance metrics for high value medical equipment so the relevant data can be captured and reported on—to identify available equipment capacity and potential system-wide improvements (Chapter 3).

Reference to comments

In accordance with section 64 of the *Auditor-General Act 2009*, we provided a copy of this report to the chief executive officers of all Hospital and Health Services and to the Director-General of the Department of Health with a request for comments. Their views have been considered in reaching our audit conclusions and are represented to the extent relevant and warranted in preparing this report.

The comments received are included in Appendix A of this report.

Report structure

Chapter	
Chapter 1	provides context for the audit findings and conclusions.
Chapter 2	evaluates how hospitals plan and manage high value medical equipment.
Chapter 3	assesses how well high value medical equipment is being used and whether there are opportunities for improvement.
Chapter 4	assesses whether procurement of high value medical equipment is achieving value for money.

Report cost

This audit report cost \$526 000 to produce.

1. Context

The rising cost of public healthcare is a focus of governments at a national, state, and territory level. They are grappling with the problem of how to balance increasing demand for health services with this cost, as health budgets are already stretched. This problem requires critical analysis of:

- the drivers for demand and how they can be influenced
- the cost profile of delivering a range of health services
- how to improve delivery in a constrained budgetary environment.

The ability of a Hospital and Health Service (HHS) to improve service delivery depends on whether they understand the volume of services they are currently delivering, and whether they can make the most of their capacity. It also depends on whether they can afford the costs associated with purchasing, maintaining, and operating the equipment they use to deliver services.

By examining the use of significant assets, such as high value medical equipment, HHSs and the Department of Health (referred to collectively in this report as the health system) have an opportunity to identify unused capacity and consider how they can better capitalise on it.

High value medical equipment

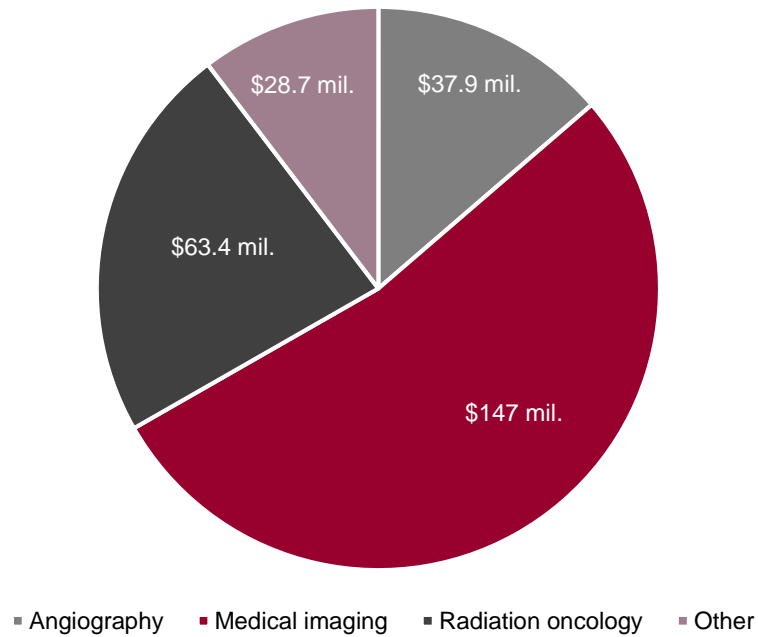
We define high value medical equipment as equipment with an acquisition value of \$1 million or more. High value medical equipment is a subset of the health system's health technology equipment category of 'assets', which includes all medical equipment with a value over \$5 000. The terms health technology equipment and medical equipment are used interchangeably in this report.

High value medical equipment in Queensland hospitals

Queensland public hospitals have 134 items of high value medical equipment spread across 12 of the 16 HHSs, with a total historical acquisition value of approximately \$277 million. The total cost of ownership of this equipment, however, is significantly higher than \$277 million, as it can include other costs such as upgrades to infrastructure to fit the equipment, and maintenance and service fees during the lifetime of the equipment.

Figure 1A shows the four categories of high value medical equipment in use by Queensland's HHSs, broken down by total acquisition value.

Figure 1A
Acquisition value of high value medical equipment by service type, as at September 2016

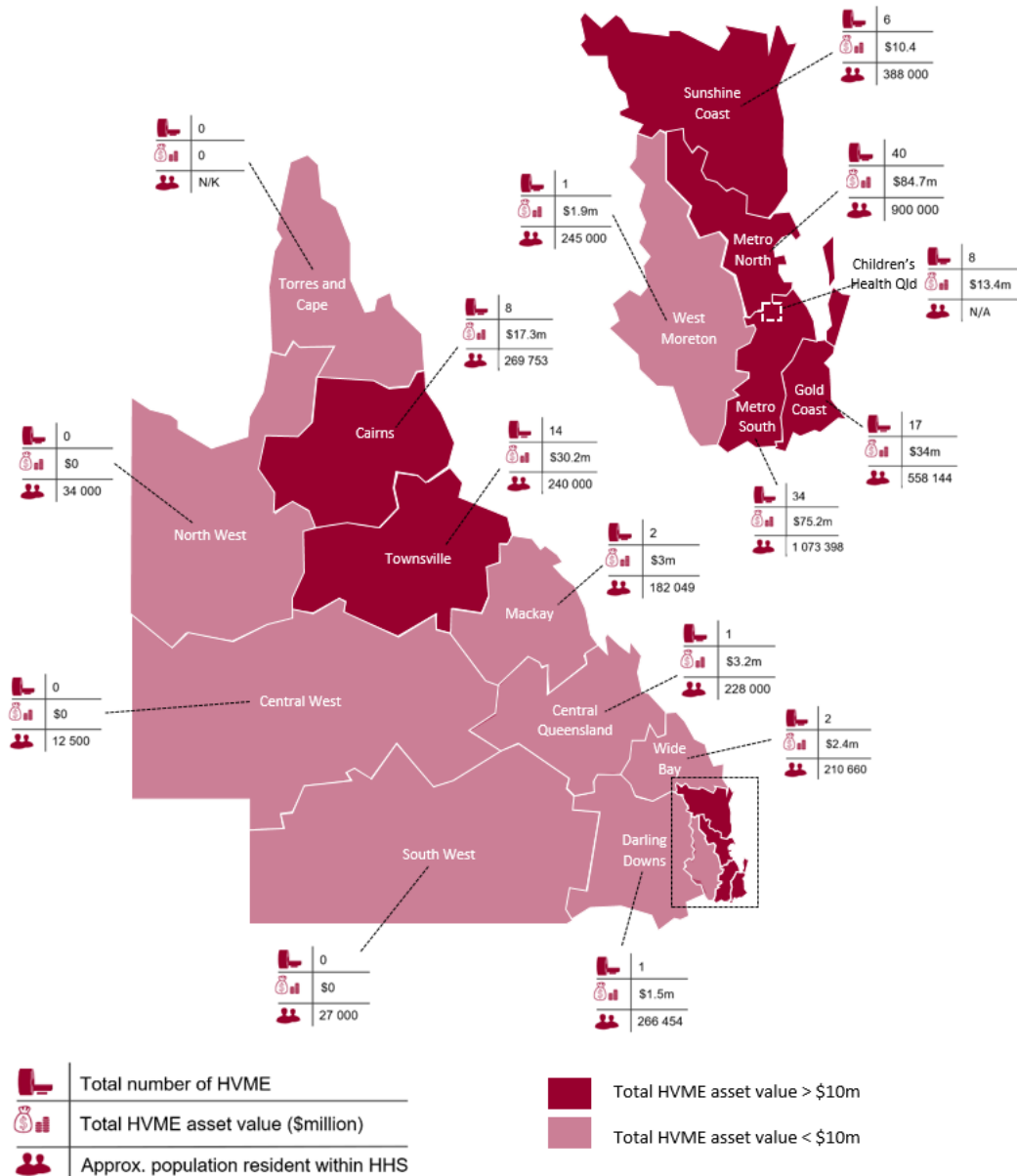


Note: Information drawn from the health system's Financial Accounting and Materials Management Information System (FAMMIS) and HHS reporting, current as at September 2016. 'Other' high value medical equipment includes the Gamma Knife (x1), the surgical (DaVinci) robot (x2), hyperbaric chambers (x2), and a cyclotron (x1). (Appendix D provides descriptions of relevant high value medical equipment.)

Source: Queensland Audit Office

Figure 1B shows the breakdown by number and acquisition value of items of high value medical equipment within each HHS, and the catchment population serviced by the HHS. Appendix C has further detailed information about the location of high value medical equipment.

Figure 1B
High value medical equipment (HVME) within each HHS catchment
as at September 2016



*Resident population is direct catchment only and does not account for patients referred from and treated by other HHS areas, for example, referrals to specialist treatment Hospital and Health Services such as Children's Health Queensland.

Source: Queensland Audit Office, HHS Total Asset Management Plans, and FAMMIS

Categories of high value medical equipment

We categorise high value medical equipment into:

- replacement—high value medical equipment purchased as a like-for-like replacement of existing equipment/capability
- new—high value medical equipment purchased to provide additional services the HHS or hospital is not currently delivering, or to expand on current capability to deliver related medical services
- new technology—medically innovative high value medical equipment that is new to Queensland, Australia, or the public health system.

The category of high value medical equipment dictates the funding source, procurement process, and the operational management of the equipment.

Replacement equipment and new equipment

Eighty per cent of high value medical equipment in Queensland public hospitals is located in medical imaging and radiotherapy units. The term used to define a particular piece of imaging equipment by the function it performs is *modality* (for example, x-ray is a modality). We analysed the use of the following replacement and new medical imaging, and radiotherapy equipment:

- Magnetic resonance imaging (MRI)—a diagnostic medical imaging machine used in radiology to create an image of parts of the anatomy. It can create detailed images of the organs and tissues within the body.
- Computed tomography (CT)—a diagnostic medical imaging machine used to create detailed images of internal organs, bones, soft tissue, and blood vessels.
- Linear accelerator (LINAC)—a device used for delivering radiotherapy treatment. It is most commonly used for patients with cancer.

Although Positron Emission Tomography (PET) —an imaging machine used to observe metabolic processes—and dual machines (PET/CT and PET/MRI) are medical imaging high value medical equipment, we have discounted them from our detailed analysis because there was limited useable data available for them.

New technology equipment

There has only been one acquisition of new technology high value medical equipment in Queensland in the past three years. Metro South HHS purchased a Gamma Knife intra-cranial stereotactic radiosurgery unit as new technology in 2015. The Gamma Knife is innovative because it uses radioactive sources to predominantly treat brain tumours and other brain abnormalities without damaging surrounding healthy tissue, and offers capabilities beyond other types of equipment.

Appendix D provides descriptions and the approximate acquisition value of the medical equipment we mention in this report.

Demand for high value medical equipment services

The demand for high value medical equipment is rising due to an increasing and ageing population, modern technological advances, and an increase in chronic health conditions among Queenslanders. In 2014 and 2015, Queensland public hospitals produced more than 500 000 scans on high value imaging equipment alone (not including other scans on equipment costing under \$1 million, such as x-ray machines).

Queensland's population is growing at an annual rate of approximately 1.8 per cent, or 107 000 people per annum, as detailed in Figure 1C.

Figure 1C
Population projections and growth rate for Queensland from 2016 to 2036

	ERP* 2014	2016	2021	2026	2031	2036
Population forecast (millions)	4.72	4.95	5.48	6.01	6.55	7.1
Growth rate (%)		2.26	1.94	1.77	1.65	1.54
Increase (by numbers)		223 872	530 763	530 496	540 642	546 957

* Estimated resident population (ERP) from 2011 census

Source: Australian Bureau of Statistics Catalogue No.3235.0

Although the rate of population growth is slowing, an increase of approximately 2.1 million people over the next 20 years has significant implications for the use of high value medical equipment, particularly in the high growth regions of South East Queensland and the central coast.

Planning for demand

The Queensland Department of Health (the department) is responsible for planning statewide public health service and monitoring the performance of the service against health plans and strategies. The department's planning:

- informs local planning at a HHS level for service types and volumes
- assists in aligning services with geographical areas and population groups.

Every year, the department undertakes activity projection development, which is a collection of medium-term projections over different types of health services. Each HHS then determines the high value medical equipment it needs to deliver the level of services it reasonably expects to undertake in any given year.

Over the last 10 years, due to the increasing service demand and improvements in medical technology, HHSs have increased the number of items of high value medical equipment they own. For example, the number of items of radiation oncology and medical imaging high value medical equipment has more than doubled, and the total acquisition value of this equipment has almost tripled during this period, as shown in Figure 1D.

Figure 1D
Total number and acquisition value of imaging and radiation oncology modality held in 2006 compared to 2016

Equipment	2006 No. held	2016 No. held	2006 Total cost \$mil.	2016 Total cost \$mil.
Computed tomography (CT)	20	34	26.3	54.1
Linear accelerators (LINAC)	14	24	30	66.0
Magnetic resonance imaging (MRI)	7	20	17.2	53.3
Positron emission tomography (PET)	0	7	0	25.0
Total	41	85	73.5	198.4

Source: Queensland Audit Office with information taken from FAMMIS at Sep 2016

Planning for high value medical equipment must take into account socio-economic factors and the complexities of delivering contemporary healthcare services that meet patient needs across Queensland's wide geographic area, for varying population densities, and within infrastructure limitations.

In this complex operating environment, the ability of HHSs to address patient needs and coordinate patient flows across hospitals and HHSs is a constant challenge. This is especially the case in regional and rural/remote areas, where the ability of the patient to travel for healthcare services may be hindered by distance and cost of travel.

Wait lists

The demand for services that use high value medical equipment and the way in which the equipment operates is influenced by each hospital's medical imaging wait lists, state recommended times for consultation, and national targets.

Hospitals within HHSs define their own priorities for managing wait lists. They base these mainly on the clinical need and priority of the patient, but they also deliver services in accordance with their HHS's service agreement with the department. Each hospital's specific casemix (the profile of its patients and types of services it offers) and regional demographics are key drivers of its priorities. For example, The Prince Charles Hospital (Metro North HHS) specialises in cardiac treatment and aims to see cardiac patients quicker than other hospitals within the HHS.

Regional differences are another important consideration. A smaller regional hospital may have a shorter wait list target than a large metropolitan hospital due to having fewer patients. They would expect to see their patients in a shorter time frame than their metropolitan counterparts. Bundaberg Hospital (Wide Bay HHS), for example, has a same-day wait list for medical imaging outpatients, whereas Princess Alexandra Hospital (Metro South HHS) has a target of less than four weeks.

In Queensland, there are three standard treatment categories with recommended timeframes for consultation. These timeframes are applied to outpatients who require consultation with a specialist, and to patients who require elective surgery (surgery that can be planned).

The timeframes are the same for both outpatient and elective wait lists, and are:

- urgent (category 1)—recommended within 30 days
- semi-urgent (category 2)—recommended within 90 days
- non-urgent (category 3)—recommended within 365 days.

Hospitals plan to treat patients within these time frames unless they are expected to meet benchmarks for specific treatments.

The size of wait lists can affect how efficiently high value medical equipment is used. When wait lists increase, HHSs allocate additional resources to increase the operating hours of service departments and increase the use of their high value medical equipment. This response generates additional service availability, thereby reducing the number of patients on the wait lists.

Radiotherapy (LINACs)

The Royal Australian and New Zealand College of Radiologists has developed recommended wait times for radiotherapy treatment:

- emergency care—within 24 hours
- high priority care—within 14 calendar days
- planned care—within 28 calendar days.

Measurement of the wait time starts once a patient is diagnosed.

Measuring the wait time allows radiological departments to determine whether they are meeting recommended benchmarks. Five of the hospitals that provide radiation oncology treatment (Cairns, radiation oncology Mater Centre, Princess Alexandra, Royal Brisbane and Women's, and Townsville) submit their wait lists to the department's Health Analysis and Access team. The department then publishes (on the specific hospital's website), the average number of working days until their next available treatment start date.

Roles and responsibilities

Queensland Department of Health

The department is the system manager for Queensland's health system. As such, it is responsible for the overall management of the public sector health system, including for promoting the effective and efficient delivery of health services. The department's strategic plan for 2016–20 outlines its strategies for supporting the health and wellbeing of all Queenslanders, and includes a focus on high performance.

Health service planning plays a key role in informing the service delivery purchasing intentions of the department. For statewide planning, the existing service agreements between the department and each HHS support alignment of HHS services with statewide service directions.

Each service agreement defines the health services, teaching, research, and other services to be provided by the HHS. It defines the funding that will be provided by the department for the service, and the outcomes expected. It also defines how HHS performance will be measured. This assists the relative HHSs in their planning for service provision and in quantifying their need for high value medical equipment.

Health Support Queensland

Health Support Queensland provides procurement policy advice and sourcing support for the department and HHSs. This support includes the management of maintenance for medical asset categories, including medical equipment.

Biomedical Technology Services (BTS) is a business unit of Health Support Queensland. It has a number of service centres across the state to support HHSs in managing their assets through service agreements. BTS provides a range of health technology maintenance services (including for high value medical equipment) and other services including:

- health technology equipment and information systems
- technicians to provide scheduled maintenance services on medical equipment
- engineering expertise to design, manufacture, and modify equipment to meet medical equipment standards
- radiation safety consultancy services and compliance testing for medical imaging and laser radiation.

BTS uses a hospital equipment management system to manage the maintenance of HHS equipment, in accordance with the Australian standard on management programs for medical equipment.

Hospital and Health Services

Queensland's HHSs and their governing boards were established as part of national health reforms agreed between the federal and state governments in August 2011, and articulated in the National Health Reform Agreement. HHS functions are detailed in section 19 of the *Hospital and Health Boards Act 2011* (Qld). HHSs provide health services across the metropolitan, regional, and rural areas of Queensland.

Each HHS, as the principal provider of public health services in its catchment, has a service agreement with the department that sets out the services it will provide and for which it will be funded. HHS boards are responsible for ensuring the operations of the HHSs are carried out efficiently, effectively, and economically. There are also general principles that apply to all HHSs, including that:

- demand for services is driven by the financial, educational, geographic, and cultural barriers to good health
- major inputs include infrastructure assets, medical equipment, specialist staff, drugs, and clinical and pathological supplies
- revenue is primarily dependent on the activities delivered to inpatients, outpatients, and for emergency care, but this is a finite source that needs to be carefully managed for the sector to remain sustainable
- having healthy Queenslanders is a key outcome.

Appendix E includes an overview of all health related public sector entities in Queensland and their responsibilities.

Relevant legislation and guidance

Financial accountability and efficiency

The Financial Accountability Handbook (Queensland) assists accountable officers and statutory bodies to discharge their mandated financial obligations under the *Financial Accountability Act 2009* and the Financial and Performance Management Standard 2009.

The handbook requires each HHS to ensure it is achieving maximum performance with minimum input, or to consider the ratio between input and output. This requirement ensures that public sector entities are providing their services as efficiently as possible. The notion of service efficiency is also a central tenet in the legislation that established the HHSs.

For the purposes of this audit, we define efficiency as the optimal use of high value medical equipment for the given set of resource inputs. We acknowledge that the health sector always considers patient safety and quality of care in determining how a service is provided, and that this can have an impact on how service inputs are used.

Queensland Procurement Policy

The Queensland Procurement Policy is the state government's overarching policy for the procurement of goods and services by public sector agencies. Its purpose is to deliver excellence in procurement outcomes for Queenslanders.

The department and HHSs are required to comply with the policy and to follow the six principles of government procurement when planning for services and procuring equipment for those services. The principles are:

- Principle 1: We drive value for money in our procurement.
- Principle 2: We work together across agency boundaries to achieve savings and benefits.
- Principle 3: We are leaders in procurement practice—we understand our needs, the market, and our suppliers, and have the capability to deliver better outcomes.
- Principle 4: We use our procurement to advance the government's economic, environmental, and social objectives, and support the long-term wellbeing of our community.
- Principle 5: We have the confidence of stakeholders and the community in the government's management of procurement.
- Principle 6: We undertake our procurement with integrity, ensuring accountability for outcomes.

All of these principles are directly relevant to the purchase of high value medical equipment.

Asset management standards

All public sector entities are required to manage their assets efficiently and effectively to meet the government's fiscal obligations as set out in the Queensland Government's charter of fiscal responsibility. As statutory bodies, HHSs are subject to the Financial and Performance Management Standard 2009. It requires HHSs to:

- manage their assets in accordance with an asset management system
- ensure evaluations are undertaken before acquiring, maintaining, or improving a significant physical asset
- undertake a follow-up review of the asset to ensure the objectives contained in the evaluation were met.

Australian standards

The management of medical equipment requires specific procedures that are captured within Standards Australia's AS/NZS 3551:2012—*Management programs for medical equipment*. The standard specifies the procedures for developing management programs for medical equipment. It requires:

- new equipment to have acceptance testing prior to clinical use
- routine performance verification to be performed during the equipment's useful life
- maintenance to be carried out in line with the manufacturer's instructions
- responsible organisations to ensure safety and performance of medical equipment is maintained in an effective scheme with regular testing and assessments.

Funding options

HHSs receive funds from a range of sources to allow them to purchase, maintain, and operate their high value medical equipment. This includes funding from the Queensland Government, Australian Government, private insurance companies, research funds, foundation grants, and their own source revenue. The Queensland and Australian governments provide the majority of the funding, while the level of funding from other sources differs from HHS to HHS.

Queensland Government funding

The state works under a purchaser–provider arrangement for healthcare service delivery. The department is the purchaser and is responsible for purchasing health services and ensuring the health needs of the population are catered for. The HHSs are the providers, and are responsible for delivering health services to members of the public. HHSs are responsible for identifying what equipment they require to deliver the health services, including high value medical equipment. They have to plan, acquire, operate, and dispose of it.

