

VAGO

Victorian Auditor-General's Office



Victorian Public Hospital Operating Theatre Efficiency

October 2017



Victorian Public Hospital Operating Theatre Efficiency

Ordered to be published

VICTORIAN GOVERNMENT PRINTER
October 2017

PP No 336, Session 2014–17

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ISBN 978 1 925678 03 1



The Hon Bruce Atkinson MLC
President
Legislative Council
Parliament House
Melbourne

The Hon Colin Brooks MP
Speaker
Legislative Assembly
Parliament House
Melbourne

Dear Presiding Officers

Under the provisions of section 16AB of the *Audit Act 1994*, I transmit my report *Victorian Public Hospital Operating Theatre Efficiency*.

Yours faithfully

A handwritten signature in black ink, appearing to read "Andrew Greaves", is written over a light blue circular stamp.

Andrew Greaves
Auditor-General

18 October 2017

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Acronyms

ABF	Activity-based funding
AIHW	Australian Institute of Health and Welfare
DHHS	Department of Health and Human Services
ENT	Ear, nose and throat
ESIS	Elective Surgery Information System
GP	General practitioner
HSA	<i>Health Services Act 1988</i>
IT	Information technology
KPI	Key performance indicator
SOP	Statement of Priorities
SVHM	St Vincent’s Hospital Melbourne
VAED	Victorian Admitted Episodes Dataset
VAGO	Victorian Auditor-General’s Office
VCDC	Victorian Cost Data Collection
VEMD	Victorian Emergency Minimum Dataset
VINAH	Victorian Integrated Non-Admitted Health
WIES	Weighted Inlier Equivalent Separation

Audit overview

Demand for surgery is rising in response to a growing and ageing population. Health services need to run their operating theatres as efficiently as possible if they are to meet this rising demand, and reduce waiting lists, with their current resources. They also need to balance competing demands from elective surgery and emergency surgery for limited theatre resources.

According to data from 23 health services recorded in Victoria's Elective Surgery Information System (ESIS), demand for elective surgery has increased by 12 per cent over the five years to 2015–16.

The Department of Health and Human Services (DHHS) oversees and funds health services to deliver surgery and other treatment. DHHS leads health system planning, including capital investment and funding allocation to hospitals. DHHS has significant influence on health services' performance as it determines their targets and budgets, and controls infrastructure development.

In this audit, we examined whether Victoria's operating theatres are being used efficiently and whether DHHS's leadership of the health system is driving efficiency. We audited DHHS and four health services—Alfred Health, Austin Health, Melbourne Health and St Vincent's Hospital Melbourne (SVHM). We chose to audit four tertiary hospitals—offering specialist care and catering for complex health needs—because they form a cohort with similar characteristics, which enabled us to compare their practices.

In the course of this audit, we compiled a new dataset that enabled new performance analysis and benchmarking not previously available in Victoria. We also examined policy and reporting documentation used by the health services and DHHS.

Conclusion

Operating theatres are an under-utilised resource across the system. As a result, the costs of surgery are higher than they need to be. More could be done with existing resources, to achieve reduced elective surgery wait times and shorter waiting lists.

Operating theatres are sitting idle for significant periods of time within planned surgical sessions because of late starts and early finishes. Health services need to focus more management attention on factors within their control and collect better performance data.

Current funding arrangements and patient preferences present barriers to health services optimising their operating theatre efficiency. DHHS, as system manager of the health sector, needs to reconsider how it funds health services to ensure that hospitals are encouraged to fully utilise operating theatres.

There are opportunities for DHHS and health services to improve operating theatre efficiency and access to surgery for patients.

Findings

The productive efficiency of operating theatres

We collected operating theatre data from 23 health services from 1 July 2014 to 31 December 2016, which we collated into a new dataset so we could evaluate efficiency across a range of measures. We found that, although the state average is generally good, there is significant variation between health services, as shown in Figure A.

Figure A
Variation in efficiency between health services

Health service	Utilisation rate ^(a)	Unused capacity ^(b)	Salary cost per hour of surgery
Top five health services	87%	2.5%	\$1 672
Bottom five health services	75%	22%	\$2 282

(a) Utilisation rate is based on anaesthetic start to anaesthetic stop timestamps for elective surgery conducted from 1 July 2014 to 31 December 2016.

(b) Unused capacity is for 1 July 2016 to 31 December 2016.

Source: VAGO, based on health services' data.

There are opportunities for improvement across a range of underlying measures that test the efficiency of health services' practices. Each health service could improve efficiency in at least one area. During the time period we looked at, we noted in particular that across Victoria:

- 55 per cent of elective surgical sessions began more than 20 minutes late
- 10 per cent of elective surgical sessions finished more than 90 minutes early.

Despite health services demonstrably trying to improve their productive efficiency, inefficiencies still persist. Health services have attempted to address the problem of surgical sessions starting late by redesigning processes and providing feedback to staff. However, improvements have only been maintained while management keeps focusing on these specific issues.

Health services are using theatres on 90.5 per cent of business days. There is limited spare theatre capacity in metropolitan hospitals, with most spare capacity available in regional hospitals. Health services operating at high capacity will need to use their theatres more efficiently if they are to meet rising demand.

Monitoring operating theatre efficiency

DHHS has set the efficient use of resources as a goal for itself and for health services. However, DHHS cannot evaluate Victoria's operating theatre efficiency because it lacks the required data. It also lacks suitable performance targets for evaluating operating theatre performance.

Health services use varying measures of theatre efficiency, which makes evaluation and comparison difficult. Health services' information technology (IT) systems and processes for capturing data also vary significantly, which affects their ability to report accurately on theatre performance.

As a result, the health sector is limiting its own efforts to improve efficiency, because it cannot systematically identify efficient practice. Without a centralised dataset, benchmarks and monitoring, DHHS and health services are unable to effectively assess how each health service performs compared to its peers and the state average. DHHS and health services are therefore missing opportunities to identify poor and better practice, and to use that information to improve access to surgery in Victoria.

Sharing better practice

We found examples of better practice that, if evaluated and disseminated, could help other health services improve the efficiency of their operating theatres. However, there is no structured forum for health services to share information on better practice initiatives. Information exchange is currently ad hoc and primarily due to staff of different health services sharing information through their professional relationships.

Allocating theatre resources

Health services' resource allocation models

To allocate resources effectively, health services need to evaluate historical data and forecast demand for emergency surgery and non-surgical admissions. They also need to plan elective surgery to meet performance targets for their waiting list and access to surgery.

We found that health services use a significant amount of data when allocating their theatre resources and have developed individualised reporting to understand their business. However, the policies they use to underpin decision-making provide limited guidance on important aspects of resource distribution, such as allocating resources between surgery types. Consequently, health services rely heavily on their managers' knowledge and experience to allocate resources efficiently. Without documented policies, health services cannot effectively evaluate the quality of this decision-making and risk losing corporate knowledge as staff change.

Victoria's health services manage their operating theatres using different resource allocation models, due to variations in their infrastructure, case load, staff profile and historical precedent. In particular, health services vary significantly in how they manage the competition for resources between emergency and elective surgery. Among the audited health services, Alfred Health and Austin Health have the infrastructure to physically separate emergency and elective streams, which correlates with lower overrun sessions across both surgery streams.

We found minimal benchmarking and limited evidence of health services evaluating how their chosen model for allocating resources affects outcomes. This increases the risk that health services are using historical resource allocation models that do not maximise access to surgery.

DHHS's resource allocation model

DHHS is responsible for ensuring that the health system has sufficient operating theatre capacity and funding to enable timely access for Victorians to surgery. DHHS policies also list the efficient operation of the health system as a key goal.

We found that DHHS does not have a dataset to identify theatre capacity usage or theatre efficiency, which inhibits its understanding of Victoria's operating theatre performance. As a result, DHHS is unable to provide targeted support to health services to improve efficiency or reallocate the health budget to better use existing capacity.

DHHS measures the number of people waiting for public hospital elective surgery and the proportion of patients who receive treatment within clinically recommended time frames to evaluate whether the 'right' amount of elective surgery is available to the Victorian public. However, the data DHHS uses to forecast demand and plan delivery is incomplete as it does not include people waiting for surgery at small regional health services who represent 15 per cent of all elective surgery patients. It also does not account for how the waiting list for specialist appointments across the health system affects the elective surgery waiting list. DHHS therefore risks misallocating resources as it increases theatre capacity and allocates budgets to health services.

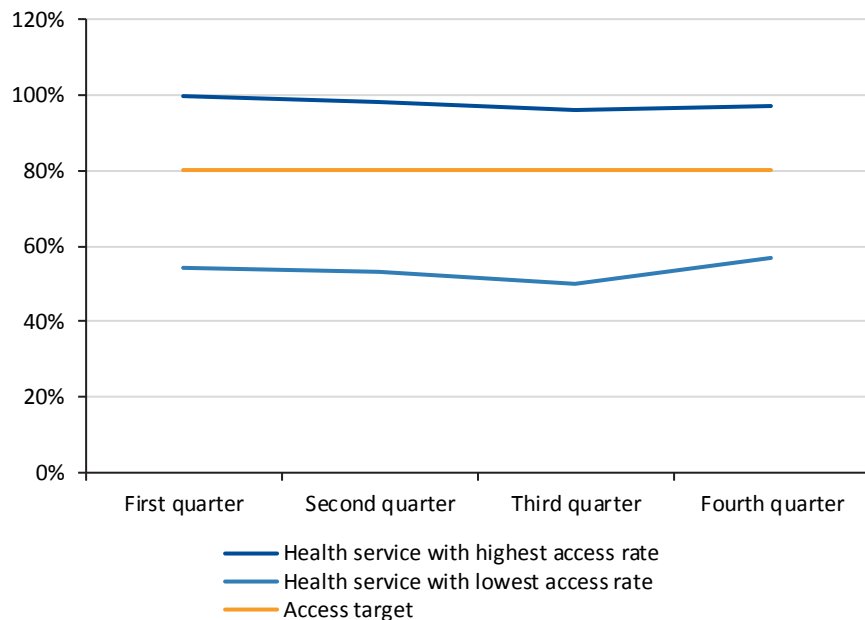
Due to current funding levels, the elective surgery waiting list remains relatively constant each year. However, Victoria is not meeting its access targets for patients waiting for semi-urgent and non-urgent elective surgery.

DHHS began recording emergency surgery start times in 2016–17 and provided some performance information to health services. As yet, there are no timeliness or access targets for emergency surgery nor public reporting. DHHS's analysis does not clearly identify how resource allocation between emergency and elective surgery affects Victorians' access to surgery. This increases the risk that Victorians will wait longer than the clinically recommended time frames for surgery.

We found significant variation between health services:

- Access by clinical need varies significantly between health services and fluctuates throughout the year. Figure B shows how the highest and lowest access rates changed over 2016–17.
- Access to each type of surgery varies between health services, with the median waiting time being up to twice as long for the same surgery at different health services.
- There is no measure for access to emergency surgery that categorises patients’ access within clinically recommended time frames.

Figure B
Category 2 (semi-urgent) elective surgery patients treated within 90 days in 2016–17



Source: VAGO, compiled from DHHS performance data.

To achieve DHHS’s efficiency objective, the funding model needs to encourage health services to use their resources efficiently.

Health services’ internal reporting focuses strongly on meeting DHHS targets and delivering activity levels that will maximise the amount of funding they can receive.

DHHS funds health services up to 104 per cent of their final activity cap. In 2015–16, 19 of the 23 health services delivered activity at 99–105 per cent of their initial cap. The other four finished at 95–98 per cent of their initial cap. While capping funding controls spending on health, it also reduces the incentive for health services to be more productively efficient because they cannot increase their revenue above the cap.

Recommendations

We recommend that the Department of Health and Human Services, in collaboration with health services:

1. implement an agreed suite of definitions, measures and targets for theatre efficiency that target the underlying causes of inefficiency (see Section 4.3)
2. issue mandatory data quality standards for operating theatre data to ensure consistency in the data captured by health services (see Section 4.3)
3. develop a centralised dataset for operating theatre data, to inform decision-making at the Department of Health and Human Services (see Section 4.3)
4. disseminate operating theatre data to health services in a form that enables them to evaluate and benchmark their performance and identify sector best practice (see Section 4.3)
5. establish a regular sector-led, multidisciplinary forum focused on sharing information and practices that improve the efficiency of operating theatres (see Section 4.3)
6. work with the sector to improve productive efficiency at the theatre level, particularly to reduce late starts and underruns (see Section 4.3)
7. develop and implement emergency surgery access measures (see Section 4.2)
8. analyse and forecast the impact of budget allocations on category 2 and 3 surgery access indicators (see Section 4.3)
9. review the current process for setting funding caps, to ensure caps are based on a comprehensive assessment of demand, capacity and performance measures (see Section 4.3)
10. review current operating theatre management guidance provided to health services to incorporate better practice, to drive theatre efficiency (see Section 4.3).

We recommend that the audited health services:

11. formalise governance policies to guide decision-makers when allocating theatre resources between emergency and elective surgery and between surgical specialities (see Section 3.2).

Responses to recommendations

We have consulted with DHHS, Alfred Health, Austin Health, Melbourne Health and SVHM, and we considered their views when reaching our audit conclusions. As required by section 16(3) of the *Audit Act 1994*, we gave a draft copy of this report to those agencies and asked for their submissions and comments. We also provided a copy of the report to the Department of Premier and Cabinet.

The following is a summary of those responses. The full responses are included in Appendix A.

DHHS agrees with the findings in the report focusing on the importance of benchmarking data to drive performance. DHHS has accepted nine of the 10 recommendations directed at it, and accepted recommendation 3 in principle. DHHS will explore options for responding to recommendation 3.

Alfred Health plans to review its policies in line with recommendation 11 and looks forward to working with DHHS on the other recommendations.

Austin Health is undertaking an improvement project focused on theatre efficiency and utilisation, including reviewing governance structures and policies. It is also looking forward to working with DHHS on the recommendations in this report.

Melbourne Health and SVHM did not provide a formal response for inclusion in this report.

1

Audit context

The *Health Services Act 1988* (HSA) establishes Victoria's public health services as independent legal entities that operate at 'arm's length' from DHHS.

In this system of devolved governance, boards appointed by the Minister for Health are responsible for the efficient and effective management of health services. DHHS's role is to fund, monitor and evaluate healthcare delivery. DHHS also retains responsibility for the sector's ongoing capital investment, including building new operating theatres.

While DHHS sets health services' budgets and targets, the boards are responsible for achieving the targets. This includes providing elective and emergency surgery, allocating resources and employing staff. The devolved system therefore allows health services to make 'local decisions for local needs', including on how best to manage their operating theatres.

In 2016–17, 60 health services delivered surgery in 295 operating theatres. In 2015–16, 17 per cent of all hospital admissions involved surgery, as outlined in Figure 1A.