HHS funding is provided from the state purchasing pool that provides funding for the delivery of services. In addition to this funding, the department also manages the Capital Acquisition Plan that comprises state and federal funds for capital investments (for example, infrastructure upgrades). The department details all existing capital investment for the current year and forward estimates.

HHSs receive an annual distribution of capital funding from two specific programs: the Minor Capital Projects and Acquisition Program, and the Health Technology Equipment Replacement Program. Equipment over \$5 000 (including high value medical equipment) is procured through capital funding.

Replacement equipment

The department administers the Health Technology Equipment Replacement Program. This operates as a two-year recurring capital funding pool available for HHSs to replace their high value medical equipment on a like-for-like replacement basis, while acknowledging changes in technology. The funding is currently capped at \$140 million for all HHSs (collectively) each two-year period.

One of the primary objectives of the Health Technology Equipment Replacement Program is for the department to use its buying power, and gain associated economies, to procure large fleets of medical equipment for all of the HHSs. The HHSs use the program as a primary means to replace ageing and obsolescent medical equipment valued over \$5 000. It includes funding for items such as MRI and CT scanners.

New technology

Funding for new technology high value medical equipment differs to funding for replacement or new high value medical equipment. The Queensland Policy and Advisory Committee for new Technology was established in 2009 after the department identified the need to control how new medical technology was introduced in Queensland.

The committee's role is to provide advice to the health system on the adoption, implementation, and evaluation of new health technologies, and on their role in clinical practice.

It also oversees the New Technology Funding and Evaluation Program, which encourages HHS clinicians to apply for funding for the introduction and evaluation of technologies that are new to Queensland, Australia, or the public health system. The objectives of the New Technology Funding and Evaluation Program include:

- introducing safe and effective health technologies
- ensuring equitable patient access to health services
- improving patient flow through acute health services
- decreasing elective surgery wait lists for acute health services
- enhancing service delivery for major Queensland hospital redevelopment projects.

The funding program has an annual budget of \$5 million to support proposed new technology emerging in clinical practice.

Following the successful application and purchase of new technology, the Queensland Policy and Advisory Committee for new Technology evaluates the effectiveness and efficiency of the new technology over a two-year period after purchase.

Leasing arrangements

HHSs have the option of leasing medical equipment to reduce the impact of significant financial purchases. Introduced in April 2016, the *Queensland Leasing Approval Policy for Public Sector Entities* (the leasing approval policy) allows HHSs to enter directly into lease arrangements with external private medical equipment providers. Before this time, public sector entities could only enter into lease arrangements via sale and leaseback arrangements with the Queensland Treasury Corporation, within the terms and conditions of a master lease agreement.

The leasing approval policy means HHSs are no longer restricted to sale and leaseback arrangements, which provides them with flexibility to best suit their individual circumstances. The process of leasing, however, requires HHSs to use their operational funding, whereas purchasing of high value medical equipment uses capital funding.

The decision to lease equipment must therefore be balanced against the impact this may have on each HHS's operational funding. Some HHSs are investigating the leasing approval policy process as an avenue to address future funding shortfalls for high value medical equipment.

Australian Government funding

HHSs can receive funding for delivery of services through federal programs including:

- the Radiation Oncology Health Program Grant scheme
- Medicare—the Medical Benefits Schedule Capital Sensitivity program.

Radiation oncology equipment

Under the national Radiation Oncology Health Program Grant, HHSs can apply to become an 'approved organisation' for the delivery of radiation oncology. Where this is approved, the Australian Government provides a contribution towards the capital cost of the LINACs used to deliver cancer treatment. This funding is in addition to any other funding the HHS may receive through the Medical Benefits Scheme.

Radiation Oncology Health Program Grant funding is in the form of a rebate system that is provided to the HHS throughout the operational life of the LINAC. The amount of the monthly rebate provided is directly proportional to the machine's usage (so higher usage will result in larger rebates).

Some HHSs hold these rebates in a specific account that is quarantined. When the LINAC reaches its end of life, the HHSs uses the funds stored in the account to replace it. The objective of this funding approach is to ensure there is adequate coverage nationally for radiation oncology for cancer sufferers, as well as to enable national planning for future demand.

Capital Sensitivity program

HHSs can receive a rebate from Medicare through the Medical Benefits Schedule Capital Sensitivity program for numerous medical imaging services provided to private patients. The rebate amount is determined by the age of the imaging equipment used to provide the service. Depending on the modality and its defined useful life, there are two rebates available—100 per cent or 50 per cent of the Medical Benefits Schedule fee. The rebate is only available to the HHS once the Medical Benefits Schedule item is raised and processed.

The Australian Government introduced the Capital Sensitivity program as an incentive for service providers to upgrade and replace (as appropriate) aged equipment, with the aim of improving the quality of diagnostic imaging services. Once the rebated medical imaging equipment becomes 10 years old, HHSs only receive half the rebate amount unless they choose to upgrade the equipment.

Own source revenue

HHSs are able to charge some types of private and compensable patients (for example, patients eligible for workers' compensation) for the health services they provide. The revenue they obtain through this type of activity is referred to as own source revenue and is separate to the funding provided by the department in its budget allocation process.

Own source revenue is critical to HHSs' operating budgets. HHSs can use retained surplus revenue generated through the provision of private and compensable patient services to fund the purchase of new high value medical equipment.

Own source revenue can also be used to purchase new high value medical equipment and replacement high value medical equipment that is not funded through the department. In addition, HHSs use own source revenue to fund infrastructure upgrades to accommodate their high value medical equipment, and to upgrade equipment (for example, to add new parts) rather than to replace it.

Procurement processes

Depending on the funding source, both the department and the HHSs purchase high value medical equipment. The department's Medical Equipment and Maintenance Category Team—formerly known as the Health Technology Procurement Unit—leads the procurement process for replacing health technology equipment. For new equipment or to replace equipment not funded by the department, HHSs undertake their own procurement, although they can request support from the Medical Equipment and Maintenance Category Team.

Procurement of new technology high value medical equipment

As mentioned earlier, the department's Queensland Policy and Advisory Committee for new Technology assists HHSs to procure new technology through the New Technology Funding and Evaluation Program it administers. The Queensland Policy and Advisory Committee for new Technology runs an expression of interest process that allows HHSs to apply for new technology funding grants.

In the past 24 months, there were multiple applications for grants under this program; however, only one HHS application was for a grant for high value medical equipment. Metro South HHS successfully applied for funding for the procurement of a Gamma Knife for the Princess Alexandra Hospital. (The Gamma Knife uses precisely focused beams of radiation to target brain tumours without damaging surrounding healthy tissue.)

The partnership between Metro South HHS and the Queensland Policy and Advisory Committee for new Technology to fund and evaluate the Gamma Knife was in recognition of the Princess Alexandra Hospital's role as a statewide intra-cranial stereotactic radiosurgery centre of excellence. One of the objectives was to determine the appropriate patient cohort, funding, and infrastructure requirements for the effective and efficient ongoing use of this new technology in Queensland.

Procurement of replacement high value medical equipment

When HHSs identify the need to replace high value medical equipment, they engage the department's Health Technology Equipment Replacement Program, which commenced in 2001. The Health Technology Equipment Replacement program unit administers the replacement cycle and priority listing.

The department's Medical Equipment and Maintenance Category Team, within Health Support Queensland, leads the procurement process for replacing technology equipment. It undertakes the statewide procurement for HHSs once their equipment needs have been established. The Queensland Government funds the Health Technology Equipment Replacement Program through the Capital Acquisition Plan, and the Governor-in-Council grants approval.

The Medical Equipment and Maintenance Category Team uses its buying power to procure large fleets of medical equipment for all of the HHSs. When HHSs make procurement requests over \$1 million, the framework (both a standard and a procedure) for the Health Technology Equipment Replacement Program requires them to provide a copy of a business case for specific high value medical equipment to the department for appraisal.

Better practice asset management

The department's service agreement with each HHS requires the HHS to manage its assets. Within each HHS, medical service departments are responsible for the operation and maintenance of their high value medical equipment assets. They undertake the daily scheduling of services and control the workforce that delivers the specific services provided by that service department.

The management of high value medical equipment requires a robust asset management process that complies with relevant state policies and considers the complete asset life cycle from strategic asset management planning through to asset disposal. A sound asset management strategy ensures HHSs have a long-term focus. They should plan and document each stage of the asset life cycle for transparency and accountability.

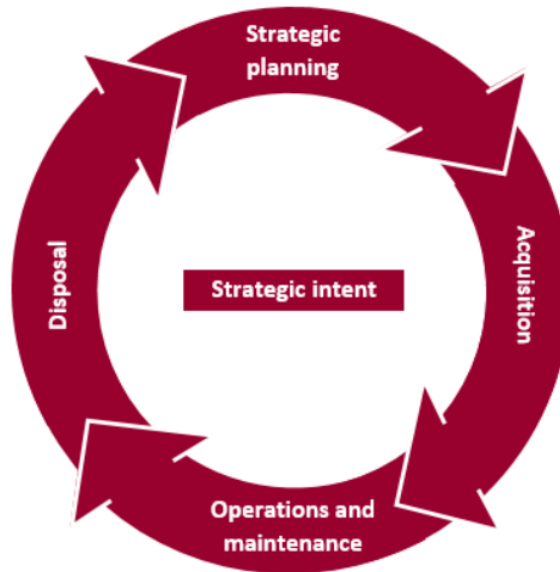
This is because better practice asset management suggests that the procurement of new and replacement equipment requires planning to account for the full cost of an asset over its life cycle, or total cost of ownership. It also provides for detailed business case analysis that includes the benefits and risks of all available operational and funding alternatives.

The asset management strategy should also support the organisation's future resource requirements in order to meet service delivery requirements. Better practice identifies four main elements of a comprehensive asset management strategy, including:

- strategic planning
- acquisition
- operations and maintenance
- disposal.

Figure 1E sets out these elements and their linkages.

Figure 1E
Elements of an asset management strategy



Source: Adapted from Australian National Audit Office better practice guide on strategic and operational management of assets by public sector entities.

The cost of maintenance alone can add significantly to the total cost of ownership of an asset. Figure 1F provides a snapshot of maintenance costs associated with four items of high value medical equipment, taken from the Biomedical Technology Services asset management system ECRI-AIMS. It highlights how the total cost of maintenance is directly linked to how long the item is expected to operate (proposed end of life) and can represent a significant proportion of the equipment's acquisition cost.

Figure 1F
Total cost of maintenance as a percentage of acquisition cost

Asset	Acquisition cost (\$)*	Maintenance per year**	Proposed end of life (years)*	Total cost of maintenance	Maintenance as a percentage of original acquisition cost
MRI	4 000 000	138 000	14	1 900 000	48
LINAC	4 000 000	477 000	10	4 770 000	119
PET	3 700 000	426 000	8	3 400 000	91
Surgical robot	3 500 000	315 000	8	2 500 000	72

Notes: * extracted from FAMMIS at 9 Sep 2016.
**as an average of annual costs.

Source: Queensland Audit Office using FAMMIS and ECRI-AIMS

2. Planning and managing

Chapter in brief

Comprehensive planning for medical equipment is important in an environment of constrained funding, particularly as the demand for health services is increasing. It is essential that the Department of Health (the department) and each Hospital and Health Service (HHS) have a clear understanding of the equipment that is currently available to deliver services and its service delivery capability, as well as of the future health service needs of the public.

This detailed information is also required in order to determine proper funding arrangements for high value medical equipment and other significant health assets.

Main findings

- While the department has developed specific guidelines to assist HHSs plan for the number of items of high value medical equipment they need to deliver services, the HHSs do not use these guidelines for their strategic asset planning.
- There are various asset management systems and asset registers that the department and HHSs use to record and manage their assets individually, but no one entity is collecting and analysing the asset data to provide a complete picture of all high value medical equipment in the state.
- None of the HHSs we audited in detail had implemented a strategic asset management plan that covered the asset life cycle and provided an understanding of the total cost of ownership of their high value medical equipment assets.
- The funding pool for the Health Technology Equipment Replacement Program (which includes high value medical equipment) has been capped at \$140 million per two-year cycle since 2008. It is insufficient to meet the rapidly rising costs of replacing equipment. Based on the department's expected rate of equipment replacement, if there is no change in funding, we estimate that by the 2018–20 funding cycle the shortfall between equipment replacement costs and available funding will be approximately \$390 million.

Audit conclusions

Since HHSs were established in 2012, the health system's approach to planning for and managing high value medical equipment has been uncoordinated. The department and HHSs have used various asset management systems and individual approaches. The lack of a complete picture about what high value medical equipment assets exist, and how they are being used, stymies the ability of the department to effectively plan at a state level for high value medical equipment services—now and into the future.

The department doesn't have a system-wide approach for understanding when high value medical equipment assets need to be replaced. This, coupled with the significant funding shortfall, has led to a risk that the supply of health services using high value medical equipment will not match the demand in the community across HHS catchments.

Introduction

The Department of Health (the department) is responsible for statewide public health service planning and the monitoring of system performance against health plans and strategies. The department's role is to inform local planning at a Hospital and Health Service (HHS) level for service types and volumes, and to assist in aligning the services with geographical areas and population groups.

As part of its system manager role, the department has also developed specific health service operational guidelines for medical imaging and radiological high value medical equipment, including computed tomography (CT), magnetic resonance imaging (MRI), and linear accelerator (LINAC) equipment.

The Health Technology Equipment Replacement Program is an important part of health planning as it provides the funding for, and assists in purchasing and replacing, high value medical equipment and other health technology. Its primary functions, operations, and funding base have largely remained unchanged since 2008.

We examined aspects of the program relating to high value medical equipment—for example, the funding and equipment prioritisation process—but we did not assess the effectiveness or efficiency of the entire program.

Once high value medical equipment assets have been acquired, HHS service agreements with the department require the HHSs to maintain those assets. As statutory bodies, HHSs must also comply with the Financial and Performance Management Standard 2009 and establish an asset management system to manage their financial resources efficiently, effectively, and economically. According to the standard, the asset management system must be able to perform a range of functions including identifying, managing, evaluating, and reviewing the performance of significant assets.

We audited, in detail, four of the HHSs (Metro North, Metro South, Gold Coast, and Cairns and Hinterland) to assess if they effectively plan for the high value medical equipment required to deliver their medical imaging services. We assessed whether the department is supporting the HHSs in funding, acquiring, and managing their fleet (the term used by the health system) of high value medical equipment effectively. We also assessed whether there is complete visibility of the high value medical equipment asset base at a statewide level.

Audit conclusions

The absence of a consistent and complete asset management system limits the ability of health planners to effectively plan to replace high value medical equipment and to better manage future demand. It also means that there is difficulty in understanding the total cost of ownership of these assets.

In turn, this has meant that both the department's and the HHSs' decisions about purchasing high value medical equipment have traditionally failed to consider life cycle costs and funding implications. Effectively, the health system (encompassing the department and the HHSs) is not applying lessons from previous funding and procurement cycles to inform future purchasing decisions.

The funding amount for the replacement of health technology equipment and the methodology used to derive it have remained unaltered since 2008. This funding arrangement has failed to cater for the large increase in medical equipment in the intervening period and, as such, will not meet the ever-increasing costs of replacing the new equipment commissioned since that time.

We understand that the department has taken preliminary steps to investigate the extent of the problem and to identify potential options for how this funding shortfall can be addressed. This will require the department and the HHSs to work together to accurately record, monitor, and continue to update high value medical equipment records. Only in this way will they be able to accurately plan for replacement funding to ensure there is no disruption of clinical services.

Planning

The department developed guidelines to assist with planning for medical imaging, LINAC, and positron emission tomography (PET) services. The guidelines recommend the ratio of machine numbers to population size and hospital casemix profile (the types of patients and types of services offered). The documents are:

- *Recommendations for Paper Medical Imaging Services*—these provide a recommended average time for medical imaging services to undertake examinations. These are intended to help the HHSs to identify the number of imaging high value medical equipment assets required.
- *Recommendations for Linear Accelerator (LINAC) Services*—these provide a functional calculation to determine the required number of LINACs based on treatment courses for newly registered patients and a maximum number of courses per machine.
- *Public Hospital Positron Emission Tomography (PET) Services*—these propose a number of PET/CT imaging units based on population (excluding research machines).

The suggested throughput, methodologies, and metrics set out in the planning guidelines were developed for planning purposes only and are not considered to be targets that HHSs need to meet.

Although these guidelines have been in circulation for up to six years, the HHSs we audited in detail were unaware of them, or were aware of them but did not use them for high value medical equipment planning. The HHSs we audited in detail plan for and manage their high value medical equipment in different ways. We found that their planning was primarily focused on addressing service needs through managing their hospitals' patient wait lists.

Furthermore, even though the HHSs' information systems are capable of recording the information required to measure the HHSs against the operational metrics suggested in the guidelines, they are not set up to do so. This limits the effectiveness of the guidelines as a planning tool.

Specific metrics and data anomalies are discussed in more detail in Chapter 3.

Meeting demand

Hospitals within HHSs define their own priorities for managing wait lists for patients—based on the services they will deliver according to their HHS's service agreement with the department. There is no standard system-wide approach to how wait lists are developed. This means that from hospital to hospital there are different wait list categories and definitions, and differences in how targets are set within those wait lists.

Each hospital has discretion about the appropriate time frame for how long a patient will wait for a particular high value medical equipment service. This approach is different to other aspects of clinical service, where there are prescribed maximum waiting time frames. For example, the maximum national waiting time for an emergency patient to be seen is within four hours.

HHSs plan the delivery of services according to the current waiting times for each modality (which is the function each piece of imaging equipment performs) and whether they are within the hospital management's acceptable range. They don't plan the use of the machine to a targeted usage rate. When a wait list or average wait time per patient reaches a pre-determined tolerance level, the HHS provides additional high value medical equipment operating hours to meet the demand.

This pre-determined level varies from HHS to HHS and even from hospital to hospital within the same HHS. As a result, HHSs are reactively planning high value medical equipment services based on fluctuating wait lists, rather than using machine performance data to maximise the use of their high value medical equipment.

The differing approaches between hospitals is further complicated by the fact that there are no standard wait list categories across the state, and hospitals report different categories of patient waiting times even within the same HHS. To demonstrate this issue, Figure 2A provides a snapshot of CT wait list categories and times recorded within six hospitals during a single week in July 2016.

Figure 2A
CT wait list times and categories (selected hospitals) for one week in July 2016

Hospital	HHS	Wait list category	Wait list time
Cairns	Cairns and Hinterland	Inpatient	Within 24 hours
Cairns	Cairns and Hinterland	Outpatient	Within 24 hours
GCUH	Gold Coast	Outpatient	9 days
Robina	Gold Coast	Outpatient	2 days
RBWH	Metro North	Urgent	3 days
RBWH	Metro North	Routine	9 days
RBWH	Metro North	Intervention	10 days
TPCH	Metro North	Outpatient general	10 days
TPCH	Metro North	Outpatient cardiac	5 days
TPCH	Metro North	Outpatient interventional	30 days
TPCH	Metro North	Outpatient biopsies	5 days
PAH	Metro South	Inpatient category 1	1–2 days
PAH	Metro South	Inpatient category 3	7 days
PAH	Metro South	Outpatient category 1	2 days
PAH	Metro South	Outpatient category 2	28 days
PAH	Metro South	Outpatient category 3	42 days

Note: Hospital abbreviations—Gold Coast University Hospital (GCUH), Royal Brisbane and Women's Hospital (RBWH), The Prince Charles Hospital (TPCH), Princess Alexandra Hospital (PAH).

Source: Queensland Audit Office

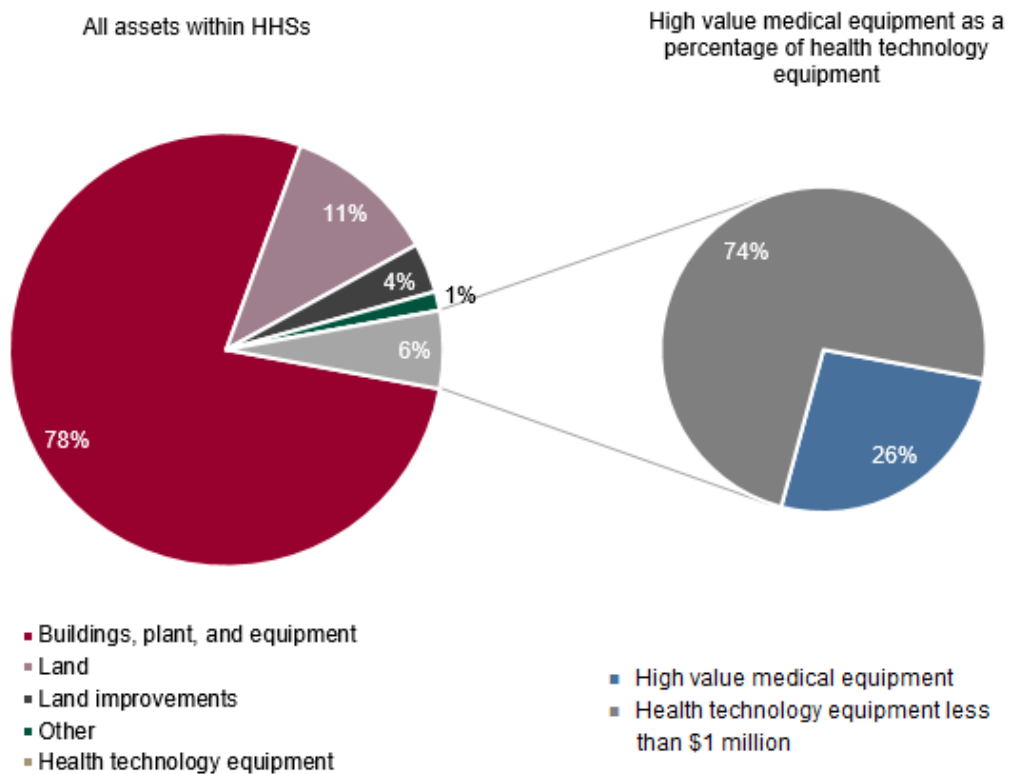
Two of the four HHSs audited in depth (Metro North and Metro South) have documented internal procedures that require the medical imaging departments to record wait list times and report on them internally to assess trends. The type of data they record varies. One HHS records patients based on their outpatient urgency category (1, 2, or 3), and the other on the type of treatment required (such as cardiac, biopsies, and general treatments).