Figure 1A
Healthcare provided by Victorian public hospitals in 2015–16

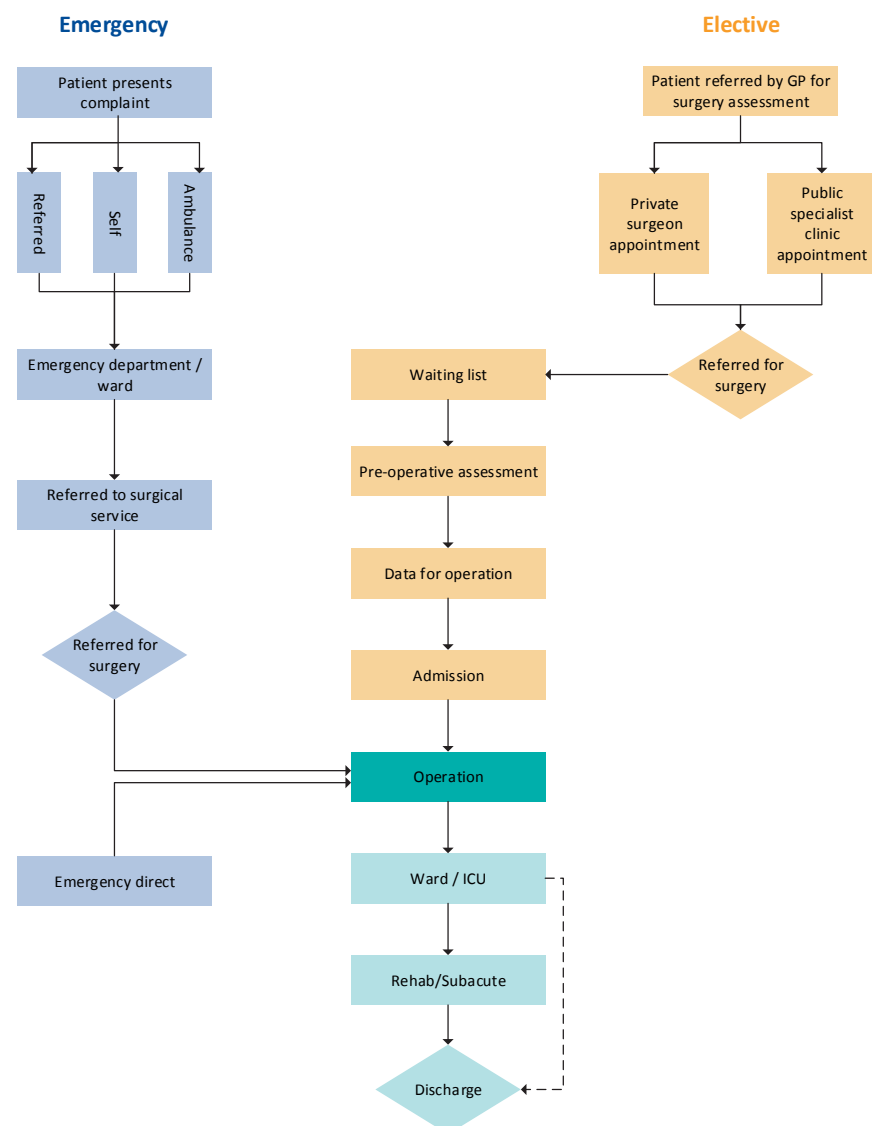
Healthcare	Number	Percentage of admissions
Elective admissions involving surgery	217 203	13%
Emergency admissions involving surgery	68 262	4%
Admissions not involving surgery	1 384 097	83%
Total number of patients treated (surgical and other)	1 669 562	100%

Source: VAGO, based on Australian Institute of Health and Welfare, *Admitted patient care 2015–16: Australian hospital statistics*.

Operating theatres are part of a hospital’s infrastructure, along with specialist clinics, emergency departments, intensive care units and hospital wards. Clinical staff—including surgeons, anaesthetists, nurses and technicians—and other support teams deliver surgical services. These components must be available and coordinated for a theatre to run efficiently, so it is important to consider the hospital holistically when assessing operating theatre performance. In this audit, we have focused on fully equipped operating theatres only, and we have not reported on the use of procedure rooms.

Figure 1B shows the paths patients take through a health service, depending on whether they need elective or emergency surgery.

Figure 1B
Flowchart of surgical services



Note: ‘Emergency direct’ refers to an emergency patient who is transferred from a lower to higher acuity hospital.

Source: VAGO, based on DHHS, *A guide to surgical services redesign: measures for improvement*.

The Australian Institute of Health and Welfare (AIHW) defines the two streams:

- **Elective surgery**—planned surgery that can be booked in advance as a result of a specialist clinical assessment resulting in placement on an elective surgery waiting list.
- **Emergency surgery**—surgery to treat trauma or acute illness following an emergency presentation. The patient may require immediate surgery or may present for surgery at a later time following this unplanned presentation. This includes instances where a patient leaves hospital and returns for a subsequent admission. Emergency surgery includes unplanned surgery for admitted patients and unplanned surgery for patients already awaiting an elective surgery procedure—for example, in cases of acute deterioration of an existing condition.

1.1 Surgery targets and access in Victoria

Each year DHHS negotiates a Statement of Priorities (SOP) with each health service. SOPs outline budgets, waiting list targets, access measures, and safety and quality indicators for each health service.

DHHS sets targets for elective surgery waiting list numbers and access to treatment within clinically recommended time frames. Figure 1C shows DHHS’s key performance indicators (KPI) for elective surgery ‘access and timeliness’. Health services and DHHS report performance against these targets in their annual reports.

Figure 1C
Elective surgery access and timeliness KPIs in health services’ 2016–17 SOPs

KPI	Description	Target
Category 1 admit	Percentage of category 1 (urgent) elective surgery patients admitted within 30 days	100%
Category 1, 2 and 3 admit	Percentage of category 1 (urgent), 2 (semi-urgent) and 3 (non-urgent) elective surgery patients admitted within clinically recommended time frame	94%
Longest waiting elective surgery patients	20 per cent longest waiting urgency category 2 and 20 per cent longest waiting category 3 patient removals from the elective surgery waiting list	100%
Elective surgery waiting list	Number of patients on the elective surgery waiting list	Specific to individual health services
Hospital-initiated postponements	Number of hospital-initiated postponements per 100 scheduled elective surgery admissions	Less than 8 out of 100
Admissions	Number of patients admitted from the elective surgery waiting list	Specific to individual health services