The disparity in reported wait list categories prevented us from undertaking a comparison of waiting times across the audited HHSs. It also means the department is unable to undertake analysis of wait lists across the system and use the results to identify potential spare capacity in some areas that could be used to reduce excess demand in other areas.

Strategic asset management

Health technology equipment is the third largest asset class value for all HHSs after buildings, plant, and equipment, and land, as summarised in Figure 2B. High value medical equipment is a subset of the health technology equipment asset class, and makes up over a quarter of the HHSs' health technology equipment.

Figure 2B
Breakdown of all HHS asset classes as at June 2016



Note: Chart does not include one rural HHS due to incompatibility of data.

Source: Queensland Audit Office

The department does not provide guidance material to assist HHSs in strategically planning and managing their high value medical equipment assets. As a result, the HHSs we audited plan and manage these assets in different ways. For example, each of the HHSs audited in detail has differing systems for:

- documenting assets
- developing maintenance schedules
- planning upgrades or replacements.

As a result, the ability to aggregate high value medical equipment asset information to form a view of the whole system is limited.

Registering and maintaining assets

The department and the HHSs use the asset module in the department's Financial Accounting and Materials Management Information System (FAMMIS) as their financial asset register to record all medical equipment costing over \$5 000. FAMMIS does not, however, adequately satisfy the requirements of an 'asset management system' (as stipulated in the Financial and Performance Management Standard) because it does not record the cost of medical equipment operations and maintenance.

Instead, operations and maintenance activities are recorded in the ECRI-AIMS asset management system that the department's Biomedical Technology Services unit administers. However, it is not mandatory for the HHSs to engage Biomedical Technology Services to undertake maintenance, nor is it mandatory for every HHS to use the ECRI-AIMS system to log instances of services for its high value medical equipment.

As a result, the completeness of the maintenance and service details in ECRI-AIMS varies from HHS to HHS, ranging from comprehensive asset life cycle costs in some HHSs to more limited interactions and maintenance records in others.

There are obvious difficulties with storing asset management information in two different systems. HHSs primarily use FAMMIS as an asset register and ECRI-AIMS to record maintenance activities on assets. We analysed the level of completeness of the maintenance information in ECRI-AIMS against the assets registered in FAMMIS and determined that approximately 18 per cent of high value medical equipment has no maintenance information recorded in ECRI-AIMS, and only 50 per cent of LINACs have maintenance details recorded.

The inconsistency in recorded information and the lack of complete visibility over the costs of acquiring and managing assets limits the department's ability to obtain complete information about the total cost of assets for strategic asset planning at the health system level.

Maintenance costs anomalies

Inconsistencies in information contained in ECRI-AIMS and FAMMIS also make it difficult to understand the level and cost of maintaining each HHS's high value medical equipment.

We analysed how high value medical equipment maintenance fees are incurred. We took one month of ECRI-AIMS data for the four HHSs we audited in detail. (This information is used to ascertain the maintenance fee that will be charged to HHSs.) We then compared that data with the financial assets listed in FAMMIS.

We identified anomalies where maintenance was recorded against assets not located within the HHS that was invoiced for the maintenance, or where maintenance was recorded against equipment that was retired. Appendix G provides the specific context and results of our analysis. These anomalies and data inconsistencies require further investigation to ensure that asset maintenance is required and is appropriately incurred against the asset being maintained.

Total cost of ownership

None of the four audited HHSs had a strategic asset management plan that allowed them to determine the mix of high value medical equipment assets they needed to cost-effectively meet health service levels. This increases the risk to each HHS's long-term financial sustainability, as operating and maintenance costs can be substantial and are committed to for the asset's life at the time of procurement.

HHSs should ensure that life cycle costs are identified early and that purchase decisions are informed by comprehensive financial and non-financial analysis (for example, research into emerging technologies) against health service requirements.

Figure 2C sets out the proposed costs that were considered for the installation of a new MRI service at one HHS. It demonstrates that overall costs can be significantly higher than the MRI's initial acquisition cost.

Figure 2C
New MRI cost breakdown

Summary costs of new MRI installation	
Approximate cost of the MRI scanner acquisition	\$2 500 000
Additional acquisition costs	
Upgrade to existing chiller system for new machine*	\$500 000
Shielding for MRI*	\$330 000
Anaesthetic equipment*	\$271 000
Artwork, murals, etc. (claustrophobia is a significant clinical issue with MRIs and this can be addressed to a surprising degree with room decoration)	\$5 000
Contrast pressure injector	\$15 000
Building works^	\$5 500 000
Subtotal—Additional acquisition costs	\$6 621 000
Total acquisition cost of MRI scanner	\$9 121 000

Notes: * Based on previous installation costs from another HHS and excludes disposal costs.

^ Dependant on location; detailed assessment required.

Source: *Queensland Audit Office*

We also identified variations in the level of documented asset management maturity across the audited HHSs. Metro South HHS's processes were more mature than the other audited HHSs. It has recently developed an asset management framework that includes a three-year infrastructure plan and investment management framework for strategically managing its assets.

It has also developed a draft asset management manual. The manual will apply to new and replacement high value medical equipment and provides guidance on strategic asset planning, asset life cycle, asset acquisition and use, and maintenance. Metro South HHS is undertaking this work in accordance with the International Standard ISO 55 000 *Asset Management*.

Some HHSs have already started to source their own asset management systems. Metro South HHS, for example, is seeking its own system with the following capabilities:

- equipment cataloguing
- maintenance schedules
- service contract management
- full asset life cycle costing.

It expects its new customised system will support better decision making and it plans to have the system in place within the next 24 months. Metro North and Gold Coast HHSs also plan to implement new asset management systems that align with the international asset management standard ISO 55 000.

Planning to replace high value medical equipment

All HHSs conduct a biennial review of their health technology equipment, which includes high value medical equipment, as part of the Health Technology Equipment Replacement Program. This is to identify obsolete equipment and assets approaching the end of their useful life within the upcoming two-year funding period. They prioritise which equipment they need to replace or upgrade (to prolong its useful life).

The Health Technology Equipment Replacement Program process is consultative, and provides options based on clinical needs assessment and value-for-money analysis. Ultimately, each HHS retains the discretion to accept the equipment recommended by the Health Technology Equipment Replacement Program, or to select other items based on its own needs assessment.

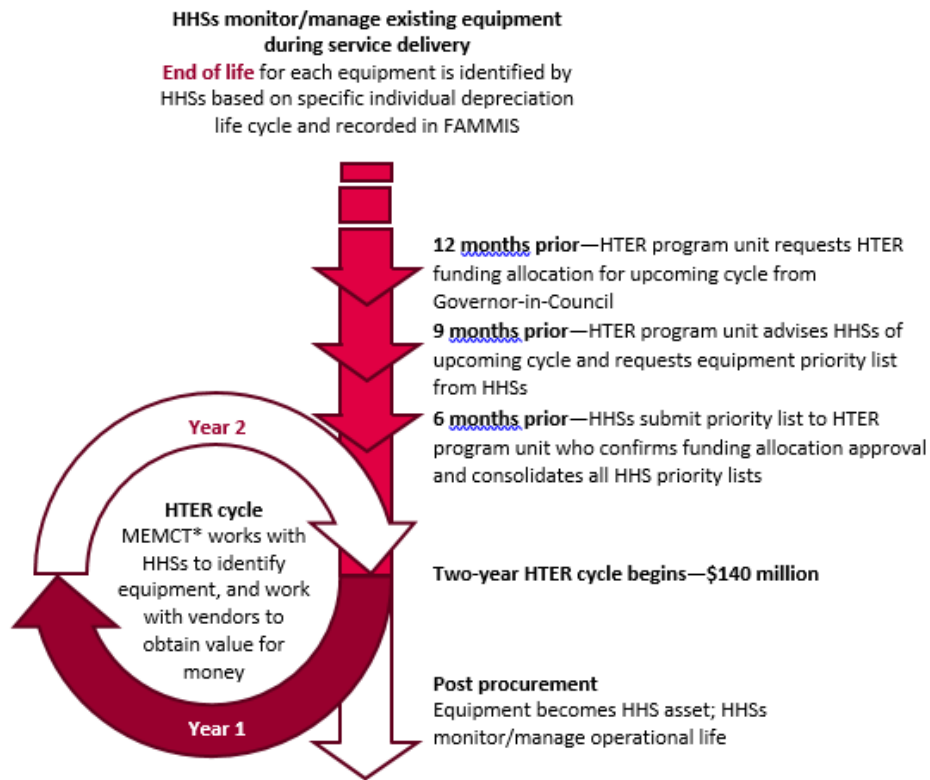
The department has developed a framework (both a standard and a procedure) to assist HHSs with the Health Technology Equipment Replacement Program process. The framework stipulates program requirements that include:

- what HHSs can replace with the funds
- how the HHSs are allocated funds
- how the HHSs need to develop their priority list for the program.

The procurement process of the program includes an options analysis on every requested piece of high value medical equipment. The program unit assesses weighted scores across all options prior to recommending the best value-for-money option for each HHS to replace its high value medical equipment.

The HHSs can then select the equipment that best meets their needs and the Medical Equipment and Maintenance Category Team can procure the equipment on their behalf. Figure 2D illustrates this process.

Figure 2D
Flowchart of the Health Technology Equipment Replacement (HTER) process



Note: *MEMCT—Medical Equipment and Maintenance Category Team.

Source: Queensland Audit Office

As part of the procurement process, HHSs can undertake the procurement themselves. This can occur when the Medical Equipment and Maintenance Category Team does not have the technical ability or staff resourcing, or when the HHSs have a short time frame.

Replacement time frames

The time at which each high value medical equipment asset is due for replacement is linked to its useful life—the time over which it earns revenue or provides service potential—and how it is depreciated over this time. The health system’s Financial Management Practice Manual establishes an indicative depreciation life of eight years for medical equipment with a value greater than \$200 000. But each piece of equipment should be re-assessed at least annually to determine if its useful life is likely to be less or more than eight years.

At the end of its depreciated life, the high value medical equipment is then eligible for replacement through the Health Technology Equipment Replacement Program. However, the type of machine, hours of usage, and anticipated maintenance cycle influence the actual operating life of the equipment, along with whether the HHS uses it beyond its fully depreciated life. In this circumstance, the equipment may continue to provide services as long as it has passed appropriate clinical and mechanical service assessments.

Funding

HHSs predominantly rely on funding from the department to replace high value medical equipment. The department provides this funding through the Health Technology Equipment Replacement Program, with a recurrent allocation of \$140 million every two financial years. The funding allocation is only used to fund equipment that is deemed medical equipment ('MEDEQP') class assets valued at \$5 000 or greater. Another potential source of departmental funding is the Minor Capital Program, although none of the HHSs we audited in detail indicated they have purchased high value medical equipment using this funding source.

The Health Technology Equipment Replacement Program started in 1997 with \$5 million of funding. The funding allocation gradually increased until 2006–07, when the department decided that from 2008 the program funding would be \$70 million for each year of a two-year program. Queensland Treasury based the funding on the value of health technology equipment held by the public health system at the time.

Since 2008, this funding has been capped at \$140 million for the two-year funding period, despite the increasing number and value of items of equipment required for replacement across the public health system. This has included capital investments for the redevelopment of Mackay, Cairns, Rockhampton, Gold Coast, and Sunshine Coast hospitals, which have led to larger HHS asset bases.

The department's Health Technology Equipment Replacement funding analysis

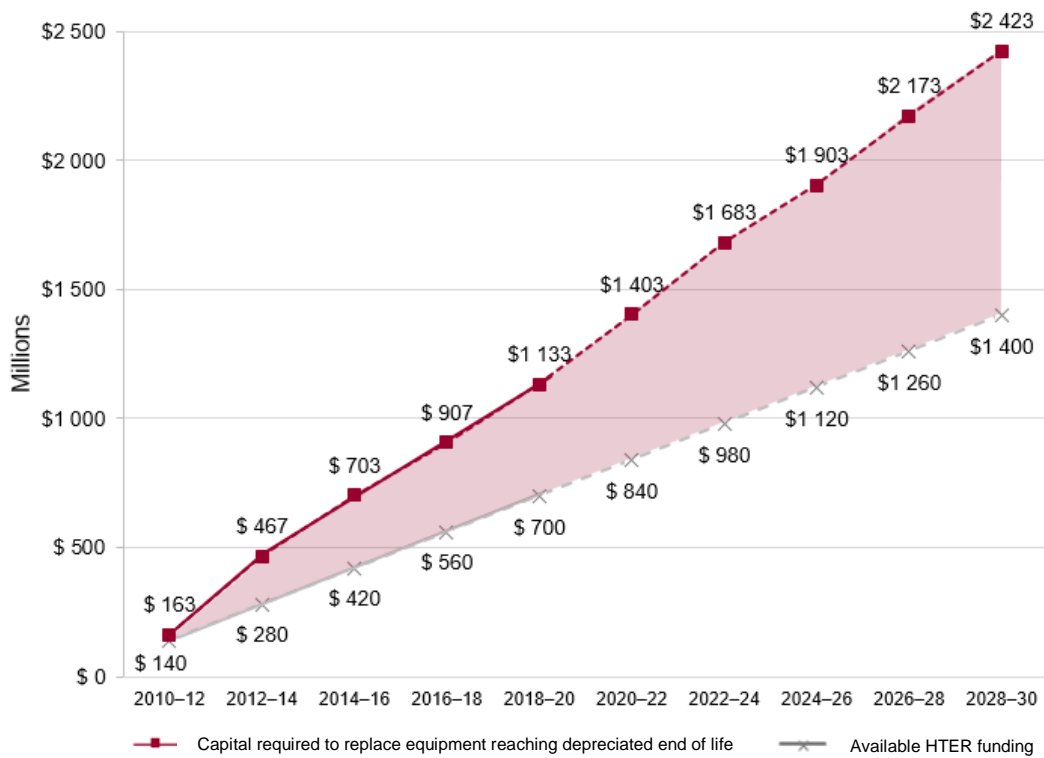
In 2013, the department conducted an internal review that confirmed the increasing gap between the amount of funding provided for the Health Technology Equipment Replacement Program and the actual cost of replacement medical equipment. In its analysis it applied the following facts and assumptions:

- FAMMIS represents financial assets only—it excludes assets under \$5 000
- FAMMIS reflects the original purchase price
- it did not factor in any increase in price of medical equipment or inflation
- it did not factor in international exchange rate changes
- it did not factor in that there may be alternative funding available to meet equipment replacement costs, such as funding grants or HHS budgets
- it assumed that medical equipment costing \$5 000–\$199 999 has a 10-year useful life, or greater
- it assumed that medical equipment costing more than \$200 000 has an eight-year useful life, or greater
- it did not factor in those assets that may have already been replaced but not yet retired.

The department's review forecast a cumulative shortfall by 2018–20 of over \$400 million. It projected that, on current trend, the shortfall could increase to \$1 billion by the 2028–30 funding cycle.

Figure 2E shows the department's forecast of the cumulative predicted cost of equipment due for replacement against committed funding.

Figure 2E
The department's forecast cost of equipment replacement vs. available funding



Note: The continuous lines represent available data extracted from FAMMIS. The broken lines are based on projected figures.

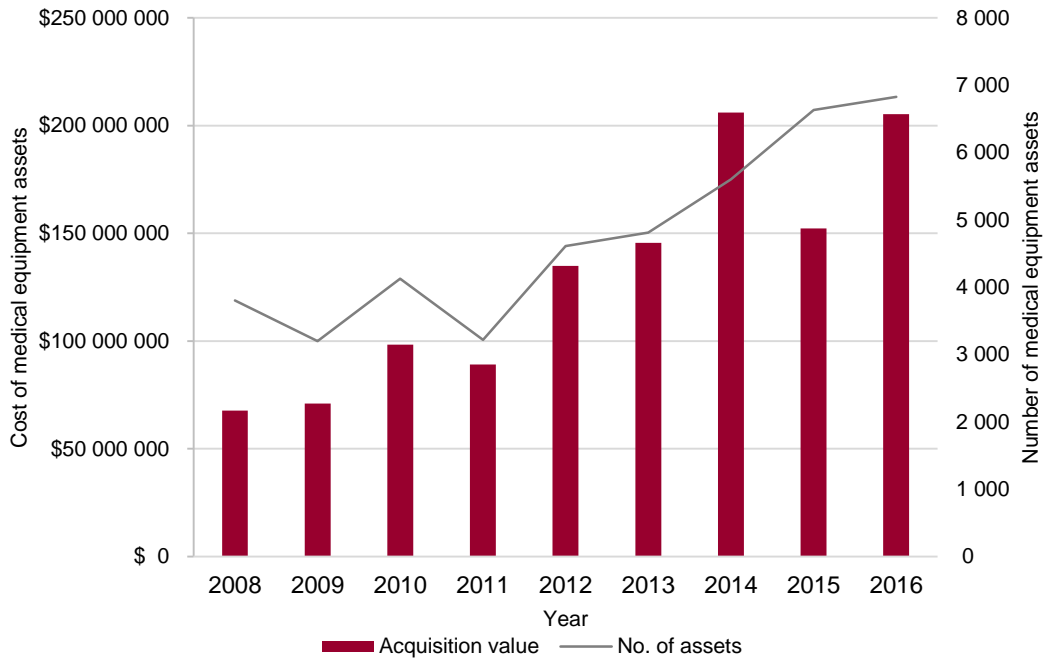
Source: The department's 2013 HTER review strategies brief to the Chief Health Infrastructure Officer

Queensland Audit Office's analysis of Health Technology Equipment Replacement

Despite the number of medical equipment assets rising by approximately 80 per cent over the last eight years, the funding for replacements through the Health Technology Equipment Replacement Program has remained stable. The allocation of \$140 million every two years to the replacement program was set in 2008 and has not changed.

Figures 2F show the growth in both the total fleet of assets over the eight-year timeframe ('No. of assets') and the yearly cost of purchasing them ('Acquisition value'). In 2014 and 2016 there was significant increased expenditure on medical equipment as a large number of assets were purchased for major projects, including the opening of the Gold Coast University and Sunshine Coast University hospitals.

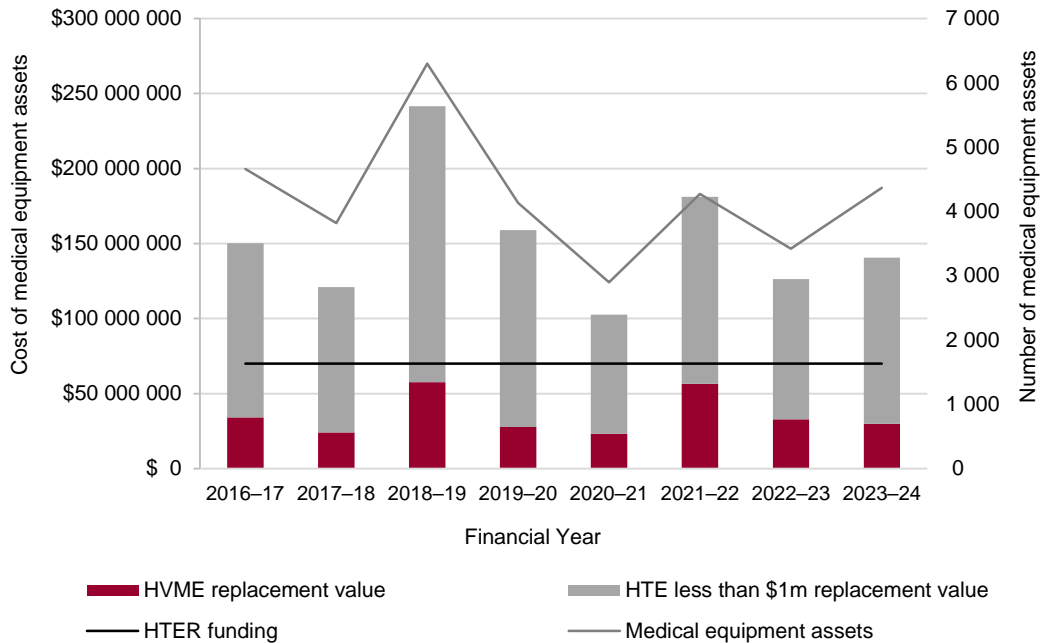
Figure 2F
Number and acquisition cost of health technology equipment assets purchased 2008 to 2016



Source: Queensland Audit Office using the Financial Accounting and Materials Management Information System (FAMMIS)

Using data from FAMMIS as at 30 June 2016, we conducted analysis of the potential replacement costs of medical equipment over the next eight years. Figures 2G and 2H show the annual cost from 2016 to 2024 to replace medical equipment assets, including the proportion of that cost that is made up by high value medical equipment.

Figure 2G
Annual cost to replace medical equipment assets 2016–2024, including high value medical equipment



Note: HVME—high value medical equipment; HTE—health technology equipment; HTER—health technology equipment replacement.

Source: Queensland Audit Office using FAMMIS

The horizontal black line in this graph represents the funding available under the Health Technology Equipment Replacement Program (\$70 million per annum—\$140 million per two-year cycle). The vertical bars represent the items of medical equipment and their replacement cost for each particular year. The analysis shows a clear shortfall for each of the next eight years between the funding available and the total cost of all medical equipment that is, according to FAMMIS, expected to be replaced in each of those years.

In particular, in the 2018–19 and 2021–22 years the cost of replacing high value medical equipment alone consumes approximately 80 per cent of the total budget for equipment replacement.