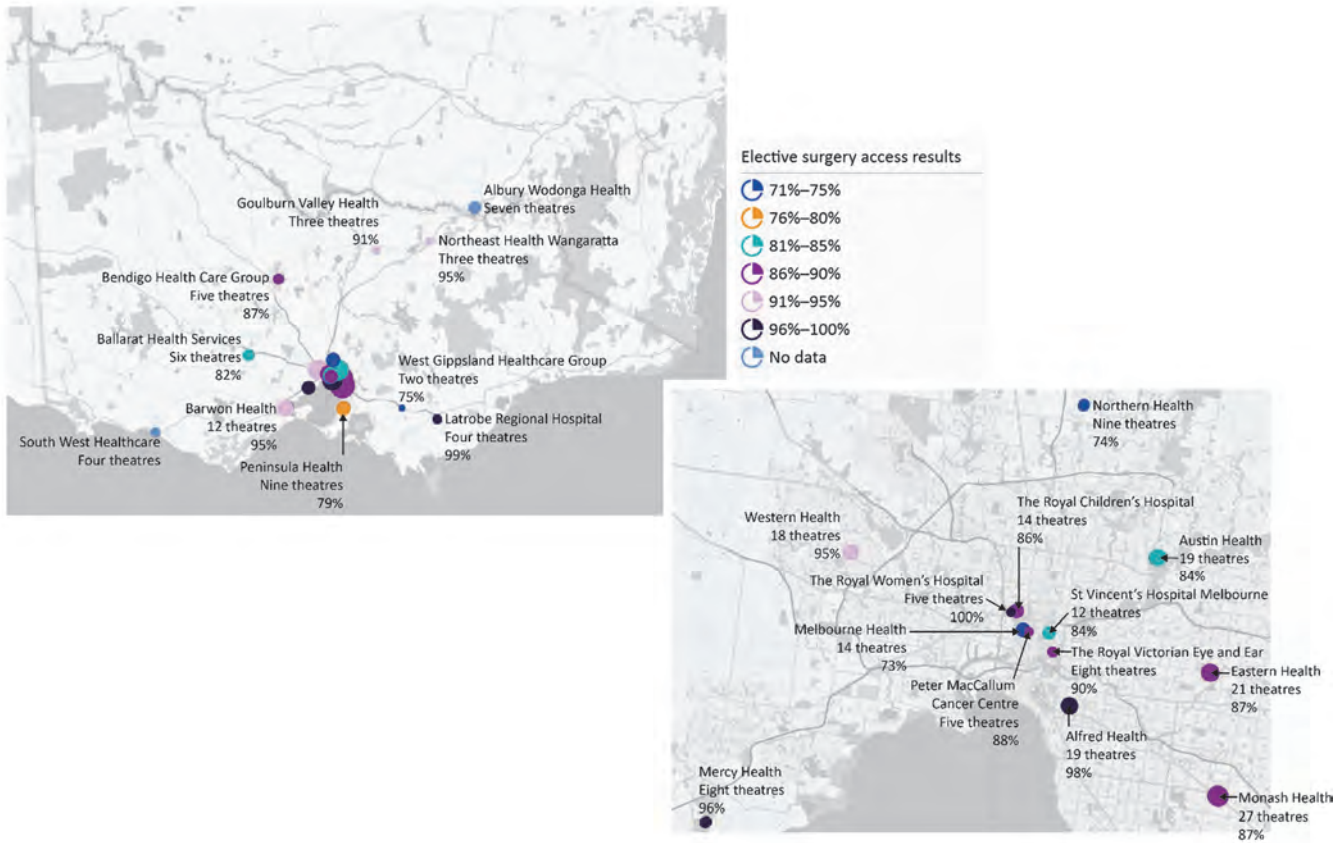
Note: Surgery categories 1, 2 and 3 are defined in Figure 1F.

Source: VAGO, compiled from health services’ statement of priorities 2016–17.

DHHS uses the elective surgery waiting list to monitor the demand for elective surgery in Victoria. It collates the state waiting list from data provided by the 23 health services that report to DHHS’s Elective Surgery Information System (ESIS). The 37 health services not included in the ESIS dataset are small regional health services. DHHS excludes these health services, which represent 15 per cent of elective surgery cases, to release them from the administrative burden that reporting would place on them.

Figure 1D shows the 23 ESIS health services, the number of theatres that each health service runs, and their elective surgery access results for 2015–16.

Figure 1D
Map of health services across Victoria



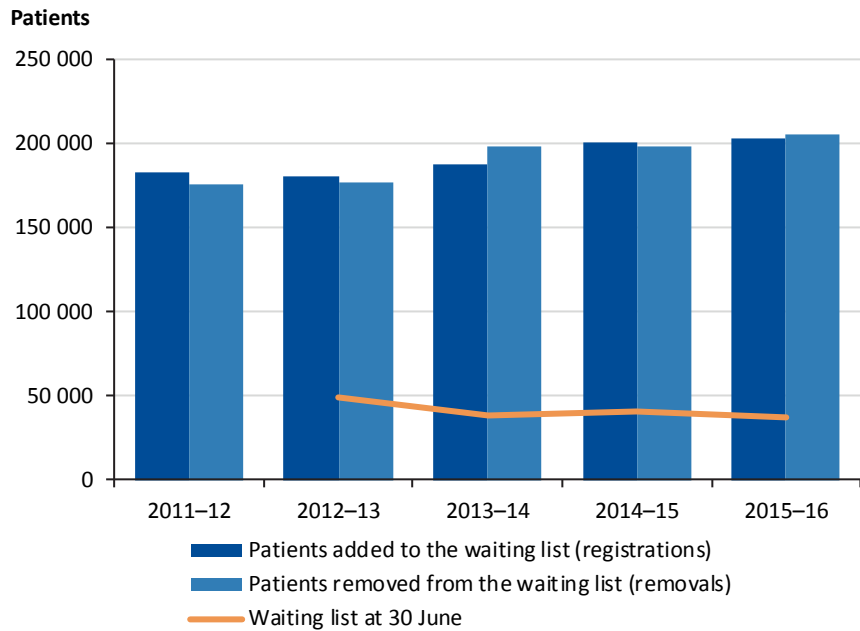
Note: In 2016–17, Albany Wodonga Health Service and South West Healthcare joined ESIS.

Source: Compiled by VAGO. Theatre numbers are based on DHHS data. Access levels are compiled from health services’ 2015–16 annual reports.

The number of people on the elective surgery waiting list increases or decreases based on additions—surgical registrations—and removals, as well as the number of health services contributing their data to ESIS. Removals occur for various reasons, mainly due to patients receiving elective surgery.

Figure 1E shows elective surgery waiting list numbers over time and highlights the relationship between additions and removals. The waiting list target for 2016–17 was 38 498.

Figure 1E
Elective surgery registrations and removals from the waiting list



Note: The waiting list at 30 June 2012 was not reported in the former Department of Health’s annual report for 2011–12, so there is no comparable data for this period.

Source: VAGO, based on DHHS data.

Elective surgery patients are categorised by clinical urgency, as shown in Figure 1F. These categories are consistent nationally and indicate the recommended time frame in which health services should treat patients. Health services report their results, and Victoria’s performance overall is reported at state and federal levels.

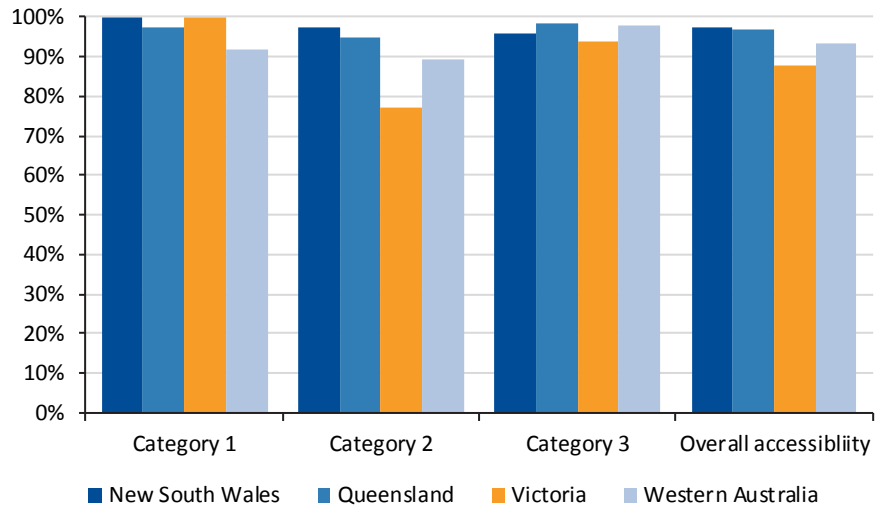
Figure 1F
Elective surgery clinical categorisation definitions

Clinical category	Recommended time frame in which treatment should occur
Category 1 (urgent)	30 days
Category 2 (semi-urgent)	90 days
Category 3 (non-urgent)	365 days

Source: VAGO, based on DHHS elective surgery access policy.

In 2015–16, Victoria met its category 1 target of 100 per cent, although Victoria’s performance lags behind comparable states for category 2 and category 3 patients, as shown in Figure 1G.

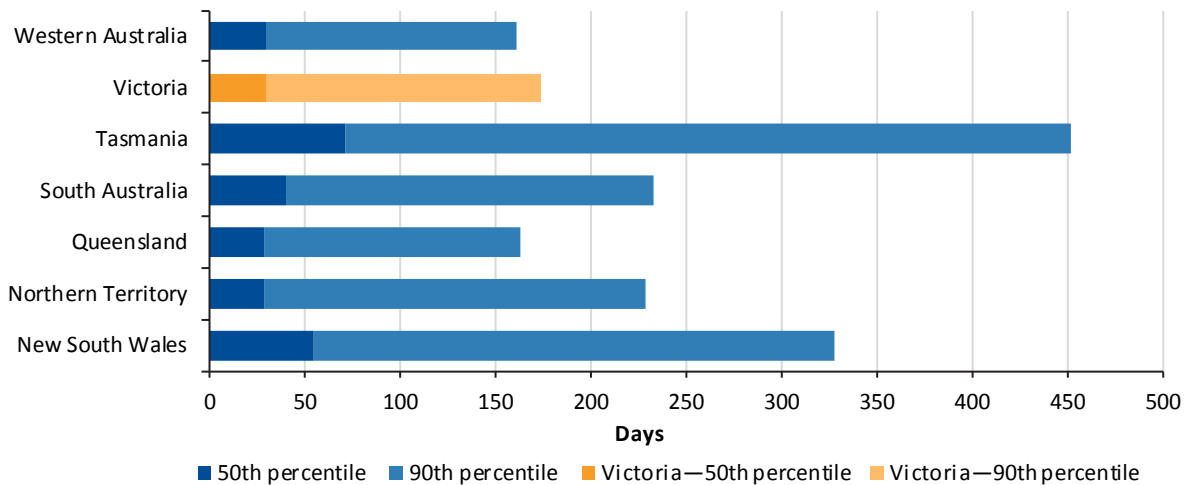
Figure 1G
Proportion of patients treated within clinically recommended time frames



Source: VAGO, based on AIHW, *Elective surgery waiting times 2015–16: Australian hospital statistics*.

AIHW collects data from each state and territory to report on health services’ performance nationally. Figure 1H shows that Victoria’s performance is comparable when considering the wait time for patients at the 50th and 90th percentiles. AIHW does not report on access to emergency surgery, as there are no nationally agreed measures.

Figure 1H
Elective surgery, time to admission (days), 2015–16

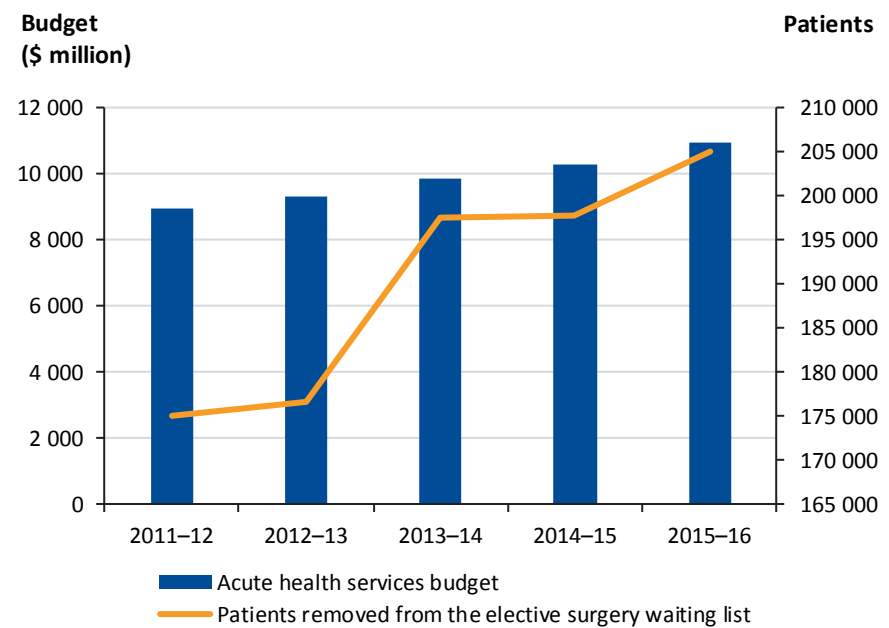


Source: VAGO, based on AIHW, *Elective surgery waiting times 2015–16: Australian hospital statistics*.

1.2 Funding surgery

The Victorian State Budget allocated \$11.8 billion to acute health services in 2016–17 and \$13.1 billion in 2017–18. Figure 1I shows that the acute health services' budget has grown significantly from 2011–12 to 2015–16.

Figure 1I
Victoria's budget allocation for acute health services



Source: VAGO, based on State Budget papers and DHHS ESIS data.

Funding for surgery is included within the budget for acute health services—there is no budget specifically allocated to surgery. However, the Victorian Government regularly funds budget initiatives to increase the delivery of elective surgery, as shown in Figure 1J.

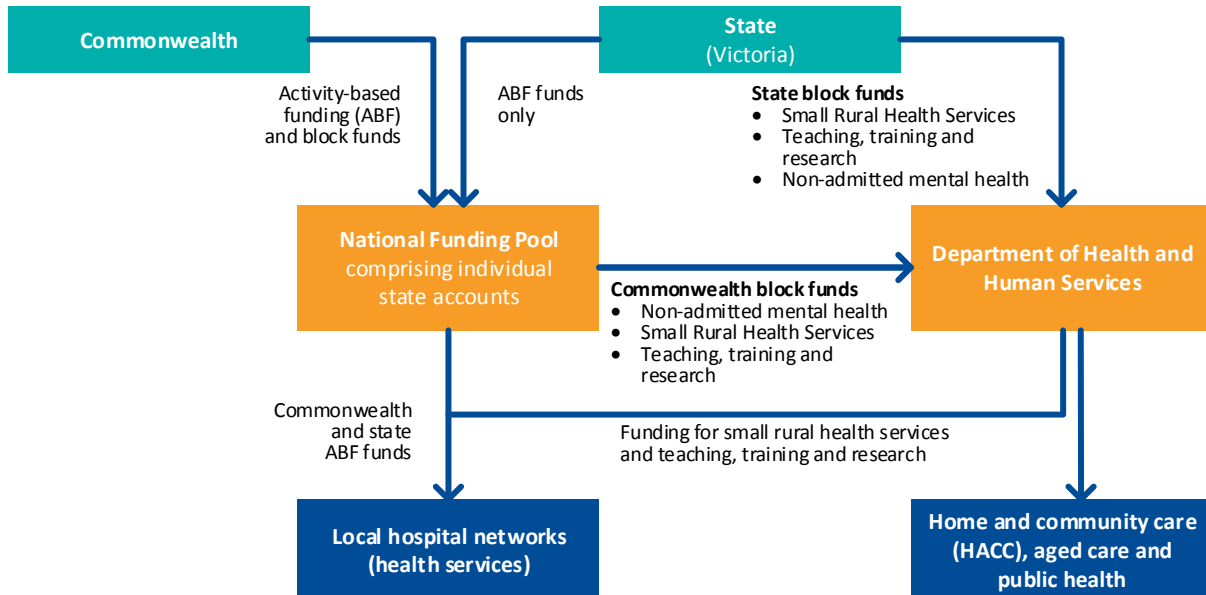
Figure 1J
State Budgets' priority focus on elective surgery

Budget year	Name of initiative	Funding promise
2012–13	Sustaining hospital performance—maintaining elective surgery capacity	\$44 million
	Sustaining hospital performance—ongoing elective surgery	\$149.8 million over four years
2013–14	Securing Victoria's health system—elective surgery	\$420.6 million over four years
2014–15	Boosting elective surgery capacity	\$190.1 million over four years
2015–16	Elective surgery boost	\$60 million
2016–17	Improving access to elective surgery	\$335.2 million over five years

Source: VAGO, based on State Budget papers.