On the department's current projections, if there is no change in funding, we estimate that by the 2018–20 funding cycle the cumulative shortfall between equipment replacement costs and available funding will be approximately \$390 million.

Figure 2H
Breakdown by financial year of number and acquisition value of health technology equipment assets due for replacement

Financial year	No. of all assets	HTE* less than \$1 mil. replacement value	HVME** assets	HVME** replacement value
2016–2017	4 658	\$115 990 591	15	\$34 202 416
2017–2018	3 817	\$96 926 162	14	\$24 140 189
2018–2019	6 297	\$183 775 595	26	\$57 670 673
2019–2020	4 134	\$131 176 463	14	\$27 800 213
2020–2021	2 898	\$79 362 790	12	\$23 157 385
2021–2022	4 273	\$124 495 519	27	\$56 590 716
2022–2023	3 422	\$93 534 715	15	\$32 774 166
2023–2024	4 368	\$110 659 643	17	\$29 940 043

Note: *health technology equipment
 **high value medical equipment

Source: Queensland Audit Office using FAMMIS

In conducting this analysis, we have been conservative and assumed that no additional medical equipment will be purchased during the 2016–24 time frame, which is unlikely, and we have not rolled over any funding shortfalls from previous years.

The current medical equipment funding model and total funding amount is inadequate to meet the replacement needs of the medical equipment fleet. This highlights the importance of HHSs properly prioritising which medical equipment they will replace using Health Technology Equipment Replacement Program funding, as it is unlikely that all high value medical equipment can be replaced every year.

Insufficient funding also means there is a risk that health services using high value medical equipment may not be able to maintain current (and potentially future) service levels unless the department or HHSs identify alternative funding sources. Some HHSs have recognised the risks this scenario poses to the delivery of services and are investigating alternative options, such as leasing arrangements for high value medical equipment.

3. Monitoring performance

Chapter in brief

The health system must ensure that public sector assets, including high value medical equipment, are used efficiently, effectively, and economically.

To understand how well high value medical equipment is performing, it is first necessary to decide what type of performance information should be measured and captured, how and when this information will be monitored, and how it will be used to improve performance.

Once baseline performance information has been established, it can be further refined to drive ongoing improvements. In this way, the health system can maximise the benefits derived from high value medical equipment assets.

Main findings

- There are no utilisation performance targets for computed tomography (CT) or magnetic resonance imaging (MRI) in Queensland or nationally, and there are some significant differences in the level of throughput of these machines across the state.
- The Hospital and Health Services (HHS) cannot drive performance using the Department of Health's (the department) CT and MRI planning guidance metrics because:
 - scan start and stop times are not standardised across hospitals
 - the various systems in use do not capture all of the same data fields.
- Three of the four HHSs we audited in depth drive usage by individual hospitals' patient wait lists. One of the HHSs is currently compiling performance data from medical imaging equipment to analyse and help improve efficient use of its equipment.
- Some CT and MRI machines are being used, on average, more than comparable local and international benchmarks. But some also show opportunities for improvement in efficient use.
- There are anomalies with how linear accelerator (LINAC—used for radiotherapy) treatment duration is recorded across the various data recording systems. There is some spare capacity in 11 of the 16 LINACs in the audited HHSs, although we did not find evidence to suggest that demand is not being met.

Audit conclusions

The health system is not effectively managing high value medical equipment to optimise its usage. Targets are not set and information is not being recorded to monitor and drive performance. This is because the HHSs' sole focus is on using equipment to meet individual hospital patient wait lists. They do not also consider equipment capacity, or cross-HHS or cross-health system opportunities to use it more efficiently. In some cases, this results in unused equipment capacity in HHSs, even when there are patients waiting for those services.

The lack of an established procedure that standardises what information should be captured, by whom and at what stage of the patient treatment, makes it difficult to identify potential performance improvements. It also prevents the department from comparing the performance of high value medical equipment across the HHSs to drive improvements more broadly in the system.

Introduction

The use of high value medical equipment refers to the proportion of each machine's available design capacity that is used. Design capacity is specific to the equipment, for example, it could be the recommended number of maximum scans per machine per annum, or its recommended running time per annum. A number of factors affect high value medical equipment usage, including:

- the complexity of different types of services provided. For example, more complex imaging takes longer to scan, and intense radiotherapy takes longer to administer
- changes to the demand profile for equipment services within a hospital's geographic location
- availability of, and access to, appropriately skilled personnel to operate and maintain the machines
- the physical location of the high value medical equipment in the hospital building, for example, its proximity to the emergency department
- specific wait time targets (and acceptable ranges) established by the Hospital and Health Service (HHS) or hospital.

The efficient use of high value medical equipment is key to ensuring HHSs meet current and forecast service demand in a cost-effective way. To determine whether high value medical equipment is being used efficiently, HHSs need to monitor the performance of their equipment. They can then compare this against benchmarks or targets to identify whether there is opportunity for improvement. The ability to review trend data over time also supports better scheduling and the optimisation of high value medical equipment's available design capacity.

Number and spread of machines across the state

The number of items of high value medical equipment for medical imaging and radiation oncology across the state has increased over the past five years.

Within medical imaging, 12 of the 16 HHSs have either computed tomography (CT) or magnetic resonance imaging (MRI) equipment, or both types of high value medical equipment. The larger metropolitan HHSs have a number of both machines to service the greater demand from a larger population base. These HHSs also have specialist equipment to undertake interventional radiological procedures.

Radiation oncology treatment is available within five of the 16 HHSs, with linear accelerator (LINAC—used to administer radiotherapy) numbers having increased from 18 to 24 since 2011. This is because new services have started in the Gold Coast and Cairns, and Townsville Hospital has increased its delivery of services.

Figure 3A shows the increased access to CT, MRI, and LINACs across the state between 2011 and 2016.

Figure 3A
Number of CTs, MRIs, and LINACs within each Hospital and Health Service
in 2011 and 2016

HHS	Hospital	Modality	No. in 2011	No. in 2016
Cairns and Hinterland	Cairns Base Hospital	CT (excluding PET [^])	1	2
		MRI	1	1
		LINAC*	0	2
Children's Health Queensland	Lady Cilento Children's Hospital	CT	1	3
		MRI	1	4
Central Queensland	Rockhampton Hospital	CT	1	0
		MRI	1	1
Darling Downs	Toowoomba Hospital	CT	1	2
Gold Coast	Gold Coast University Hospital (formerly GCH)	CT	2	2
		MRI	1	3
		LINAC*	0	3
	Robina Hospital	CT	1	1
		MRI	0	1
Mackay	Mackay Hospital	CT	1	1
		MRI	0	1
Metro North	Royal Brisbane & Women's Hospital	CT (excluding PET)	3	3
		MRI (excluding PET)	2	2
		LINAC	6	5**
	Redcliffe Hospital	CT	1	1
	Prince Charles Hospital	CT	3	3
		MRI	2	2
Metro South	Princess Alexandra Hospital	CT (excluding PET)	5	6
		MRI (excluding PET)	2	2
		LINAC	5	5
	Logan Hospital	CT	1	2
		MRI	1	1
	Radiation Oncology Mater Hospital	LINAC	4	4
Sunshine Coast	Sunshine Coast Hospital	CT	2	2
		MRI	0	1
Townsville	Townsville Hospital	CT (excluding PET)	2	3
		MRI	1	1
		LINAC	3	5
Wide Bay	Hervey Bay Hospital	CT	1	1
	Bundaberg Base Hospital	CT	1	1
West Moreton	Ipswich Hospital	CT	1	1
Total		CT	28	34
		MRI	12	20
		LINAC	18	24

Note: *Denotes services delivered by a private provider using publicly-owned equipment

[^] Positron emission tomography—used to observe metabolic processes.

**Two of these are machines that deliver a more complicated form of radiation oncology treatment than standard LINAC machines.

Source: Queensland Audit Office, using survey data from HHSs as at August 2016 and Financial Accounting and Materials Management Information System (FAMMIS) data as at August 2011 and August 2016.

Monitoring performance

The four HHSs we audited in detail all use demand information as the primary driver for usage of their high value medical equipment. If demand for imaging or radiation oncology services increases, the HHS may decide to open up more availability for their high value medical equipment, for example, by extending hours of use.

To test whether HHSs were using their high value medical equipment efficiently, we examined:

- information on the capacity of the equipment
- the process leading up to the use of the equipment
- how the equipment was managed
- the equipment's performance data.

We assessed whether hospitals captured relevant data that allowed them to monitor, manage, and report on the use of their equipment. We looked at the use of LINACs for radiation oncology, as well as CT and MRI medical imaging equipment.

Audit conclusions

HHSs capture poor quality data that is insufficient for effectively measuring the use of high value medical equipment. The lack of targets, along with data anomalies and inconsistencies, makes it difficult for HHSs and the department to identify potential performance improvements and to understand how high performing hospitals maximise the use of their high value medical equipment.

Our high level analysis of the throughput of MRI and CT machines identified some significant variations in equipment performance. Our analysis demonstrated that some equipment is being used, on average, more than comparable local and international benchmarks. However, some equipment also shows opportunities for improvement in efficient use.

These variations warrant further investigation to identify opportunities to better maximise the use of these machines. For LINACs, there is also a need for better planning to ensure they are being used as much as possible.

HHSs need to first determine the types of high value medical equipment usage information they would like to see, and whether the current data collection enables these reports to be generated. The department, in its overarching role of monitoring performance, would need to support any minimum data requirements established by the HHSs and ensure the data is used to drive system-wide improvements.

Efficient use of CT and MRI scanners

There are no recommended benchmarks for CT or MRI scanners for the number of scans per type of equipment, or for maximum patient waiting times. There is also a paucity of data with which to benchmark performance against other Australian jurisdictions. The Organisation for Economic Co-operation and Development (OECD) has compiled health statistical data that provides some indicative benchmark figures for the number of scans for CT and MRI scanners in its member countries (which include Australia).

To identify whether HHSs optimise their high value medical equipment to satisfy total demand, we compared the recorded number of CT and MRI scans against other national and international figures.

For our analysis, we discounted the medical imaging data obtained from Children's Health Queensland. This is due to the generally accepted complexities associated with paediatric scanning over adult scanning, including the ability of the patient to understand and comply with instructions, and the requirement for assistance due to the patient's age.

We note that the Metro North HHS has developed key performance metrics that its medical imaging departments must report on monthly. It will use the data to understand the usage of its medical imaging equipment and to help maximise the use of available resources to operate the equipment.

We analysed data from 25 (of 34) CTs and 13 (of 20) MRIs, as some of the HHSs did not or were not able to provide data on their CT and MRI machines. The scope of our audit did not include CT scanners with an acquisition cost of less than \$1 million (eight scanners). Therefore, our audited selection of CT scanners only amounted to 58 per cent of all CT scanners in the state.

Average number of CT and MRI scans

Although there are no published usage targets for CT and MRI scanners either in Queensland or nationally, 11 of the 25 CT scanners had above average annual throughput (audited sample average only) when compared against some comparable jurisdictions. The selection of Queensland CT scanners we analysed also had a 25 per cent higher average usage rate per machine than Victoria (see Figure 3B).

Victoria conducts seven per cent more MRI scans per scanner per year than Queensland (noting that Queensland averages are based on data available from 13 out of 20 scanners—see Figure 3B).

It is important to note that these performance results provide indicative comparisons only, and should be considered in full view of relevant limitations, such as:

- different methodological approaches in measuring performance
- different models of healthcare between the measured jurisdictions
- whether scans provided by private providers are included in the international data
- different casemixes (the types of patients and types of services offered), regional health complexities, and population demographics that impact on demand (for example, Queensland public hospitals service an area one quarter the size of the European Union, but with a population only one per cent of the size).
- Victorian data is for 2012 and Queensland's data is for the 2015 calendar year.

Figure 3B presents some of the most recent available data for average number of scans per machine for CT and MRI.

Figure 3B
Average scanner throughput per annum—CT and MRI

	Average CT scans per scanner	Average MRI scans per scanner
Canada	8 964	5 980
New Zealand	1 722	385
OECD [^]	7 284	5 114
Victoria [*]	7 690	5 297
Queensland (audit sample only)	9 580	5 034

Note: [^]OECD data is from 2013 calendar year.

^{*}Victorian data from 2012 calendar year.

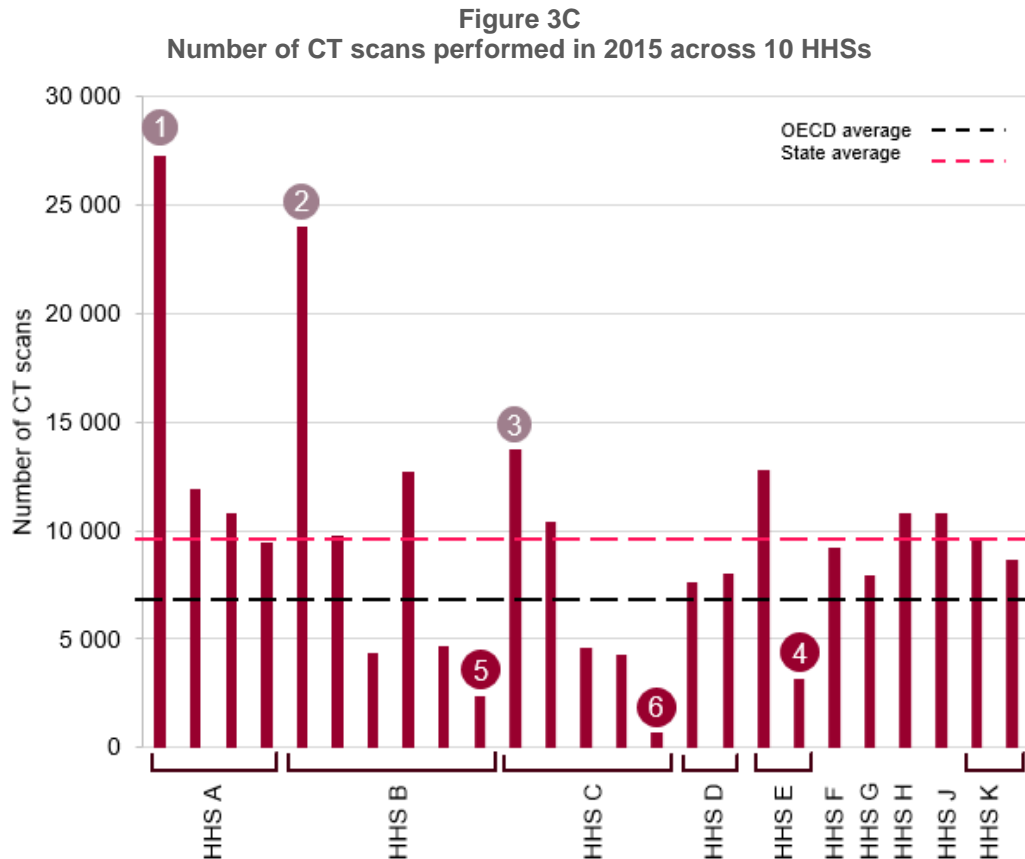
Queensland data is from 2015 calendar year and only includes analysis of data for 25/34 high value CT scanners and 13/20 MRI machines.

Source: Queensland Audit Office, OECD health statistics data set 2013, and 10 HHSs' radiology information system data

CT scanner performance

Figure 3C illustrates the number of scans performed by 25 CTs across 10 HHSs.

The number of scans varies across the state and within HHSs, with the busiest CT scanners located in emergency departments of large metropolitan hospitals. These CT scanners operate 24 hours a day, seven days a week (Scanners 1, 2, and 3 in Figure 3C).



Source: Queensland Audit Office, from OECD average scans and hospital imaging data

The comparatively lower usage rates for the three lowest used machines (labelled 4–6 in Figure 3C above) were due to the following reasons:

- scanner 4 was the second CT within a regional hospital and had only been operating for three months when the data was gathered
- scanner 5 was used predominantly for cardiac scans within a large metropolitan hospital, performing more complicated scans that take longer to complete
- scanner 6 was funded for two days a week and used only for interventional surgery, increasing the time the machine is unavailable and restricting its use for other types of scans.

Maximising spare capacity

Our analysis identified that there is potentially spare CT scanner capacity at, for example, HHS B and HHS C in Figure 3C above. Both of these HHSs have CT scanners that are performing fewer scans than the audited average and the OECD average. Both of these HHSs are located in metropolitan areas and have patients on wait lists for CT services.

HHS B’s scanners with spare capacity are located in hospitals within six kilometres of each other. HHS C’s scanners with spare capacity are located in the same hospital. The geographic proximity of these scanners means it is feasible for the HHS to divert patients to those scanners with spare capacity without unduly inconveniencing the patients. This would reduce their overall wait list times for CT services.

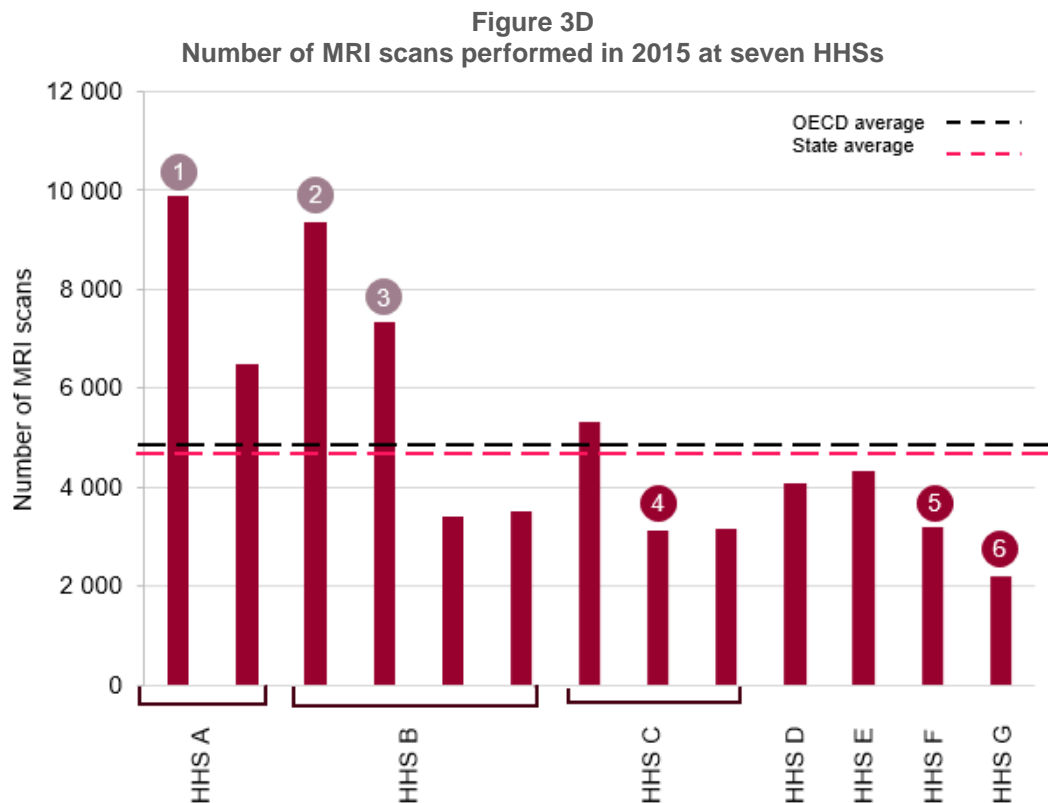
We understand one of the HHSs has implemented a review of the performance of its medical imaging services, including the use of its equipment. The aim is to identify opportunities for improvement of the services across the hospitals within the HHS.

These findings highlight broader opportunities for HHSs to investigate the potential underperformance of some of their high value medical equipment and to factor this into how they schedule use of their equipment. By better planning how high value medical equipment is used, the health system can continue to work towards its objective of ensuring timely, equitable access to services for patients.

While maximising the effective, efficient, and economic use of high value medical equipment needs to be monitored, moving patients to another location to increase efficiencies needs to be balanced with other factors. These factors include the safety and quality of patient care, and the potential impact on the patient through break in the continuity of care.

MRI scanner performance

MRI scanners display a similar usage profile to CT scanners, with large metropolitan hospitals performing the most scans annually (scanners 1, 2, and 3 in Figure 3D below). The lowest performing MRI scanners are located in regional hospitals that service a dispersed population (scanners 5 and 6 below) or are secondary support MRI scanners within large metropolitan hospitals (scanner 4 below).



Source: Queensland Audit Office, from OECD average scans and hospital imaging data

Sixty per cent of the audited sample of MRI machines are below the indicative benchmark averages. These findings highlight opportunities for some HHSs to investigate the potential underperformance of some of their MRI machines. We acknowledge there may be valid reasons for lower than average use because the usage of high value medical equipment is based on clinical need.

As noted before, the HHSs do not follow the department's guideline recommendation for time per scan, which suggests an MRI average scan time of 41.8 minutes. They do not capture the relevant scan time data to conduct a comparison of the actual scan duration to the average suggested scan duration.

This, and other data limitations, and their impact on measuring high value medical equipment performance, are discussed in detail in the following section.

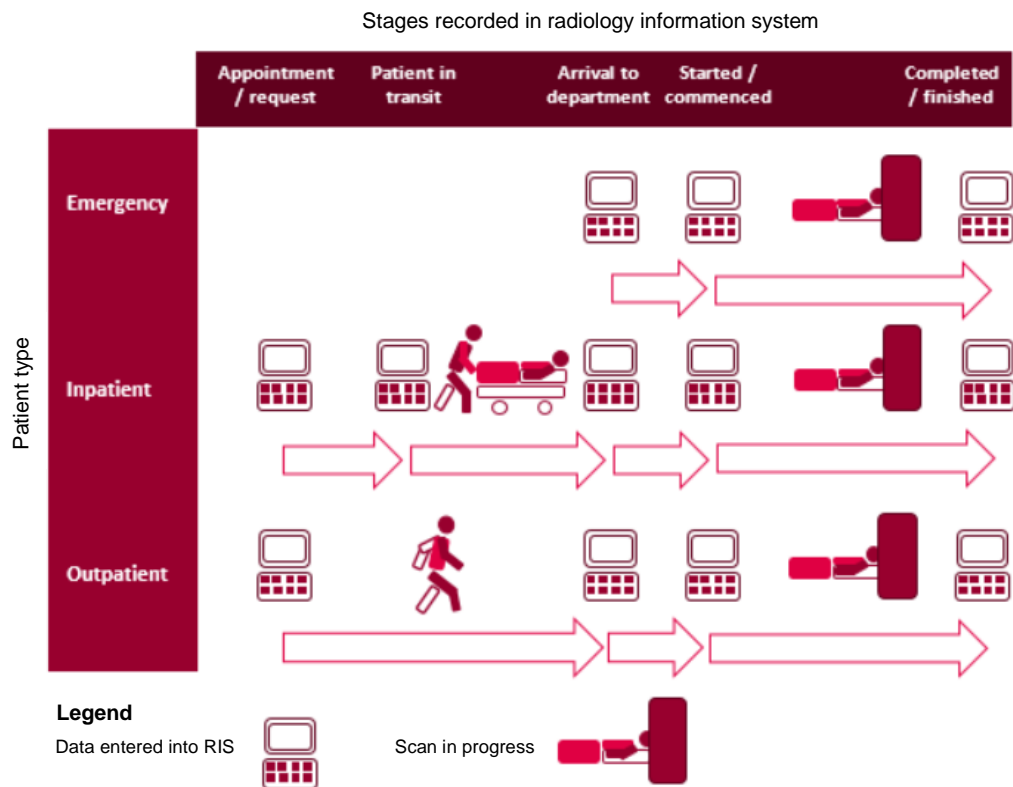
CT and MRI data anomalies

The starting point for data collection depends on the patient category: emergency, inpatient, or outpatient. Patient category also determines who enters the relevant information into each radiology information system, and what type of information is recorded in the system. Information may be recorded in the system by:

- administration/reception staff
- porters
- radiographers.

Data can be entered even before the patient is ready to receive their CT or MRI treatment in the medical imaging department. The flow chart in Figure 3E demonstrates the various stages at which a staff member can potentially first enter a patient's details into the radiology information system.

Figure 3E
Flowchart of medical imaging stages recorded on radiology information system (RIS)



Source: Queensland Audit Office

Standardised 'start' time

The department's planning guidelines for medical imaging recommend CT machines should deliver scans in 23.6 minutes (on average) and MRI machines should deliver scans in 41.8 minutes (on average). These average durations are based on the average time taken:

- to prepare a patient once in an imaging room
- to conduct the examination
- for initial interpretation of results.

We attempted to measure HHS performance against scan time targets set in the guidelines. To do this, we analysed the patient flow process in four large medical imaging hospital departments to understand when a scan is deemed to start and when it is deemed to finish.

We found that there is no standard procedure for how HHSs record patient scan start and stop times, and the different radiology information system software used by HHSs influences what information staff record for patients. For example, the audited HHS medical imaging departments record different commencing stages for when a scan actually starts, with responses stating a scan commences when:

- a patient presents at the imaging department reception
- a patient enters the scanning room
- a patient enters the machine.

The type of information recorded also varies depending on the individual operator, the equipment brand, and the patient's acuity.

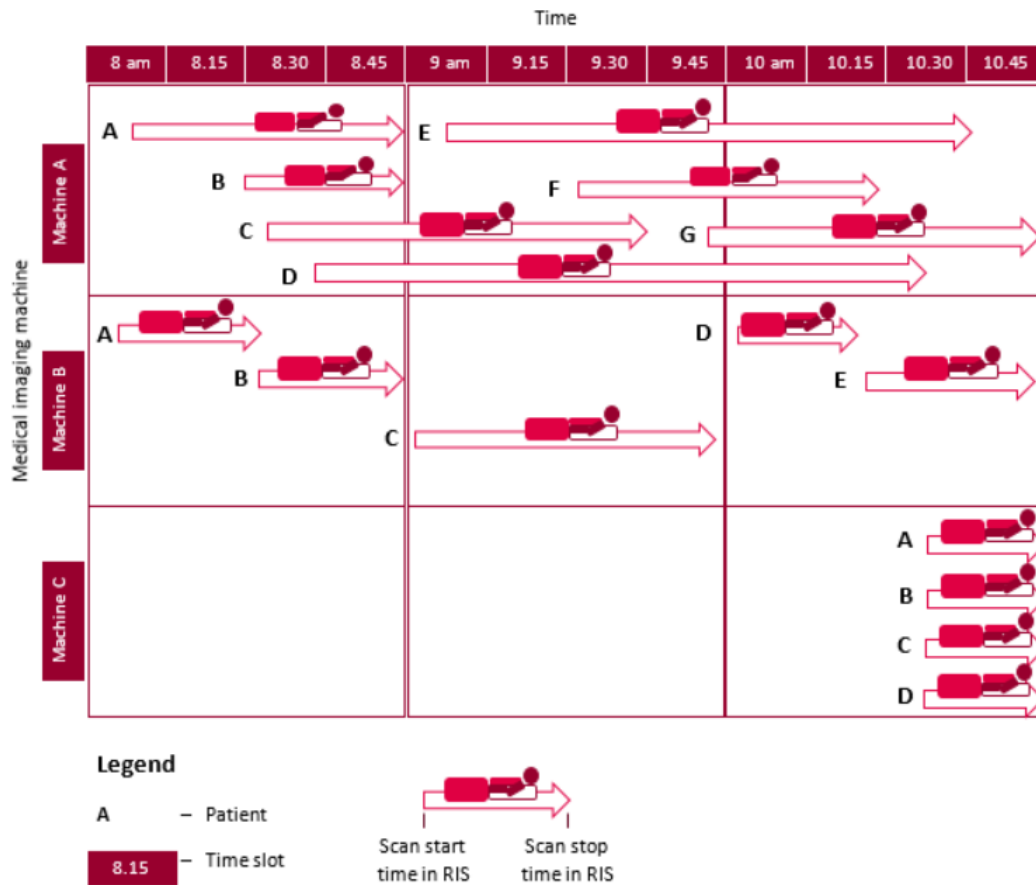
Recording 'complete' times

To compound the definitional problems with start times, there is no mechanism in the medical imaging software to prevent a scan being 'commenced' before a previous scan has been 'completed' in the system. Scans can only be completed manually by the operator physically marking the scan as 'completed' in the system. Therefore, if a scan is not marked as completed, multiple scans may be conducted and will appear as an aberration in the data, suggesting the patient has been scanned for a much longer time than has actually occurred.

This anomaly can also lead to instances where the data suggests multiple individuals are being scanned simultaneously on the same piece of equipment. This is impossible in practice.

Machines A and C in Figure 3F provide examples of where inaccurate recording of completed scans can present in the data as several individuals being scanned on the same machine simultaneously. Machine B, on the other hand, shows how patients are treated in practice—in a linear manner with only one patient on the machine at a time.

Figure 3F
Examples of how patients are being recorded on radiology information systems (RIS) on different machines



Source: Queensland Audit Office

Figure 3G uses real data from three hospitals' radiology information systems to illustrate in further detail where overlapping scan times appear to suggest more than one patient on the same machine at the same time.

Figure 3G
Overlapping recorded scan start times

HHS	Patient	Exam started	Exam finished
A	A1	2/03/2015 17:30	2/03/2015 17:56
A	A2	2/03/2015 17:30	2/03/2015 17:50
A	A3	2/03/2015 17:36	2/03/2015 17:43
B	B1	11/23/2015 08:15:00	11/23/2015 09:00:00
B	B2	11/23/2015 08:30:00	11/23/2015 10:24:30
B	B3	11/23/2015 08:31:00	11/23/2015 09:11:37
C	C1	2/01/2014 1:10:52 PM	2/01/2014 1:27:06 PM
C	C2	2/01/2014 1:13:14 PM	2/01/2014 4:56:08 PM
C	C3	2/01/2014 1:53:43 PM	2/01/2014 2:43:03 PM

Source: Queensland Audit Office and hospitals' RIS data

The information in the table indicates, for example, that patients A1, A2, and A3 are all being treated at the same time.

Variability in information captured

Of the 25 CT and 13 MRI machines we examined, there were six different medical imaging software systems that captured the relevant imaging information. Figure 3H provides an example snapshot of the data captured by the respective hospitals' software. This, coupled with the anomalies relating to scan start and stop times, makes it difficult to accurately compare this data and to determine how HHSs are performing relative to each other.

Figure 3H
Hospital data recorded in RIS

Hospital	Appointment/request	Arrival to department	Started/commenced	Completed/finished	Report released
Cairns	Date time	Date	Not recorded	Date time	Date time
GCUH	Date time	Date time	Date time	Date time	Date time
Robina	Date time	Date time	Date time	Date time	Date time
RBWH	Not recorded	Not recorded	Date time	Date time	Date time
Redcliffe	Date time	Not recorded	Date	Date time	Date time
TPCH	Date time	Date time	Date time	Date time	Date time
PAH	Date time	Date time	Date time	Date time	Date time

Note: Hospital abbreviations—Gold Coast University Hospital (GCUH), Royal Brisbane and Women's Hospital (RBWH), The Prince Charles Hospital (TPCH), Princess Alexandra Hospital (PAH).

Source: Queensland Audit Office and HHS radiology information system

Appendix F provides further details of the various software systems in use.

Efficient use of LINACs

LINACs provide courses of radiation oncology treatment. The severity of a patient's cancer will dictate how long their treatment will take and how many courses they require. The department recommends within its guidelines that each LINAC machine should perform 414 courses of treatment per annum, based on standard operating hours (eight hours per day Monday–Friday), and as advocated by the Radiation Oncology Jurisdictional Implementation Group (ROJIG).

The Royal Australian and New Zealand College of Radiologists has also developed recommended wait times for radiotherapy treatment:

- emergency care—within 24 hours
- high priority care—14 calendar days
- planned care—28 calendar days.

Radiation oncologists determine the 'ready for care' date at initial consultation, which triggers the commencement of the wait time count. These wait times allow radiological departments to determine whether they are meeting recommended time frames.

Five of the hospitals that provide radiation oncology (Cairns, radiation oncology Mater Centre, Princess Alexandra, Royal Brisbane and Women's, and Townsville) are required by the department to publish on their websites the average number of working days until their next available treatment start date.

To determine if HHSs were meeting the national waiting time guidelines for treatment, we reviewed the time taken from 'ready for care' to the start of treatment for the emergency, high priority, and planned care. We also assessed whether the total number of treatment courses per LINAC on an annual basis met the department's guideline of 414 courses per annum.

LINAC data recording

We identified five stages during the patient treatment process with LINACs:

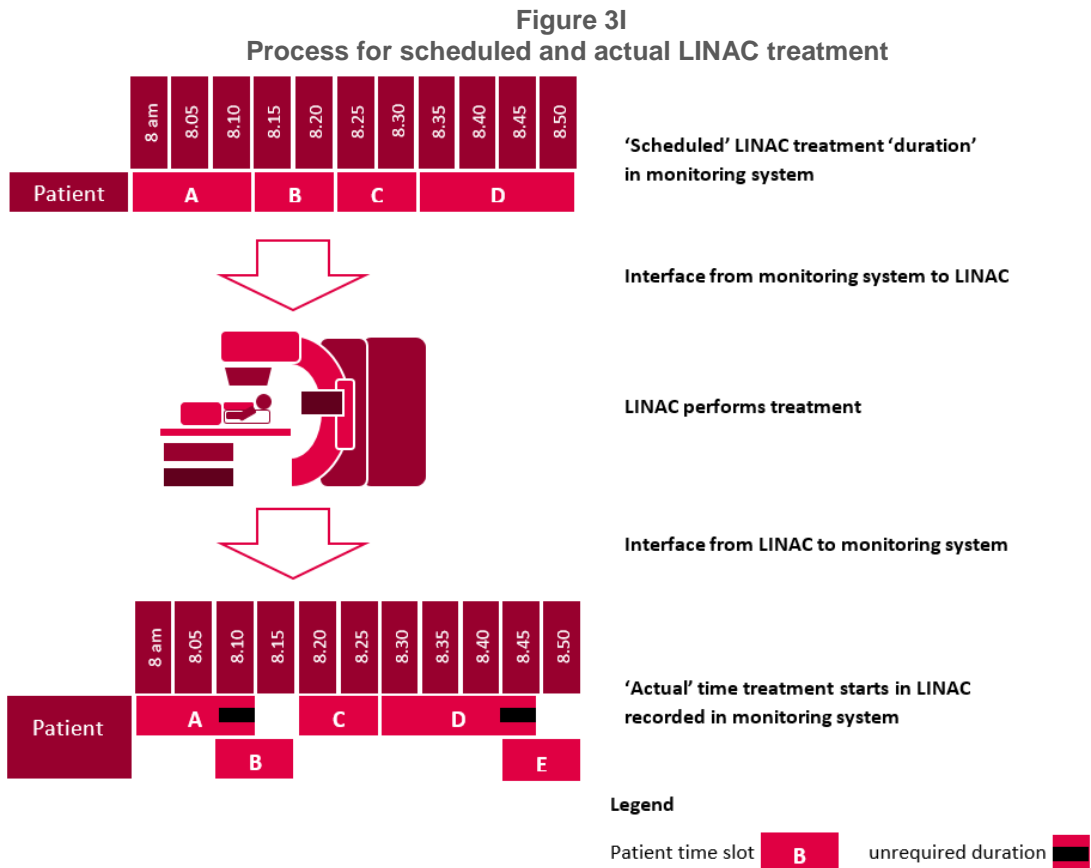
- schedule treatment—where a patient is 'scheduled' in the monitoring system with a proposed date, start time, and duration of LINAC treatment. The duration is predetermined by the radiation oncologist based on varying patient factors (for example, age, stage of treatment, and type of treatment)
- interface from monitoring system to LINAC—occurs on the day of treatment prior to patient starting in the LINAC, with the monitoring system uploading the start time and duration of treatment
- LINAC treatment—carried out by the LINAC, with the machine recording the actual start time (within a five minute increment) and logging the duration identified in the schedule. The actual duration of time a patient is on the machine is not recorded
- interface between LINAC and monitoring system—occurs following treatment, with the LINAC providing the start time and scheduled duration of treatment
- actual treatment—monitoring system now holds the actual start time of the patient's treatment and the scheduled duration that the treatment took (not the actual duration of the treatment).

However, we found the data systems for monitoring LINAC usage do not capture the duration of the treatment in any consistent or accurate way; therefore, there is no effective way to assess whether HHSs are using LINACs efficiently.

The monitoring system only captures the start time for a patient beginning treatment and automatically populates the duration (time in five minute blocks) of the treatment from the electronic schedule. This means that if a patient completes their treatment quicker than the programmed duration, then the next patient may begin treatment early; however, the first patient's radiation treatment is still in duration according to the system.

This creates difficulty with interpreting the usage data as, again, it can appear as if one machine is treating multiple people at the same time.

Figure 3I illustrates the difficulties with recording times accurately.



Source: Queensland Audit Office

The monitoring system does not accurately capture how much time is lost between patients or the time that is available for further use. Similarly, where there is a breakdown or the LINAC requires calibration, and is therefore unavailable for treatment, the duration recorded in the system may not accurately represent the machine's actual downtime.

Overall, these distortions can lead to a false reading of actual time used for treatment on any given day.

Number of LINAC treatment courses

Although the monitoring system does not provide an accurate reflection of time usage, it does record dosage of radiation and the total number of courses of treatment performed annually. When we compared this with the department's guideline of annual capacity of 414 courses, we found that there is spare capacity in 11 of the 16 machines—equating to approximately 700 available courses of treatment for the 2015 calendar year.

However, 10 of these 11 LINACs were performing at a level of 75 per cent or more of the department's recommended 414 courses per annum, with four of these operating at more than 90 per cent of the recommended target. HHSs have attributed not operating at full capacity to a range of factors, including:

- the complexity of some patients' treatments
- the fact that clinical treatment of children can take up to four times as long as that of adults
- advances in treatment techniques
- additional LINAC services starting at other HHSs and reducing demand at a particular hospital
- additional services starting at private providers and reducing demand at a particular hospital.

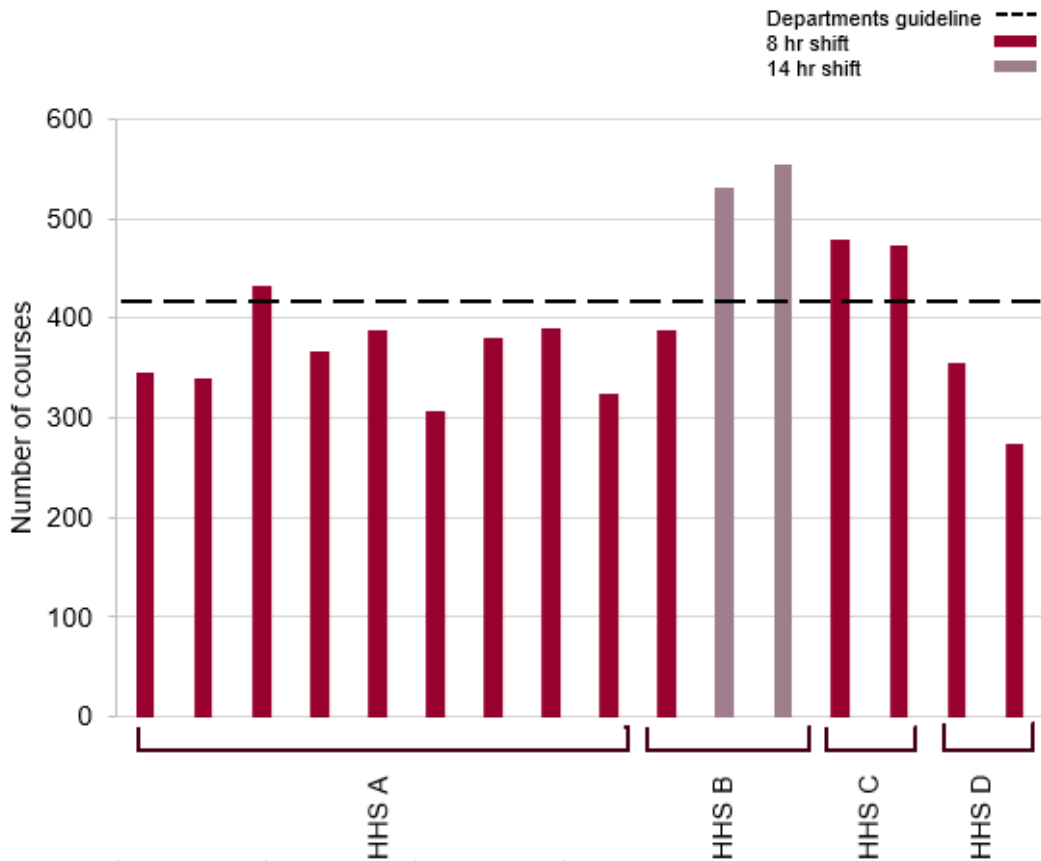
In one HHS, neither of its LINACS were operating at recommended capacity; however, the machines were located in a regional area where current patient demand was acknowledged to be lower than in metropolitan areas.

When establishing these services, the department had planned on future growth fulfilling the available capacity. They deliberately provided two matched machines so required treatment could go ahead even if one machine broke down, or was undergoing planned or unplanned maintenance (without complete recalibration). Therefore, while there is an opportunity to optimise the usage of these machines, current local demand is being met.

The findings suggest there is opportunity to revisit the planning and strategic location of LINACs across the state. There may be some instances where the offering of close-to-home provision of care capability in a certain area needs to be weighed against the economic cost of establishing and operating that LINAC treatment.

Figure 3J illustrates the comparison of LINAC utilisation against the department's guideline for recommended number of treatment courses.

Figure 3J
Number of courses delivered per LINAC in 2015



Note: Two of the audited LINACs were specialised tomotherapy machines. We have discounted them from the comparison because they provide complex treatment that can require twice as long for courses. Therefore, this would not be an accurate comparison of service delivery.

Source: Queensland Audit Office

LINAC treatment delays

The public hospitals that provide radiation therapy services are required to publish their wait times for these categories; however, they only report on the wait time averaged for the month and the average number of working days until the next available appointment. Because this information is an average, it does not provide specific detail to enable determination of how the HHS is performing in meeting its wait time targets.

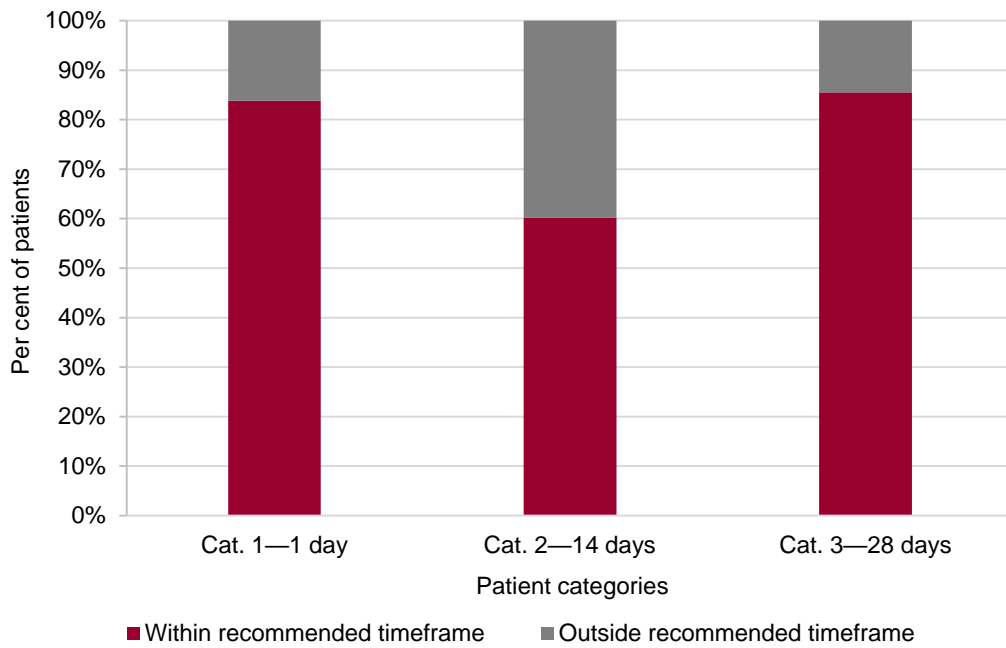
We analysed the wait times from 'ready for care' to 'start' for patients who began treatment in the period from January to June 2016. We did this to ascertain the level at which HHSs were meeting the benchmark wait time targets for each priority category.