DHHS funding is a combination of state and Commonwealth money, as shown in Figure 1K.

Figure 1K
Commonwealth and state funding for health services



Source: VAGO, based on DHHS, *Policy and funding guidelines*, 2016.

Activity-based funding

DHHS provides activity-based funding (ABF) and fixed funding to health services.

ABF funds health services for the treatment—or ‘activity’—they deliver. There are multiple streams—including acute admitted care, which funds most elective and emergency surgery.

In setting the budget for acute admitted care, DHHS considers:

- the state’s elective surgery waiting list target
- its overall financial constraints
- the sector’s previous performance
- capacity changes, such as new operating theatres
- forecast growth in demand
- its responsibilities in other areas of healthcare.

Health services receive a Weighted Inlier Equivalent Separation (WIES) payment for each patient treated or ‘separated’ from the hospital. A ‘separation’ refers to the patient’s journey from admission to discharge. The WIES number of units paid for a patient is adjusted—or ‘weighted’—according to a patient’s condition, treatment and length of stay. DHHS pays a set price for each WIES unit, which was \$4 640 in 2016–17. DHHS resets the WIES price and its weightings annually to reflect changing hospital costs.

Capping activity-based funding levels

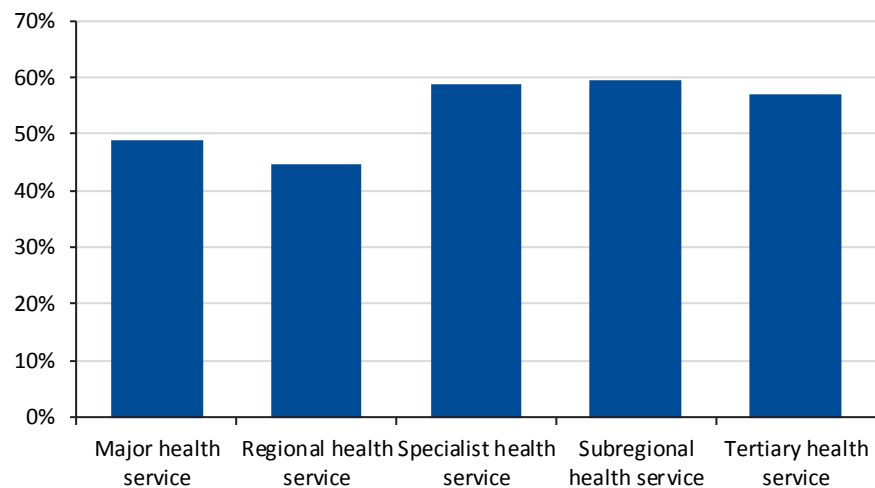
A health service's WIES cap is the maximum amount of WIES units DHHS agrees to fund. There are multiple categories of WIES, and each category attracts a different payment. The two main categories are:

- **WIES public**—for patients who are using only the public system
- **WIES private**—a lower payment for patients who use their private health insurance for their treatment in a public hospital.

The WIES cap influences the numbers of patients health services are funded to treat. DHHS funds activity delivered within a health service's cap at the full WIES price, and funds activity between 100 and 104 per cent of the cap at 50 per cent of the WIES price. Any further activity is unfunded unless DHHS adjusts the health service's WIES cap during the year.

In 2015–16, surgical separations consumed 54 per cent of the ESIS health services' WIES public and private funding allocation. The amount varied by peer group, as shown in Figure 1L. This is due to health services managing varying case loads. The remainder of the cap was used on patients requiring treatment other than surgery.

Figure 1L
Percentage of WIES public and private cap attributed to surgical separations, 2015–16



Note: Data was calculated by comparing total WIES public and private units funded for surgical separations from the Victorian Admitted Episodes Dataset (VAED) compared to the total WIES public and private funding caps identified in health services' annual reports.

Source: VAGO, based on DHHS VAED data and health services' 2015–16 annual reports.

1.3 Why this audit is important

Victoria's health system faces rising demand for surgical services from a growing and ageing population, which is increasing pressure on health services and the State Budget to maintain or improve access. Victoria's health system needs to use its resources—including operating theatres—efficiently to maintain or improve standards as demand rises.

This audit builds on our previous hospital efficiency audits, particularly the *Efficiency and Effectiveness of Hospital Performance: Emergency Care* and the *Hospital Performance: Length of Stay* audits in 2016. It continues our theme of examining hospital-level efficiency and how DHHS fulfils its role as system manager.

Recent audits of operating theatre efficiency in New South Wales, Western Australia and Queensland have all identified barriers to the efficient use of operating theatres. In this audit, we examine these barriers and the measures of efficiency in Victoria.

1.4 What this audit examined and how

The objective of the audit was to determine whether Victoria's public hospitals optimise their use of operating theatres to undertake surgery.

To address this objective we examined:

- the use of data to assess efficient performance
- the allocation of theatre resources between competing priorities
- how management and funding of the system encourage efficient performance.

The audited entities were DHHS and four health services—Alfred Health, Austin Health, Melbourne Health and SVHM. We chose to audit four tertiary hospitals—offering specialist care and catering for complex health needs—because they form a cohort with similar characteristics. This enabled us to compare their performance and practices.

We obtained operating theatre data from the 23 Victorian health services in ESIS to create a new dataset to measure theatre efficiency. In many of the report's charts, we have used anonymous letters to refer to the health services not included in the audit but from whom we obtained data. We added elements of DHHS's datasets and the health services' financial data to the operating theatre data to conduct the analysis in this report. We collected operating theatre data for 2014–15, 2015–16 and the first half of 2016–17 from health services. DHHS's data and health services' financial data covered 2014–15 and 2015–16.

In collating the data, we conducted detailed analysis to link the data accurately and remove identifiable errors.

Using the new dataset, we were able to create a dashboard to analyse health system performance in multiple ways not previously undertaken in Victoria. The dashboard enables users to analyse the efficiency of the healthcare system, health services, hospitals, theatres, specialities and surgeons.

We reviewed available legislation, policy guidance and industry standards for operating theatre efficiency in Victoria and other Australian jurisdictions.

We carried out this audit in accordance with section 15 of the *Audit Act 1994* and the Australian Auditing and Assurance Standards. The total cost of the audit was \$955 000.

1.5 Definitions

Throughout the audit, we used two definitions of efficiency—productive efficiency and allocative efficiency—derived from AIHW and the Productivity Commission. We identified various measurements, as shown in Figure 1M.

Figure 1M
Measures and definitions of efficiency for operating theatres

Measure	Description
Productive efficiency	
Utilisation rate	The proportion of time surgery is performed during a planned surgical session
Cost per hour	The average salary cost of performing an hour of surgery
Length of surgery	The relative length of an operation occurring at different health services
Unused capacity	The number of business days on which an operating theatre is closed
Allocative efficiency	
Access between types of surgery	Comparative access to different types of surgery in Victoria
Access between health services	Comparative access to surgery at different health services

Source: VAGO, based on AIHW and Productivity Commission definitions.