We looked at the performance of four hospitals within three HHSs and how they were collectively performing in meeting the wait time benchmarks. We found the following:

- within 24 hours (emergency care)—16 per cent of patients were not seen within the recommended time
- within 14 days (high priority care)—40 per cent of patients were not seen within the recommended time
- within 28 days (planned care)—14 per cent of patients were not seen within the recommended time.

Figure 3K illustrates the results of our analysis.

Figure 3K
Performance against wait time targets for four hospitals



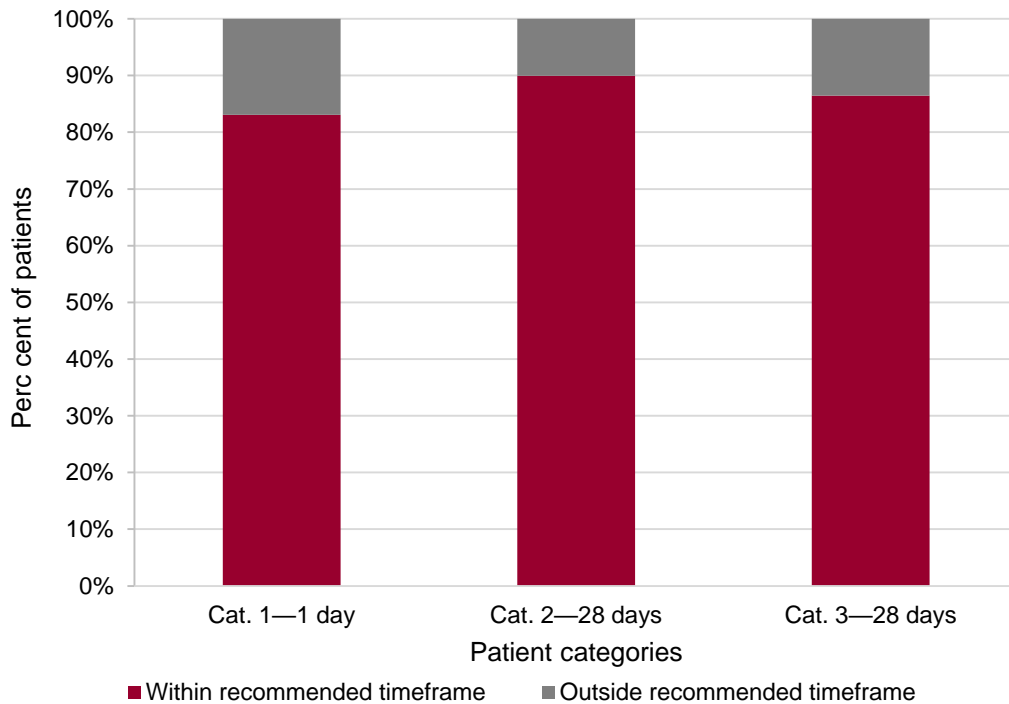
Source: Queensland Audit Office

The recommended acceptable time frame of 14 days to wait for high priority care (category 2) is considered best practice; however, a number of clinicians advised us that acceptable practice is within 28 days. We have therefore revised the figures to reflect meeting these time frames.

This adjusted the category 2 patients not seen within the recommended time frame from 40 per cent down to 10 per cent.

Figure 3L illustrates the adjusted time frame results of our analysis.

Figure 3L
Performance against revised wait time targets for four hospitals



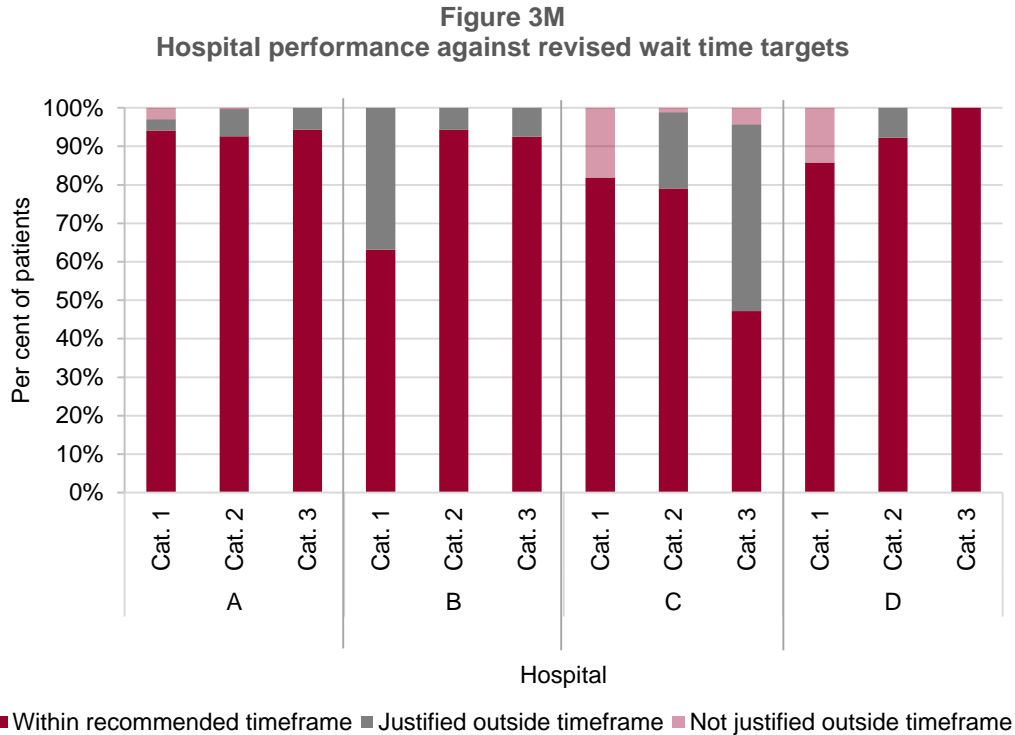
Source: Queensland Audit Office

Based on these revised targets, 13 per cent of patients across all three categories were not seen within the recommended time frames.

Justification for delay

We then further analysed the performance of four hospitals in meeting the relevant time frames. This included reviewing the reasons for why patients were not being treated within the acceptable time frames. We have labelled the hospitals A–D.

Figure 3M illustrates the results of our analysis on the performance of the four hospitals based on the clinicians’ revised recommended days for category 2 treatment.



Source: Queensland Audit Office

Where time frames were exceeded and the reasons were recorded to justify this, the reasons included:

- chemotherapy treatment being included in wait times
- a CT scan being required before treatment
- a patient's availability
- the referring doctor's availability.

Some of the extended delays between 'ready for care' and 'start' periods can also be attributed to patients' requests. For example, where patients are not high risk, they may opt to delay the start of their treatment. We also found the ready for care date is a clinical determination, not the date of referral for treatment, and is not recorded consistently in the radiation oncology information system.

Justification not recorded

In some instances, the hospitals were unable to provide justification as to why patient treatment times exceeded the recommended time frames. Using the clinicians' revised recommended days for category 2 treatment, we identified that six per cent of the total delayed patients were not seen within the recommended time frame, and had no justification recorded.

Across all categories, only one per cent of patients did not receive treatment within the revised recommended time frame without justification.

4. Achieving value for money

Chapter in brief

The first principle in the Queensland Procurement Policy is driving value for money in procurement. To achieve value for money, public sector entities must consider what they need to purchase and how that need can be met cost-effectively. A business case is often used to record the different options considered and the estimated costs and benefits.

With high value medical equipment (which we have defined as equipment with an acquisition value of \$1 million or more), it may be some time before the purchaser can evaluate whether the purchase has delivered on its expectations. This is why it is so important for public sector entities to identify at the outset the benefits of significant purchases, and how they will measure the effectiveness of those purchases.

We have categorised the purchases into three categories:

- replacement high value medical equipment
- new high value medical equipment
- new technology high value medical equipment.

Main findings

- The Department of Health (the department) has failed to enforce its own policy and was only able to provide one complete business case from 17 instances for replacement equipment in excess of \$1 million between 2014 and 2016.
- Five of these 17 replacement purchases in 2014–16 did not have any documentation to support the purchase.
- None of the six high value medical equipment purchases in the new category in the last two years involved identification and evaluation of the proposed benefits of the equipment purchase.
- The process for purchasing high value medical equipment in the new technology category is rigorous, and exhibits elements of better practice procurement as established in the Queensland Procurement Policy.

Audit conclusions

The health system (which encompasses both the department and the Hospital and Health Services) cannot demonstrate that high value medical equipment replacement is procured economically. Although appropriate governance processes for purchasing the equipment have been established with the aim of delivering value-for-money outcomes, the department and Hospital and Health Services are not consistently following them.

There is insufficient documentation, which means the department is not validating the rationale supporting the need for the purchases and ensuring that steps have been taken to minimise the total cost of ownership.

The process for purchasing new technology equipment is effective and provides greater ability to measure the equipment's benefits. The health system could apply a similar, but scaled down, process for its purchase of other high value medical equipment to ensure it meets procurement requirements.

Introduction

Eight Hospital and Health Services purchased 24 high value medical equipment assets (equipment with an acquisition value of \$1 million or more) in the last two years, with an approximate total acquisition cost of \$44 million and at an average cost of \$1.8 million per item.

Sunshine Coast Hospital and Health Service also purchased high value medical equipment but has been excluded from this analysis because of significant capital works for a major new hospital build project.

The purchases by the eight Hospital and Health Services included:

- replacement high value medical equipment—17 assets
- new high value medical equipment—six assets
- new technology high value medical equipment—one asset.

The category of asset purchased (replacement, new, or new technology) dictates the procurement process and the associated governance and probity requirements. However, to drive value-for-money outcomes in all high value medical equipment purchases, the Department of Health (the department) and each Hospital and Health Service (HHS) must, in line with the Queensland Procurement Policy, demonstrate that they have:

- considered options and selected the best value-for-money outcome
- collaborated with clinicians and business managers to understand service needs
- collaborated across HHSs to maximise savings and benefits, and reduce duplication
- engaged stakeholders to understand their service needs
- considered the total cost of ownership before making a decision to purchase
- identified measurable benefits of the procurement.

Under the department's Health Technology Equipment Replacement Program guidelines, the department must review business cases for replacement equipment over \$1 million to ensure that the procurement is achieving value for money. HHSs are expected to summarise in a business case how they have addressed the procurement principles.

This chapter assesses how well the department and HHSs procure the three categories of high value medical equipment. In our audit, we examined whether the HHSs applied appropriate procurement practices prior to incurring expenditure on high value medical equipment, and whether they achieved value for money.

Audit conclusions

The department's governance over high value equipment replacement purchases is poor. HHSs have not been preparing, and the department has not been requiring, business cases for significant high value medical equipment purchases through the Health Technology Equipment Replacement Program process. This is despite its own policy requiring it. This makes it difficult to ascertain whether HHSs are following the Queensland Procurement Policy and ultimately achieving value for money.

The absence of business cases—or other proper consideration of the available options—also makes it difficult to determine whether HHSs have properly:

- identified the need for the purchase in the first instance
- considered the expected benefits of the high value medical equipment
- evaluated alternatives to the procurement or new technology options
- chosen the value-for-money option.

More broadly, a lack of proper planning documentation is a missed opportunity for the department and HHSs to capture information on what high value medical equipment has previously performed well and why. These insights should inform future procurement decision-making and ultimately create long-term value in the high value medical equipment procurement process.

We acknowledge that the concept of value-for-money also encompasses considerations such as whether or not high value medical equipment has successful clinical outcomes, and where patients can be treated close to home so they don't have to travel.

Replacing high value medical equipment

Business cases

The framework (both a standard and a procedure) for the Health Technology Equipment Replacement Program requires HHSs to prepare a business case for purchases in excess of \$1 million and forward a copy to the department for review.

Of the 17 high value medical equipment assets replaced in 2014–16 through the Health Technology Equipment Replacement Program, the department could only provide one business case (from Cairns and Hinterland HHS).

For the remaining 16 purchases:

- one purchase had a complete business case retained by the HHS
- nine purchases have some level of documentation
- six purchases had no documentation at all.

Value-for-money decisions

One of the primary objectives of the Health Technology Equipment Replacement Program was for the department to use its buying power to get better value for money in high value medical equipment purchases. So as part of the funding process, the department advises HHSs on the best value-for-money options for their equipment needs.

For the 17 high value medical equipment purchases in the 2014–16 funding round, the department could only provide us with relevant value-for-money documentation for eight pieces of equipment. Of these eight, no HHS selected the value-for-money option. However, in each case, the HHS provided a reason why they did not choose it. For example, on their own evaluation, they decided to select a technically and clinically more appropriate piece of equipment.

In the remaining nine instances of high value medical equipment procurement, the HHSs did not provide us with relevant value-for-money documentation.

Figure 4A summarises each instance of replacement high value medical equipment for the period 2014–16, including whether the HHS chose the value-for-money (VfM) option and whether documentation was available to support their decision.

Figure 4A
Documentation received for 2014–16 Health Technology Equipment Replacement Program equipment costing \$1 million or more

HHS	Asset description	Amount (\$ mil.)	Procurement documentation	VfM option chosen	VfM documentation supporting decision
Cairns and Hinterland	Computed tomography (CT) scanner	1.3	Referral and briefing note Business case	No	Financial, clinical, and technical
Darling Downs	CT scanner	1.5	Business improvement case Briefing note	No	Financial, clinical, and technical
Gold Coast	CT scanner	1.4	Briefing note	No	Financial, clinical, technical, and compatibility
Mackay	CT scanner	1.3	Briefing note	No	Financial, clinical, technical, and familiarity
Metro North	CT scanner	1.9	Documentation not provided	Unknown	Documentation not provided
Metro North	CT scanner	1.1	Documentation not provided	Unknown	Documentation not provided
Metro North	CT scanner	1.9	Briefing note Clinical evaluation	No	Financial, clinical, technical, and compatibility
Metro North	Radiographic /fluoroscopic system	1.5	Documentation not provided	Unknown	Documentation not provided
Metro South	Angiographic system	1.9	Requisition form, purchase order Memo advising approval Infrastructure costs	Unknown	Documentation not provided
Metro South	Cardiac angiography system	1.3	Briefing note	Unknown	Documentation not provided—self-procured
Metro South	Gamma Camera	1.3	Memo to confirm service need	Unknown	No justification provided
Metro South	Gamma Camera	1.1	Memo to confirm service need	Unknown	No justification provided
Metro South	CT scanner	1.8	Documentation not provided	Unknown	Documentation not provided
Townsville	CT scanner	1.2	Briefing note	No	Financial justification

HHS	Asset description	Amount (\$ mil.)	Procurement documentation	VfM option chosen	VfM documentation supporting decision
Townsville	Gamma camera	1.1	Documentation not provided	Unknown	Documentation not provided
Wide Bay	CT scanner and installation	1.1	Briefing note	No	Financial, clinical, and technical justification
Wide Bay	CT scanner	1.2	Briefing note	No	Financial, clinical, and technical justification
Total		\$23.9M		VfM 0/17	

Source: Queensland Audit Office

Purchasing new high value medical equipment

HHSs are responsible for identifying the need for new high value medical equipment (as opposed to replacement high value medical equipment), finding a funding source, and undertaking the procurement process. Four HHSs have purchased six new high value medical equipment assets in the last two years, at a total cost of \$15.7 million (Children's Health Queensland HHS, Metro North HHS, Townsville HHS, and Cairns and Hinterland HHS).

The department's Medical Equipment and Maintenance Category Team assisted Children's Health Queensland HHS in purchasing equipment. Children's Health Queensland HHS was able to demonstrate that it had conducted a value-for-money analysis; however, it did not select the best value-for-money option. Instead, it opted for the third best value. It stated in a briefing note to its chief financial officer that the value-for-money option did not meet its clinical need.

Townsville HHS identified funding sources for its new linear accelerators through its regional cancer centres business case. However, there was no evidence that it conducted a value-for-money analysis or had clearly defined and documented the proposed benefits of the new purchase.

The remaining two HHSs could not demonstrate how they considered value for money in their new high value medical equipment purchases. Cairns and Hinterland HHS produced a business case for its new high value medical equipment following the procurement, yet this focused on the associated infrastructure costs for the high value medical equipment.

Metro North HHS considered the total cost of ownership of its new high value medical equipment, which focused on annual maintenance for the positron emission tomography (PET)/computed tomography (CT). All other high value medical equipment documents from HHSs varied in the information they provided, but none of them clearly identified the benefits to justify the procurement.

Figure 4B summarises the new equipment purchased and the supporting documentation.

Figure 4B
Documentation received for new high value medical equipment procured over the past two years

HHS	Asset description	Acquisition price (\$ mil.)	Documents supporting the purchase decision
Cairns and Hinterland	Positron emission tomography (PET)	3.9	Business case (post procurement for infrastructure works only)
Children's Health Queensland	CT scanner	1.2	Briefing note
Metro North	PET/CT	3.5	Memo and briefing note
Metro North	CT	1.8	Briefing note
Townsville	Linear accelerator	2.7	Business case Commitment approval form
Townsville	Linear accelerator	2.6	Business case Commitment approval form
Total		\$15.7M	

Source: Queensland Audit Office and HHSs

None of the audited HHSs undertook any form of post implementation review of their high value medical equipment. Without having identified and defined the proposed benefits, the HHSs were unable to determine if the benefits of the new high value medical equipment had ultimately been realised.

Purchasing new technology high value medical equipment

There has only been one purchase of new technology equipment in Queensland in the period we reviewed. Metro South HHS purchased the Gamma Knife high value medical equipment in October 2015. It was the first public hospital in Australia to have a Gamma Knife intra-cranial stereotactic radiosurgery unit—there was previously only one in operation at a private hospital in Sydney. (The Gamma Knife uses precisely focused beams of radiation to target brain tumours without damaging surrounding healthy tissue.)

The Gamma Knife was only available via a sole-supplier arrangement. Metro South HHS demonstrated its commitment to deliver value for money through this procurement decision by documenting key information, which is shown in Figure 4C.

Figure 4C

Summary costs of new magnetic resonance imaging (MRI) installation	
Service need	The average years of life lost to invasive brain cancer in Queensland was 3 599 years, and the average years of life lost per death was 15.4.
Comparison with alternative options	<p>There were three identified alternatives to the Gamma Knife [with associated restrictions]:</p> <ul style="list-style-type: none"> ▪ open surgery for small–medium size cranial lesions [significant recovery and cosmetic impact] ▪ hypofractionated (three treatment) ‘stereotactic’ treatment [increased radiation dosage for patient] ▪ cyberknife radiosurgery [lacks accuracy and multiple lesions efficiency].
Expected benefits	<ul style="list-style-type: none"> ▪ non-invasive treatment ▪ lower morbidity and mortality in patients ▪ patients would: <ul style="list-style-type: none"> - receive better quality of life - spend less time in hospital - experience a reduced absence from their vocation.

Source Queensland Audit Office

To achieve the best price it could in a sole-supplier market, Metro South HHS negotiated a 30 per cent discount with the supplier, and obtained an additional two years of maintenance, for a total of five years, at no extra cost. In addition, because the supplier was located overseas, the HHS fixed the foreign exchange rate to mitigate the risk of changes in the exchange rate once it finalised the transaction.

Business case

While Metro South HHS did not present a formal business case for the Gamma Knife, the information it provided in its funding application covered the essential elements of a business case. It could clearly demonstrate that it planned for the asset life cycle and considered the:

- need for the service delivered
- clinical health benefit for patients
- advantages of the high value medical equipment
- evidence of effectiveness
- economic and organisational feasibility
- total cost of ownership.

Metro South HHS considered the total cost of ownership by including all costs and associated resources involved for the expected life of the asset, including:

- infrastructure
- systems
- implementation of the service to current clinical pathways
- legal and regulatory costs
- ongoing maintenance
- consumables
- workforce.

Because Metro South HHS purchased the Gamma Knife through a sole-supplier scenario, it was unable to test the market for competitive prices. Its process did, however, consider key relevant factors, demonstrating adherence to the Queensland Procurement Policy's primary principle of driving value for money in procurement decisions. In this instance, Metro South HHS's approach is consistent with the principle that price is not the only indicator of value for money.

Realising benefits

In conjunction with the relevant HHS, the department's Healthcare Evaluation and Assessment of Technology team undertakes post implementation evaluations of any new technology purchased. The evaluation occurs at the six and 24-month point post commissioning of the high value medical equipment. The team assesses whether the new technology aligns to the original funding request and what impact it is delivering. This is a good practice for identifying if the new equipment has realised the expected benefits. Some of the other benefits that can be derived from high value medical equipment include better patient outcomes, the ability to treat patients closer to home, and innovative technology that can reduce the length of hospital stay.

The department's Healthcare Evaluation and Assessment of Technology team publish evaluation reports on the Queensland Policy Advisory Committee for new Technology intranet site and the Health Policy Advisory Committee on Technology website. The reports highlight whether the new technology is of benefit to the state health system and provides information to support the planning, procurement, and use of the new technology.

Metro South HHS, with the support of the Healthcare Evaluation and Assessment of Technology team, is currently drafting the implementation report for the Gamma Knife. As a result, we were unable to review it as a completed process. Figure 4D lists some of the specific benefits Metro South HHS identified it could achieve by implementing the Gamma Knife (expanded from the summary in Figure 4C).

Figure 4D
Benefits of implementing the Gamma Knife

Benefit	Current 'usual care'	Proposed technology
Reduced length of inpatient hospital stay	Average 9.85 days for open surgery	1 day
Reduced number of inpatient tests	Open surgery costs as inpatient include: <ul style="list-style-type: none"> ▪ medical imaging ▪ blood tests 	80% reduction in costs MRI on same day No other additional test required
Reduced readmissions	6%	2%
Reduced adverse events (permanent neurological impairment)	65% (open skull base surgery for meningioma)	25% (Gamma Knife for skull base meningioma)
Reduced patient time off work following open skull base surgery	160 days on average	8 days on average
Time saved for all treatment staff	Depending on type of open procedure often for complex skull base and pituitary lesions, 6–12 hours of theatre time	Outpatient procedure: Frame attachment 30 min, planning imaging (CT/MRI—2hrs), planning 1–2 hours, treatment delivery 1–2 hours depending on complexity

Source: Queensland Audit Office and the new technology funding and evaluation program

The Queensland Policy Advisory Committee for new Technology-governed procurement process is transparent and comprehensive, and incorporates a better practice approach to high value medical equipment procurement and benefits realisation.

There is potential for this committee's process to be adapted and applied to the procurement processes for replacement and new equipment.

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Appendix A—Full responses from agencies

As mandated in section 64 of the *Auditor-General Act 2009*, the Queensland Audit Office gave a copy of this report with a request for comments to:

- the Department of Health
- all Hospital and Health Services

The heads of these agencies are responsible for the accuracy, fairness, and balance of their comments.

This appendix contains their detailed responses to our audit recommendations.

Comments received from Director-General, Queensland Health



3 FEB 2017

Enquiries to: Bron Nadi
A/Executive Director & Chief
Health Infrastructure Officer
Infrastructure Strategy and
Planning Branch
Telephone: 3234 0915
File Ref: DG082592

Mr Anthony Close
Acting Queensland Auditor-General
Queensland Audit Office
PO Box 15396
CITY EAST QLD 4002

Dear Mr Close *Anthony*

Thank you for your letter dated 22 December 2016 on the Queensland Audit Office's (QAO) performance audit on Queensland Health's efficient and effective use of high value medical equipment (HVME). I additionally thank you for your time on 22 November 2016 and 22 December 2016, to discuss the audit.

Queensland Health is continuously looking to improve the safety, quality, effectiveness and efficiency of its services and welcomes the report as a contribution to this continuous improvement. Queensland Health will be progressing all of the recommendations in the report.

We note the following findings in the body of the report:

- The average utilisation of CT Scanners is above the OECD average and above the average of the other states included in the comparison. (Page 43).
- The average utilisation of MRI Scanners is comparable to the OECD average. (Page 44).
- The average utilisation of LINACs is slightly below the recommended average utilisation of 414 courses per year (Page 52), recognising that lower utilisation potentially allows for the machine to be used for more years. (Page 31).
- The treatment in time targets, in the four hospitals analysed in detail, for LINAC treatment for Category One (24 hours), Category Two (14 days) and Category Three (28 days) are fully (100%) met for Category Two and Three in three of the hospitals. Category One targets are fully (100%) met in one of the hospitals and more than 85% met on average in the other three hospitals. These performance targets include where a delay in treatment was considered justified as a result of reasons such as chemotherapy treatment being included in waiting times, the requirement for a CT scan prior to treatment, a patient's availability and the referring doctor's availability. Of note, 99% of patients received treatment within the revised recommended time frame with justification for treatment time. (Page 55).

Office
Level 37
1 William Street
BRISBANE QLD 4000

Postal
GPO Box 48
BRISBANE QLD 4001

Phone
3708 5990

Email:
DG_Correspondence@health.qld.gov.au

Responses to recommendations

- All (100%) of the high value medical equipment is registered in FAMMIS and 82% of the high value medical equipment has maintenance information in the Biomedical Technology Service system ECRI-AIMS. (Page 28)

When new and replacement high value medical equipment is being considered for purchase, there is a requirement to determine clinical demand at both the State and the Commonwealth level. In addition to the State determining the clinical need for the equipment, new and replacement equipment within the audit was assessed by the Commonwealth Government as being required and therefore eligible for capital subsidy and ongoing private activity billing.

The activity based funding model used in Queensland Health to fund hospital activity, including activity associated with high value medical equipment, includes the operational and maintenance costs for the equipment. The majority of the HHSs have been planning and delivering the clinical services and operating within their allocated budgets since their commencement in 2012, inclusive of these operating and maintenance costs.

As the report highlights, due to the significant hospital expansion program that has been operating from 2008, there has been a large increase in the number and acquisition value of high value medical equipment. This has meant that people are able to receive a quality service that is safe and available closer to home. However, it does point to the need to plan for increased capital expenditure for when the equipment comes due for replacement.

Should you require further information, the Department's contact is Ms Bronwyn Nardi, Executive Director, Infrastructure Strategy and Planning Branch, Strategy, Policy and Planning Division, on telephone

Yours sincerely



Michael Walsh
Director-General
Queensland Health

Responses to recommendations

Queensland Health's Response - Queensland Audit Office findings – Efficient and effective use of high value medical equipment

Queensland Audit Office Recommendations (QAO) [Queensland Audit Office findings – Efficient and effective use of high value medical equipment]			
QAO Recommendation	Health Response	Additional Comment	Indicative Implementation Timeframe
<p>Department of Health:</p> <p>1. Leads a comprehensive stocktake of the high value medical equipment fleet across the health system to establish and maintain a complete, accurate register of the State's high value medical equipment (Chapter 2).</p> <p>The analysis should include a review of the completeness and accuracy of the relevant asset information systems used by the health system for financial reporting and asset maintenance</p>	Accept	<p>The stocktake will be undertaken collaboratively with the Hospital and Health Services (HHSs).</p> <p>The asset information system review will be undertaken in collaboration with the HHSs.</p>	December 2017
<p>2. Investigates, in consultation with the Hospital and Health Services, options to aggregate data across the health system asset management systems in a way that provides meaningful decision support information for assets across their life cycle (Chapter 2)</p>	Accept	No additional comments required.	Commencing March 2017
<p>3. Undertakes a review of the Health Technology Equipment Replacement (HTER) Program with a particular emphasis on:</p> <ul style="list-style-type: none"> - identifying the most suitable funding arrangements for replacing high value medical equipment as it becomes obsolete (including a 10 year equipment replacement horizon (Chapter 2) - identifying whether aspects of the Queensland Policy and Advisory Committee for new Technology process should be applied to the Health Technology Equipment Replacement Program process to increase transparency and rigour in how high value medical equipment replacement decisions are made (Chapter 4). 	Accept	<p>An external review of HTER Program has been progressed.</p> <p>The governance processes for HTER will be reviewed and revised.</p>	June 2017

Responses to recommendations

Queensland Health's Response - Queensland Audit Office findings – Efficient and effective use of high value medical equipment

QAQ Recommendation	QH Response	Additional Comment	Indicative Implementation Timeframe
Hospital and Health Service:			
4. Develop or augment their strategic asset management plans according to the specific needs of their operational environment (Chapter 2).	Accept	No additional comments required.	June 2018
Department of Health and hospital and health services collaborate to:			
5. Develop guidelines to strategically plan for high value medical equipment assets, addressing key elements of the asset life cycle (Chapters 2, 4).	Accept	No additional comments required.	June 2017
6. Consider standardising wait list templates so all Hospital and Health Services are capturing and reporting on the same information—to enhance high value medical equipment planning (Chapters 2, 3).	Accept		June 2018
7. Standardise definitions for key data points (such as start and completion times) when using high value medical equipment (Chapter 3).	Accept		June 2018
8. Identify key baseline performance metrics for high value medical equipment so the relevant data can be captured and reported on—to identify available equipment capacity and potential system-wide improvements (Chapter 3).	Accept		June 2018

Comments received from Director of Medical Imaging, West Moreton Hospital and Health Service



West Moreton Hospital and Health Service

Efficient and effective use of high value medical equipment (Report No. XX: 2016–17)


Response to recommendations provided by Christopher Hicks, Director of Medical Imaging on 11 January 2017.

Recommendation	Agree / Disagree	Timeframe for Implementation (Quarter and Year)	Additional Comments
We recommend that the Department of Health:			
<p>1. leads a comprehensive stocktake of the high value medical equipment fleet across the health system to establish and maintain a complete, accurate register of the state's high value medical equipment (Chapter 2).</p> <p>The analysis should include a review of the completeness and accuracy of the relevant asset information systems used by the health system for financial reporting and asset maintenance</p>	Agree	Q4 2016/17	The Audit Report notes that the Department of Health's service agreement with each HHS requires the HHS to manage its own assets (p 20). As there is value for Department of Health to have a whole of health service oversight of the high value medical equipment fleet across the health system, WMHHS would be willing to comply with a request for such information from the Department. WMHHS is confident that the asset information used to manage its assets, and in particular its high-cost medical equipment assets, is comprehensive and will provide the information required for financial reporting and asset maintenance.
<p>2. investigates, in consultation with the hospital and health services, options to aggregate data across the health system asset management systems in a way that provides meaningful decision support information for assets across their life cycle (Chapter 2)</p>	Agree	Q2 2017/18	As with Recommendation 1, WMHHS is agreeable to provide data to the Department of Health in relation to its high-cost medical assets in order to provide aggregate data to the Department which can assist in decision support. It is noted that, while the percentage of the population served by WMHHS is 5.3% of the Queensland total, the total percentage of high value medical equipment asset value, as identified in the Performance Audit, is only 0.7% of the state's total (p71). Thus, greater visibility of the equity of distribution of high value medical equipment across the various HHSs will aid in planning for health services. This is particularly the case as WMHHS is expected to experience considerable growth in its resident population in the next 10 years, with an increasing need to develop services that require high cost assets, for example, the introduction of Magnetic Resonance Scanning.
<p>3. undertakes a review of the Health Technology Equipment Replacement Program with a particular emphasis on:</p> <ul style="list-style-type: none"> identifying the most suitable funding arrangements for replacing high value medical equipment as it becomes obsolete. The funding review should consider options for at least a 10 year equipment 	Agree	Q2 2017/18	WMHHS agrees that the Department of Health should review the funding arrangements for replacing high value medical equipment, especially given the forecast shortfall of funding required to support the Department's Health Technology Equipment Replacement (HTER) programme of some \$400m by 2020 (p32). WMHHS recommends a 15 year replacement horizon for equipment on the HTER programme to align with each HHS's Total Asset Management Plan. Additionally, consideration

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Responses to recommendations

- replacement horizon (Chapter 2)
- identifying whether aspects of the Queensland Policy and Advisory Committee for new Technology process should be applied to the Health Technology Equipment Replacement Program process to increase transparency and rigour in how high value medical equipment replacement decisions are made (Chapter 4).



should be given to the current treatment of depreciation in the HHS's financial statements. Currently depreciation is recognised as a non-cash item however, in other Queensland State Government corporations, depreciation is recognised as cash and utilised for the efficient replacement of the organisations asset base.

WMHHS agrees that high value equipment replaced under HTER should be subject to the rigour of a business case, and identifying aspects of the policy pertaining to new technology purchases is a good starting place. The usual business proposal process at WMHHS takes into account the justifications required in purchasing expensive medical equipment as outlined in the Performance Audit, including alignment to current WMHHS and Queensland Health strategies, the need for the service delivered, the clinical benefits, interdependencies and integration points, and forecast of expenditure.

We recommend that the hospital and health services:

- | | | |
|--|-------|------------|
| 4. develop or augment their strategic asset management plans according to the specific needs of their operational environment (Chapter 2). | Agree | Q2 2017/18 |
|--|-------|------------|

WMHHS has a well developed strategic and asset management plans specific to its operational environment; other HHS may not have same level of maturity in relation to the management of medical equipment assets. WMHHS has an Asset Management Team, supported by the Assets and Infrastructure Committee, which includes clinicians, and overseen by the Director Service Support. The Asset Management team and committee oversee all aspects of high cost medical equipment, including:

- Management of HTER funding
- Management of non-HTER medical equipment funding
- Asset Register
- Asset lifecycle maintenance

We recommend that the Department of Health and hospital and health services collaborate to:


- | | | |
|--|-------|------------|
| 5. develop guidelines to strategically plan for high value medical equipment assets, addressing key elements of the asset life cycle (Chapters 2, 4) | Agree | Q3 2017/18 |
|--|-------|------------|

WMHHS is willing to collaborate with the Department of Health to develop guidelines to strategically plan for high value medical equipment assets, noting that WMHHS has already well developed asset management plans. WMHHS currently has only one High Value Medical Equipment unit (a CT scanner) and, as an asset, it is managed according to WMHHS's plans. Larger HHSs, with a more extensive fleet of High Value Medical Equipment assets may derive more value from the collaborative development of guidelines than WMHHS.

- | | | |
|--|-------|------------|
| 6. consider standardising wait list templates so all hospital and health services are capturing and reporting on the same information—to enhance high value medical equipment planning (Chapters 2, 3) | Agree | Q3 2017/18 |
|--|-------|------------|

Medical Imaging departments have not been subject to the same scrutiny as Operating Theatre Environments in relation to managing waiting lists. Clear guidelines have been developed in the Operating Theatre Environment (e.g. National Elective Surgery Targets) where categories have been developed to guide the scheduling of surgery in clinically appropriate time frames. For those

Responses to recommendations



HHSs with interventional radiology services wait times for these procedures are subject to these national guidelines. Wait times for Diagnostic and Interventional procedures are not specifically mentioned in the Royal Australia and New Zealand College's *Standards of Practice for Diagnostic and Interventional Radiology* (Vol 10). The Queensland Department of Health has developed a guideline for *Key Performance Indicators for Diagnostic Imaging Services* which includes waiting times, but these KPIs do not specifically mention a metric or benchmark which HHS Medical Imaging Departments are expected to meet. In relation to wait times for CT examinations, WMHHS currently has two categories for waiting lists for CT procedures: Outpatients and Inpatients. Patients referred from the Emergency Department are scheduled either immediately or within 1-2 hours of referral. The WMHHS Medical Imaging Department has undertaken a recent review of CT utilisation and has implemented processes to increase utilisation, leading to a reduction of the wait times for outpatients to maximum of 1-2 days and inpatients to a same day service (August, 2016 data).

WMHHS would be willing to collaborate with the Department of Health in the development of wait list templates for Medical Imaging so that data across the Queensland Health System can be captured and reported on in a consistent manner.

7. standardise definitions for key data points (such as start and completion times) when using high value medical equipment (Chapter 3)	Agree	Q3 2017/18
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WMHHS would be willing to collaborate with the Department of Health to develop standard definitions for key data points in the Medical Imaging patient journey, particularly where high value medical equipment is being used. However, the collection of such data by WMHHS is limited by the capacity of the current RIS to record such data. Other HHSs may be similarly hampered. Standard definitions would need to be translated to the set-up characterises of each HHS's RIS, and this might be a technically difficult and expensive process to roll out to each HHS given that a variety of RIS systems are in use across Queensland Health facilities.

8. identify key baseline performance metrics for high value medical equipment so the relevant data can be captured and reported on—to identify available equipment capacity and potential system-wide improvements (Chapter 3).	Agree	Q3 2017/18
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WMHHS would be willing to collaborate with the Department of Health to identify baseline performance metrics for high value medical equipment. The Medical Imaging at WMHHS has been active in developing and reporting on utilisation data relating to the various Medical Imaging units used in the department, including its CT Scanner that falls under the definition of high value medical equipment. Limitations of the current RIS at WMHHS have curtailed the extent and sophistication the utilisation data collected. Never-the-less, WMHHS would be willing to share with the Department of Health and other interested HHSs its Medical Imaging utilisation data collection methodology as a contribution to the development of performance metric benchmarks.

Comments received from Chief Operating Office, North West Hospital and Health Service



North West Hospital and Health Service (NWHHS)

Efficient and effective use of high value medical equipment (Report No. XX: 2016–17)

Response to recommendations provided by Chief Operating Office NWHHS on 16/01/2017.

Recommendation	Agree / Disagree	Timeframe for Implementation (Quarter and Year)	Additional Comments
We recommend that the Department of Health:			
1. leads a comprehensive stocktake of the high value medical equipment fleet across the health system to establish and maintain a complete, accurate register of the state's high value medical equipment (Chapter 2). The analysis should include a review of the completeness and accuracy of the relevant asset information systems used by the health system for financial reporting and asset maintenance	N/A		<include proposed action to implement the recommendation> <if agency does not agree, a brief and clear explanation should be provided>.
2. investigates, in consultation with the hospital and health services, options to aggregate data across the health system asset management systems in a way that provides meaningful decision support information for assets across their life cycle (Chapter 2)	Agree		
3. undertakes a review of the Health Technology Equipment Replacement Program with a particular emphasis on:			
• identifying the most suitable funding arrangements for replacing high value medical equipment as it becomes obsolete. The funding review should consider options for at least a 10 year equipment replacement horizon (Chapter 2)	Agree		Ensure that high value medical equipment does not consume all HTER budget
• identifying whether aspects of the Queensland Policy and Advisory Committee for new Technology process should be applied to the Health	Agree		

Responses to recommendations

Technology Equipment Replacement Program process to increase transparency and rigour in how high value medical equipment replacement decisions are made (Chapter 4).



We recommend that the hospital and health services:

4. develop or augment their strategic asset management plans according to the specific needs of their operational environment (Chapter 2).	Agree	Already in place
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We recommend that the Department of Health and hospital and health services collaborate to:

5. develop guidelines to strategically plan for high value medical equipment assets, addressing key elements of the asset life cycle (Chapters 2, 4)	Agree	
6. consider standardising wait list templates so all hospital and health services are capturing and reporting on the same information—to enhance high value medical equipment planning (Chapters 2, 3)	Agree	May be challenging to impose on private providers
7. standardise definitions for key data points (such as start and completion times) when using high value medical equipment (Chapter 3)	Agree	May be challenging to impose on private providers
8. identify key baseline performance metrics for high value medical equipment so the relevant data can be captured and reported on—to identify available equipment capacity and potential system-wide improvements (Chapter 3).	Agree	May be challenging to impose on private providers

Comments received from Acting Chief Financial Officer, Townsville Hospital and Health Service



Townsville Hospital and Health Service

Efficient and effective use of high value medical equipment (Report No. XX: 2016-17)

Response to recommendations provided by A/CFO, THHS on 30 January 2017.

Recommendation	Agree / Disagree	Timeframe for Implementation (Quarter and Year)	Additional Comments
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We recommend that the Department of Health:

<p>1. leads a comprehensive stocktake of the high value medical equipment fleet across the health system to establish and maintain a complete, accurate register of the state's high value medical equipment (Chapter 2).</p> <p>The analysis should include a review of the completeness and accuracy of the relevant asset information systems used by the health system for financial reporting and asset maintenance</p>		<p><include proposed action to implement the recommendation></p> <p><If agency does not agree, a brief and clear explanation should be provided></p>
<p>2. investigates, in consultation with the hospital and health services, options to aggregate data across the health system asset management systems in a way that provides meaningful decision support information for assets across their life cycle (Chapter 2)</p>		
<p>3. undertakes a review of the Health Technology Equipment Replacement Program with a particular emphasis on:</p> <ul style="list-style-type: none"> • identifying the most suitable funding arrangements for replacing high value medical equipment as it becomes obsolete. The funding review should consider options for at least a 10 year equipment replacement horizon (Chapter 2) • identifying whether aspects of the Queensland Policy and Advisory Committee for new Technology process should be applied to the Health 		

Responses to recommendations

Technology Equipment Replacement Program process to increase transparency and rigour in how high value medical equipment replacement decisions are made (Chapter 4).



We recommend that the hospital and health services:

4. develop or augment their strategic asset management plans according to the specific needs of their operational environment (Chapter 2).	Agree	Calendar 2017	The Townsville Hospital and Health Service Board has endorsed progression.
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We recommend that the Department of Health and hospital and health services collaborate to:

5. develop guidelines to strategically plan for high value medical equipment assets, addressing key elements of the asset life cycle (Chapters 2, 4)	Agree	FY2017-18	
6. consider standardising wait list templates so all hospital and health services are capturing and reporting on the same information—to enhance high value medical equipment planning (Chapters 2, 3)	Disagree	N/A	The recommendations 6.7,8 are unlikely to be practical and would necessitate management at a level which is unlikely to add true value, other measures such as numbers of scans are used in private sector for Medicare rebate levels and seem appropriate
7. standardise definitions for key data points (such as start and completion times) when using high value medical equipment (Chapter 3)			
8. identify key baseline performance metrics for high value medical equipment so the relevant data can be captured and reported on—to identify available equipment capacity and potential system-wide improvements (Chapter 3).			

Comments received from Executive Director Finance, Procurement and Infrastructure, Mackay Hospital and Health Service



Mackay Hospital and Health Services

Efficient and effective use of high value medical equipment (Report No. XX: 2016–17)

Response to recommendations provided by Executive Director Finance, Procurement and Infrastructure on 24 January 2017.