Productive efficiency requires health services to use their theatre resources to perform the most surgery possible. Allocative efficiency ensures timely access to surgery for patients across a range of factors, including:

- resource levels to meet demand for surgery
- theatre resources balanced between elective and emergency streams
- equity between patients for different types of surgery with similar clinical urgency, regardless of the health service where they seek treatment.

DHHS analyses the effect of different resource levels on surgery numbers. The government then uses this analysis, along with other relevant information, to set the health budget at a level it considers will enable allocative efficiency.

DHHS allocates funding to health services to deliver the state's surgery targets —elective surgery waiting list numbers and access targets. DHHS's success in allocating the right amount of resources is measured by changes to the elective surgery waiting list and the proportion of patients who receive treatment within clinically recommended time frames. The state does not have explicit targets for emergency surgery efficiency, but does forecast growth in demand for emergency surgery.

1.6 Report structure

The remainder of this report is structured as follows:

- Part 2 looks at the productive and allocative efficiency of operating theatres in Victoria's public hospitals, with a key focus on data analysis
- Part 3 looks at whether the management practices of health services lead to the efficient use of operating theatre resources
- Part 4 looks at how system design at the health service and health system levels contribute to the efficient use of Victoria's operating theatres.

2

Current performance levels

In this part of the report, we analyse the productive efficiency of operating theatres in Victoria’s public hospitals. For this purpose, we have identified various measures of productive efficiency, as shown in Figure 2A.

Figure 2A
Measures of productive efficiency for operating theatres

Measure	Description
Utilisation rate	The proportion of time surgery is performed during a planned surgical session
Cost per hour	The average salary cost of performing an hour of surgery
Length of surgery	The relative length of an operation occurring at different health services
Unused capacity	The number of business days on which an operating theatre is closed

Source: VAGO.

Theatre resource inputs include:

- **physical assets**—operating theatres and equipment
- **surgical consumables**—such as prostheses and pharmaceuticals
- **clinical staff**—surgeons, anaesthetists, nurses and technicians
- **management overheads**—such as executive staff involved in surgical planning.

2.1 Conclusion

Health services are hindered by practices and system features that inhibit productivity gains. Health services can improve their productive efficiency by minimising idle time during surgical sessions and by maximising the time that their theatres are available for surgery. This would reduce their average cost of surgery and is likely to reduce elective surgery wait times and waiting lists.

Late starts and underruns contribute most to inefficient practice at health services. Both can be reduced by more focused management attention, including providing individuals with targeted feedback on their performance backed by reliable data.

More effective system-wide management of the health system is also needed. There are no mandatory standardised data definitions or efficiency performance targets and, therefore, no valid benchmarking. There is also no central oversight of unused theatre capacity or of theatre utilisation rates, and the current funding model does not provide incentives for health services to use their unused capacity.

2.2 Utilisation rate

The utilisation rate is the proportion of time in a surgical session that the operations—anaesthetic processes and surgery—are actually occurring.

A surgical session is the rostered time when surgeons, anaesthetists, nurses and other staff are in the theatre and available to perform surgery. Staff are rostered in either part-day or full-day sessions.

Higher utilisation rates generally result in more operations being performed within a surgical session for the same salary costs—as staff are paid whether they are performing surgery or not—and reduced waiting lists and wait times for surgery.

Current utilisation performance

Health services have developed their own methods for collecting performance data and have different performance measures and IT systems. We have factored these differences into our analysis and, where necessary, have excluded some health services if we could not link their data consistently with that of the others.

Due to variations in practice, we report two elective surgery utilisation rates for Victoria to enable comparisons, as described in Figure 2B. We calculated Victoria's public hospital operating theatre utilisation rate as 74 per cent—if measured from 'anaesthetic start to surgery stop'—or 80 per cent—if measured from 'anaesthetic start to anaesthetic stop'.

Figure 2B
Theatre utilisation—elective surgery session performance for Victoria

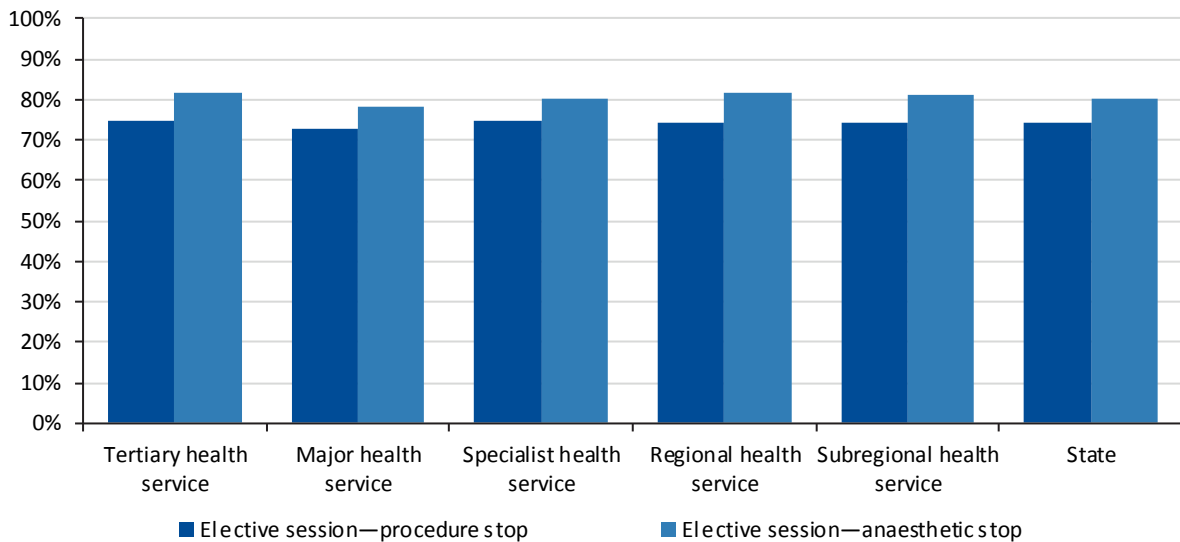
Utilisation measure	Description	Utilisation rate
Anaesthetic start to surgery stop ^(a)	From when the anaesthetist starts working on the patient until the surgeon finishes the operation. All health services provided data to enable this measurement.	74%
Anaesthetic start to anaesthetic stop	From when the anaesthetist starts working on the patient until he or she releases control of the patient after surgery. Not all health services provided an 'anaesthetic stop' timestamp.	80%

(a) This measure under-reports the actual utilisation rate as it excludes the anaesthetists' work that occurs after surgery in theatre.

Source: VAGO.

When disaggregated, we observe variations in utilisation rates between peer groups, shown in Figure 2C, and between individual health services, shown in Figure 2D.