Recommendation	Agree / Disagree	Timeframe for Implementation (Quarter and Year)	Additional Comments
We recommend that the Department of Health:			
<p>1. leads a comprehensive stocktake of the high value medical equipment fleet across the health system to establish and maintain a complete, accurate register of the state's high value medical equipment (Chapter 2).</p> <p>The analysis should include a review of the completeness and accuracy of the relevant asset information systems used by the health system for financial reporting and asset maintenance</p>	Agreed	As Required	The Mackay HHS has only 2 assets in this class, the MRI, and CT Scan. Both items are fully utilised and have active wait lists. It is anticipated that these assets will be considered to effectively utilised.
<p>2. investigates, in consultation with the hospital and health services, options to aggregate data across the health system asset management systems in a way that provides meaningful decision support information for assets across their life cycle (Chapter 2)</p>	Agreed	As Required	Information on utilisation is readily available, and identified to the patient episode. No issue is anticipated in this data aggregation process.
<p>3. undertakes a review of the Health Technology Equipment Replacement Program with a particular emphasis on:</p> <ul style="list-style-type: none"> identifying the most suitable funding arrangements for replacing high value medical equipment as it becomes obsolete. The funding review should consider options for at least a 10 year equipment replacement horizon (Chapter 2) identifying whether aspects of the Queensland Policy and Advisory Committee for new 	Agreed	As Required	The HTER is reviewed by the Clinical Equipment and Consumables Committee of which the CFO is a member. This committee is well placed to respond to any queries described.

Responses to recommendations

Technology process should be applied to the Health Technology Equipment Replacement Program process to increase transparency and rigour in how high value medical equipment replacement decisions are made (Chapter 4).



We recommend that the hospital and health services:

4.	develop or augment their strategic asset management plans according to the specific needs of their operational environment (Chapter 2).	Agreed	Annually	The Mackay HHS is incorporating this onto the routine TAMP processes. While this is an area of improvement the frameworks are now in place.
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We recommend that the Department of Health and hospital and health services collaborate to:

5.	develop guidelines to strategically plan for high value medical equipment assets, addressing key elements of the asset life cycle (Chapters 2, 4)	Agreed	As Required	The TAMP process is well placed to incorporate this strategy.
6.	consider standardising wait list templates so all hospital and health services are capturing and reporting on the same information—to enhance high value medical equipment planning (Chapters 2, 3)	Agreed	As Required	This is in place now with the HTER, and could simply be a review of existing processes/policies
7.	standardise definitions for key data points (such as start and completion times) when using high value medical equipment (Chapter 3)	Agreed	As Required	This may pose practical issues considering the range of equipment. However the concept has merit.
8.	identify key baseline performance metrics for high value medical equipment so the relevant data can be captured and reported on—to identify available equipment capacity and potential system-wide improvements (Chapter 3).	Agreed	As Required	These metrics are likely in place now, (booking diaries etc) so should be a reasonable practicality.

Appendix B—Audit objective and method

Audit objective and scope

The objective of the audit was to assess whether Queensland public hospitals are using high value medical equipment cost-efficiently and are realising expected benefits.

The audit addressed the objective through the sub-objectives and lines of inquiry outlined in Figure B1.

Figure B1
Audit scope

Sub-objectives		Lines of inquiry	
1	High value medical equipment is procured economically	1.1	Strategic asset management principles are applied
		1.2	Procurement options and methods seek to minimise the total cost of ownership
2	Public hospitals use high value medical equipment efficiently	2.1	Hospitals monitor, manage, and report how efficiently they are using high value medical equipment
		2.2	Hospitals are optimising the usage of their high value medical equipment
3	Public hospitals are deriving expected benefits from high value medical equipment	3.1	The expected benefits from the use of high value medical equipment are clearly identified and defined (for example, cost avoidance, better patient outcomes)
		3.2	Benefits realisation processes are undertaken to monitor the efficiency and value of equipment, and results are fed back into strategic asset management plans.

Source: Queensland Audit Office

Entities subject to this audit

- The Department of Health
- all Hospital and Health Services.

We selected the following Hospital and Health Services for field visits:

- Cairns and Hinterland
- Gold Coast
- Metro North
- Metro South.

The audit was conducted in accordance with the *Auditor-General of Queensland Auditing Standards—September 2012*, which incorporate the requirements of standards issued by the Australian Auditing and Assurance Standards Board.

The audit was conducted between January 2016 and December 2016. The audit included:

- medical imaging and radiation oncology facility reviews at the radiation oncology Mater Centre and five hospitals:
 - Cairns Base Hospital
 - Gold Coast University Hospital
 - Princess Alexandra Hospital
 - Royal Brisbane and Women's Hospital
 - The Prince Charles Hospital.
- interviews with Hospital and Health Service staff across eight hospitals including:
 - directors of medical imaging, executive and divisional directors, directors of radiation oncology, surgeons and registrars, nursing directors, radiographers, radiologists, asset directors and administrators, finance managers, business managers, and planning managers
- interviews with Department of Health staff from the Healthcare Improvement Unit, Healthcare Purchasing and System Performance Division, Strategy Policy and Planning Division, Radiology Informatics Support Unit, Queensland Policy and Advisory Committee for new Technology, and Health Support Queensland
- forums with the Medical Imaging Directors Association of Queensland
- analysis of data from:
 - Queensland Radiology Information Systems
 - Cerner RadNet
 - RIPS
 - MOSAIQ
 - Financial Accounting and Materials Management Information System (FAMMIS)
 - ECRI-AIMS
 - wait list data (where retained)
 - departmental diagnostic related groups
 - review of departmental guidance documents
 - review of Hospital and Health Services' and the department's total asset management plans
 - survey of all Hospital and Health Services to identify what high value medical equipment they held, expected end of life, and current maintenance costs.

Appendix C—High value medical equipment per Hospital and Health Service

Figure C1 shows the approximate population serviced by each Hospital and Health Service (HHS) as a percentage across the state, with a breakdown by value and number of high value medical equipment held.

Figure C1
Breakdown by percentage of resident population and high value medical equipment in each HHS

HHS	Proportion of state population resident within HHS (%) ^	HHS funding based on place of treatment (%)	Total high value medical equipment asset value in state (%)	Total number of high value medical equipment assets (%)
Metro North	19.4	18.57	30.6	29.9
Metro South	23.2	20.26	27.1	25.4
Gold Coast	12.0	10.14	12.3	12.7
Townsville	5.2	6.78	10.9	10.4
Cairns and Hinterland	5.8	6.08	6.2	6.0
Children's Health Queensland*	0.0	5.35	4.8	6.0
Sunshine Coast	8.4	7.81	3.8	4.5
Wide Bay	4.5	4.27	0.9	1.5
Central Queensland	4.9	4.21	1.2	0.7
Mackay	3.9	2.8	1.1	1.5
West Moreton	5.3	4.08	0.7	0.7
Darling Downs	5.7	5.26	0.5	0.7
Central West	0.3	0.55	0.0	0.0
North West	0.7	1.23	0.0	0.0
South West	0.6	1.07	0.0	0.0
Torres and Cape York**	0.0	1.55	0.0	0.0
Total	100	100	100	100

Note: ^Population data taken from 2015 HHS total asset management plans submissions

*Children's Health Queensland population not identified as it is the paediatric service provider across Queensland without a specific catchment area.

**Torres and Cape York total asset management plan does not record population serviced.

Source: Queensland Audit Office

It is important to note that some of the larger regional hospitals, such as Cairns and Townsville, provide high value medical equipment services to patients from other neighbouring HHSs that may not have high value medical equipment capability. (For example, Cairns services Cape York patients). Similarly, Metro North and Metro South can provide services to state, national, and international patients. This means that for high value medical equipment services, they may be servicing a larger patient population than Figure C1 suggests, which is reflected in the number of high value medical equipment items they own.

Appendix D—High value medical equipment descriptions

Medical imaging machines

Figure D1
Medical imaging equipment descriptions and cost

Equipment	Description	Approximate acquisition cost per machine
Magnetic resonance imaging (MRI)	This is a diagnostic medical imaging machine used in radiology to image the anatomy and create detailed images of the organs and tissues within the body. MRI can image almost the entire body using strong magnetic fields, radio waves, and field gradients to form images of the body. It does not involve x-ray radiation.	\$1.2 million to \$5.2 million
Computed tomography (CT)	This is a diagnostic medical imaging machine used to create detailed images of internal organs, bones, soft tissue, and blood vessels. A CT generates cross-sectional images (or 'slices') using x-rays and combines all slices to create two-dimensional or three-dimensional images of the body. It uses moderate to high radiation.	\$1 million to \$2.6 million
Positron emission tomography (PET)	This is a nuclear medicine, functional imaging machine used to observe metabolic processes in the body. It is used in clinical oncology (medical imaging of tumours and the search for metastases), and for clinical diagnosis of certain brain diseases.	\$3.2 million to \$4 million
Dual imaging modalities	Traditionally, medical imaging has been performed at different times, in different places, and on different equipment. Extensive development of technology over the years has allowed for image fusion techniques from complementary modalities to offer a more complete and accurate assessment of disease than a single modality. Technology of a combined PET/CT or PET/MRI provides both anatomic and functional images in a single scan.	\$3.2 million to \$5.2 million
Angiography unit	This comprises a patient table with an x-ray tube and detector suspended over it for creating still or video images of the body as a contrast medium is administered. Angiography systems can be used for interventional cardiology (which uses catheters in the treatment of structural heart diseases) or diagnostic procedures, such as an angiogram.	\$1 million to \$2.2 million

Source: Queensland Audit Office—extracted from radiologyinfo.org website and Financial Accounting and Materials Management Information System (FAMMIS)

Radiation oncology machines

Figure D2
Radiation oncology equipment descriptions and cost

Equipment	Description	Approximate cost per machine
Linear Accelerator (LINAC)	This is a device used for delivering radiotherapy treatment, most commonly used for external beam radiation treatments for patients with cancer. The linear accelerator is used to treat all parts/organs of the body. It delivers high-energy x-rays that are focused on the region of the patient's tumour.	\$1.9 million to \$4.1 million
Gamma Knife	This is a non-invasive alternative to neurosurgery that uses radioactive sources to predominantly treat brain tumours and other brain abnormalities. It uses precisely focused beams of radiation to target brain tumours without damaging surrounding healthy tissue.	Approx. \$4.5 million

Source: Queensland Audit Office—extracted from *radiologyinfo.org* website and FAMMIS

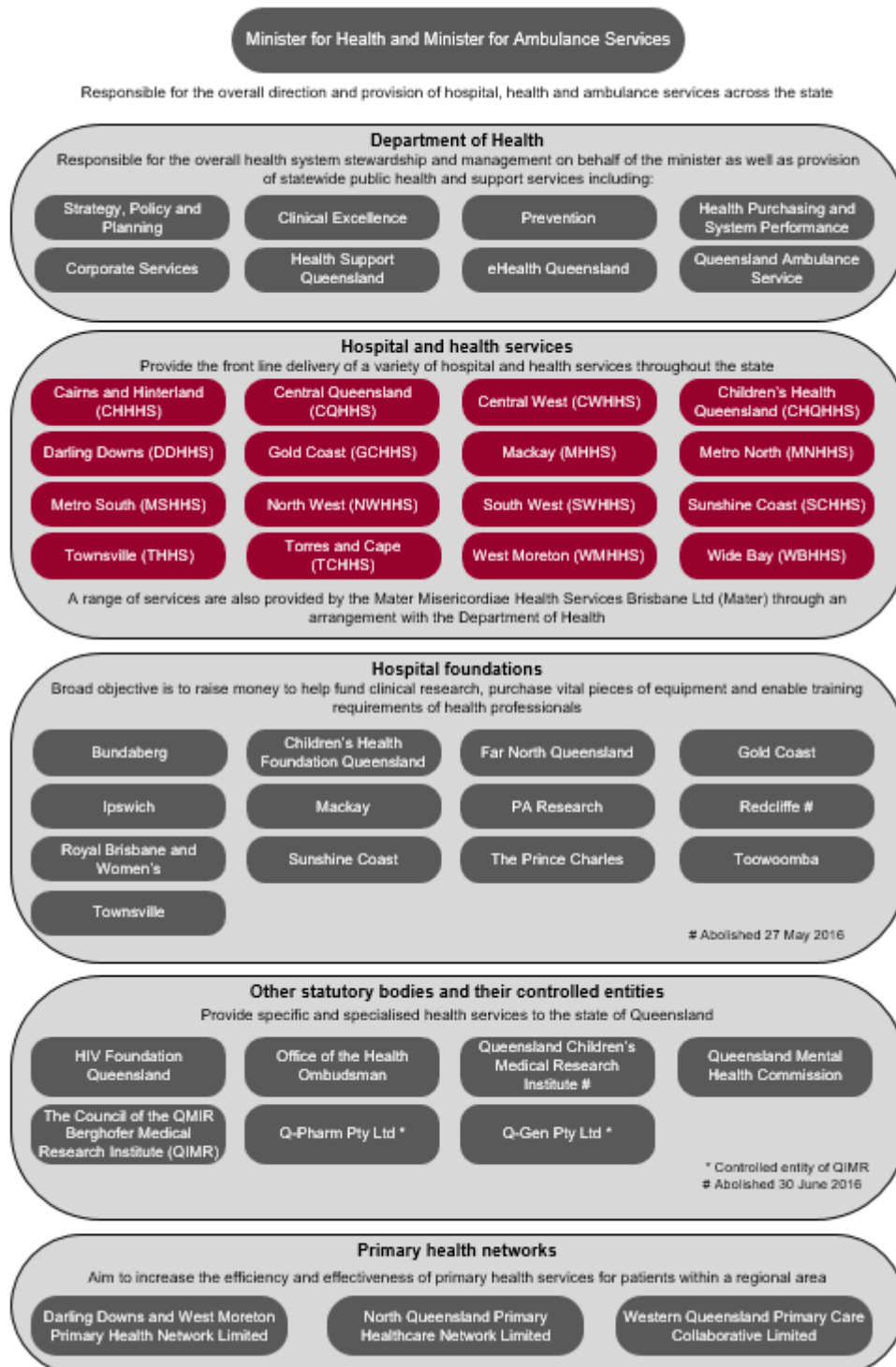
Other high value medical equipment

Figure D3
Other high value medical equipment descriptions and cost

Equipment	Description	Approximate cost per machine
Surgical Robot	This is a robotic surgical system designed to facilitate complex surgery using a minimally invasive approach. A surgeon controls it from a console. Hospitals use it for prostate cancer treatment, but it can perform other surgeries with appropriate funding and modifications.	Approx. \$3.5 million
Cyclotron	This machine produces a beam of charged particles that can be used for medical, industrial, and research processes. The cyclotron produces proton beams which are used to manufacture radioisotopes used in medical diagnosis. Radioisotopes produced in a cyclotron decay by either positron emission or electron capture. Positron emission tomography (PET) relies on cyclotron-produced radioisotopes, using the gamma rays associated with electron capture.	Approx. \$4.5 million
Hyperbaric chamber	This is a machine used to deliver hyperbaric oxygen therapy. A hyperbaric chamber uses pumps and valves to recreate the greater air pressure experienced by divers under water. Pure oxygen or other saturated gas mixtures may also be pumped into a hyperbaric chamber for medical purposes	\$2.2 million to \$2.5 million

Source: Queensland Audit Office—extracted from *the Lancet*, *Australian Nuclear Science and Technology Organisation*, and FAMMIS

Appendix E—Health entities in the Queensland public sector



^ Biomedical Technology Services (BTS) is a business unit of Health Support Queensland.

Source: Queensland Audit Office

Appendix F—Data fields from medical imaging

Information recorded by radiology information systems

A radiology information systems (RIS) is a networked software system for managing medical imaging and associated data. It is used in conjunction with Picture Archive Communication Systems (PACS) to manage patient image archives, record keeping, and billing.

In 2006, the Radiology Informatics Program (RIP) was formed within e-Health operations to continue the development and implementation of a statewide RIS, known as QRIS. RIP also deployed a statewide PACS (enterprise PACS). The scope of the RIP deployment was completed in June 2012, at which time the program was discontinued.

The deployment of these systems as at December 2015 was as follows:

- QRIS—deployed to 97 of 129 health system imaging sites across 10 Hospital and Health Services (HHSs)
- Enterprise PACS—deployed to 82 of 129 health system imaging sites across nine HHSs.

There is no requirement within Queensland for a hospital to use a sole provider of RIS and PACS. This has led to a patchwork arrangement of software systems across the state. In December 2015, Health Support Queensland's Radiology Informatics Support Unit (RISU) identified a split of software systems across the state—summarised in Figure F1.

Figure F1
PACS/RIS details across the health system imaging sites

Facility/HHS	PACS	RIS	Sites	Notes
RBWH	Agfa Impax	Cerner RadNet	1	Standalone site based
PAH	Agfa Impax	Cerner RadNet	1	Standalone site based
Cairns	CDN PACS	RIPS	11	Shared across HHS
Sunshine Coast	Agfa Impax	RIPS	3	Shared across HHS
Ipswich	Fuji Synapse	RIPS	4	Shared across HHS
Redcliffe	Fuji Synapse	RIPS	1	Standalone site based
Logan/Beaudesert	Fuji Synapse	Kestral RIS	2	Shared across 2 sites
Redlands	Fuji Synapse	Kestral RIS	3	Shared across 3 sites
Mt Isa	Private PACS	Private RIS	6	Privately owned
QE II	Private PACS	Private RIS	1	Privately owned
Caboolture	Private PACS	Private RIS	1	Privately owned
Central QLD HHS	Agfa Impax	QRIS	12	Shared across HHS
TPCH	Agfa Impax	QRIS	2	Shared across 2 sites
Townsville HHS	Enterprise PACS	QRIS	7	Shared with 82 sites
Gold Coast HHS	Enterprise PACS	QRIS	2	Shared with 82 sites
Darling Downs HHS	Enterprise PACS	QRIS	18	Shared with 82 sites
Wide Bay HHS	Enterprise PACS	QRIS	10	Shared with 82 sites
Central West HHS	Enterprise PACS	QRIS	11	Shared with 82 sites
South West HHS	Enterprise PACS	QRIS	12	Shared with 82 sites
Mackay HHS	Enterprise PACS	QRIS	8	Shared with 82 sites
Children's Health QLD HHS	Enterprise PACS	QRIS	1	Shared with 82 sites
Gatton	Enterprise PACS	QRIS	1	Shared with 82 sites
Torres and Cape HHS	Enterprise PACS	QRIS	12	Shared with 82 sites

Note: Hospital abbreviations—Royal Brisbane and Women's Hospital (RBWH), Princess Alexandra Hospital (PAH), The Queen Elizabeth II (QE II), The Prince Charles Hospital (TPCH).

Source: The department—Enterprise Radiology Informatics QRIS/Enterprise PACS

The difference of systems meant the data output provided for the audit varied based upon the provider. For our analysis, we assessed the RIS systems and received data from the following systems:

- RIPS
- Cerner RadNet
- QRIS.

The output headings received from each RIS varied depending on the system used and the version of upgrade undertaken. Figure F2 illustrates the data captured by all RIS software.

Figure F2
RIS standard software outputs

RIS system	Request details	Patient details	Exam details	Report details
All RIS	Hospital location Exam identifier Visit identifier	Unique record number Patient gender Patient date of birth Postcode Patient type	Examination room Imaging modality type Examination name	Date time of reporting completed/released

Source: Queensland Audit Office—extracted from RIS data systems

Appendix G—Asset register inconsistencies

Context

The Department of Health's Biomedical Technology Services uses the ECRI-AIMS asset management system to manage its maintenance of high value medical equipment. Biomedical Technology Services charges maintenance fees to each Hospital and Health Service (HHS) for the maintenance it provides.

The Department of Health (the department) invoices the relevant HHSs for these services on a monthly basis. The invoices are accompanied with supporting information about the maintenance performed. This information is extracted from ECRI-AIMS and provides a detailed breakdown of the work performed for the period.

Analysis

We took one month's worth of ECRI-AIMS data (June 2016) for the four HHSs we audited in detail.

We then compared that data with the financial assets listed in the department's Financial and Material Management Information System (FAMMIS), back to the time FAMMIS was established.

We compared the assets in both systems using each asset's (SAID) number, which is intended as a unique identifier for each individual asset in the health system.

We limited our analysis to assets classified in FAMMIS as medical equipment ('MEDEQP').

Observations

We identified some instances where it appeared that maintenance was undertaken on assets that were not located within the HHS that was invoiced for the maintenance. This was based on the business area in FAMMIS in which the asset was recorded as being located.

We also identified some instances where it appeared maintenance was undertaken on equipment that had been registered as 'retired' in FAMMIS by the HHS.

Some example results of our analysis for the one month period (June 2016) are displayed in Figure G1.

Some of the potential inconsistencies between ECRI-AIMS and FAMMIS data may have resulted from where:

- an asset falls below the FAMMIS asset recognition threshold of \$5 000, but still requires maintenance
- the asset is held on consignment but the HHS is responsible for maintenance
- SAID numbers have been entered incorrectly in either ECRI-AIMS or FAMMIS.

At the very least, these anomalies and data inconsistencies require further investigation to determine if maintenance is being undertaken and invoiced where not required or appropriate.

Figure G1
Example data maintenance anomalies between FAMMIS and ECRI-AIMS records

HHS	SAID number in ECRI-AIMS	Asset located in HHS that was invoiced (Y/N)	Asset recorded as 'retired' on FAMMIS (Y/N)
A	10098572	N	Y
A	10052188	Y	Y
B	10068052	N	N
B	10026370	Y	Y
C	10254681	N	N
C	10218422	Y	Y
D	10054000	N	Y
D	10118491	N	N

Source: Queensland Audit Office

Auditor-General reports to parliament

Reports tabled in 2016–17

Number	Title	Date tabled in Legislative Assembly
1.	Strategic procurement	September 2016
2.	Forecasting long-term sustainability of local government	October 2016
3.	Follow-up: Monitoring and reporting performance	November 2016
4.	Criminal justice system—prison sentences	November 2016
5.	Energy: 2015–16 results of financial audits	November 2016
6.	Rail and ports: 2015–16 results of financial audits	November 2016
7.	Water: 2015–16 results of financial audits	December 2016
8.	Queensland state government: 2015–16 results of financial audits	December 2016
9.	Hospital and Health Services: 2015–16 results of financial audits	January 2017
10.	Efficient and effective use of high value medical equipment	February 2017

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