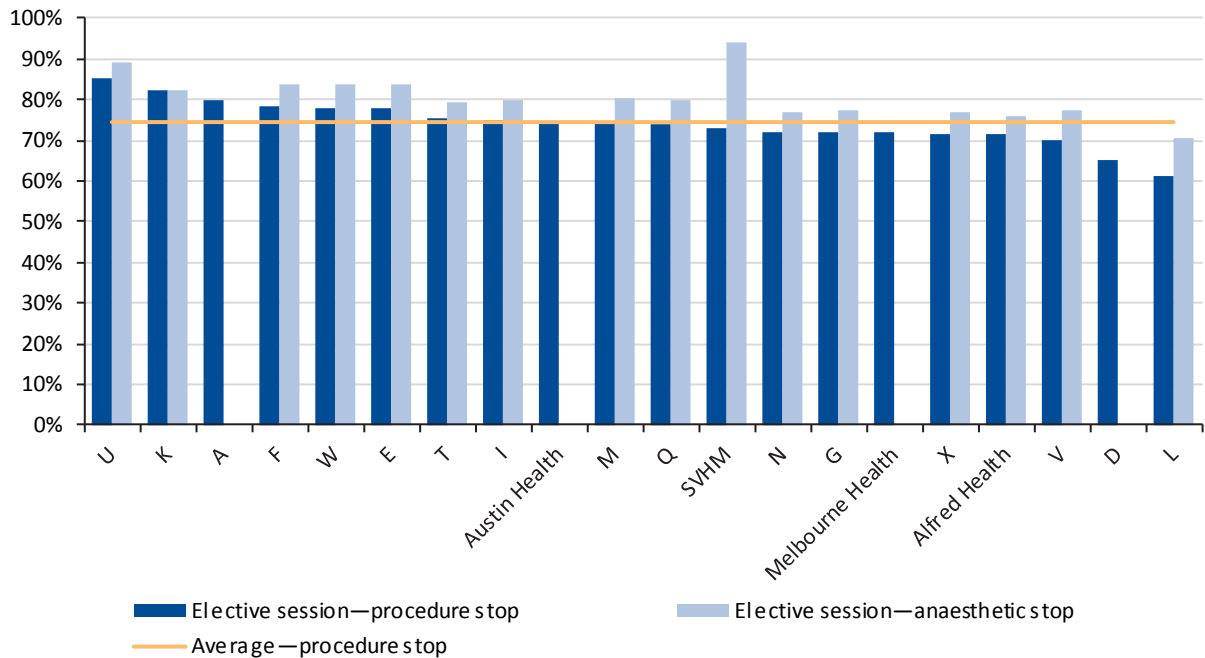
Figure 2C
Utilisation rate for elective surgery sessions, by peer group, 1 July 2014 to 31 December 2016



Note: A peer group comprises health services of similar size, location and capability.

Source: VAGO.

Figure 2D
Utilisation rate for elective surgery sessions, by health service, 1 July 2014 to 31 December 2016



Note: All health services provided a ‘procedure stop’ timestamp, although not all provided the ‘anaesthetic stop’ timestamp. Austin Health collect an ‘out of room’ timestamp to measure the end of a procedure, however this was not included in the dataset we compiled.

Note: Some operating theatres at Melbourne Health and Alfred Health do not have anaesthetic bays attached, which lowers utilisation rate because a patient cannot begin the anaesthetic process while the previous surgery is underway.

Source: VAGO, based on health services’ operating theatre data.

We have excluded emergency surgery and non-business day elective sessions from our calculations for several reasons:

- Health services must provide access to emergency surgery based on need. Access and utilisation rates are correlated with each other and driven by the amount of theatre resources health services dedicate to emergency surgery—a high resource allocation will improve access but reduce utilisation rate.
- Health services deliver different amounts of emergency surgery, so performance cannot be reliably compared when emergency sessions are included.
- The efficiency of an elective surgery session is within the control of the health service, whereas the efficiency of an emergency surgery session is not. Assessing performance against elective sessions is a more reliable gauge of theatre management.
- Scheduling elective surgery sessions on a non-business day—such as a weekend—is irregular and health services perform different amounts. We excluded these sessions to improve comparability.

Factors that drive utilisation rates

Victorian hospitals have a range of different theatre infrastructure. A health service's infrastructure influences its theatre utilisation rate—particularly if its operating theatres have separate anaesthetic rooms. These enable anaesthetists to begin working on patients while earlier surgery sessions are still underway.

Other key issues that affect utilisation rates are:

- the first case of a session not starting on time
- unreasonably long turnaround times between surgeries
- a session underrunning its allocated time because the final case finishes before the session's closing time
- a session overrunning its scheduled finishing time.

If health services improve their performance against these factors, they increase their capacity to provide more surgery within existing resources, as they pay staff for an entire surgical session regardless of their productivity.

Figure 2E shows that late starts and underruns are the two key drivers of idle capacity—more than 75 per cent start more than 15 minutes late at the positioning and preparation stage, and 55 per cent of sessions underrun by an average of half an hour.

Figure 2E
Underlying factors affecting utilisation rate, 1 July 2014 to 31 December 2016

Factor	First case start				Percentage of cases	Average time (minutes)
	0–15 minutes	15–30 minutes	30–45 minutes	>45 minutes		
Procedure step						
Anaesthetic start	30.1%	31.2%	23.7%	15.1%		
Positioning and preparing the patient	24.0%	38.0%	24.9%	13.0%		
Surgery start	12.2%	40.0%	33.0%	14.8%		
Turnaround time						
From procedure stop						21.0
From anaesthetic stop						17.5
Underruns and overruns						
Underrun					55.3%	31.8
Overrun					16.4%	12.0

Source: VAGO.

If a four-hour surgical session starts 20 minutes late and finishes 30 minutes early, then more than one-fifth of the entire session is unused and theatre staff are being paid for their presence but not their work.

We expected to find that late starts correlate strongly with fewer underruns and more overruns (or more cancellations), reasoning that starting late may cause surgeons to overrun their scheduled session or cancel elective surgery.

What we found was health services with high incidences of both late starts and underruns. This indicates that these health services construct surgical lists with a time buffer to avoid running late or cancelling surgery. In doing so, they enable these inefficient practices to persist without addressing the causes of wasted surgical time.

Health services' results against common efficiency performance indicators are shown in Appendix F.

Late starts

A surgical session 'starts late' if the first operation does not begin at the session's commencement. Health services have different theatre infrastructure, timestamp definitions and IT systems, which influence how they measure their late start performance. In particular, we found that health services use different points in the procedure to assess performance, which inhibits comparison.

We analysed late starts at three different points in the procedure:

- **anaesthetic start**—when the anaesthesia process begins, shown in Figure 2F
- **positioning and preparation**—when the patient is prepared by the surgical team for surgery in the theatre, shown in Figure 2G
- **surgery start**—this measure varies between health services, as they have different definitions for when surgery has started, shown in Figure 2H.

These charts show the proportion of cases that started in each five-minute block after the surgical session began. The darker the box, the higher the percentage of cases begun in that time block. Ideally, the charts should be darker to the left and lighter to the right—Figure 2F exhibits this pattern, but Figure 2H does not.

Health services have cited management focus and the provision of data-supported performance feedback as key drivers in reducing late starts.

Among the audited health services, Alfred Health demonstrated the strongest performance in minimising late starts, with 45 per cent of its surgery beginning within 20 minutes of the scheduled session start. Alfred Health staff advised that the key to this result was to provide data-driven feedback that attributes personal responsibility and accountability for timeliness to staff when appropriate.

Figure 2F

**Percentage of cases when anaesthetic has started, relative to session start time (minutes),
1 July 2014 to 31 December 2016 (elective sessions only)**

	0	5	10	15	20	25	30	35	40	45	50	55	60
Major health services	14.2%	10.7%	9.8%	7.7%	6.6%	4.8%	7.1%	5.5%	6.5%	7.2%	7.3%	6.0%	6.7%
Regional health services	13.8%	12.8%	11.1%	8.0%	6.4%	5.2%	6.8%	4.9%	6.0%	6.5%	6.7%	5.8%	6.0%
Specialist health services	20.0%	16.0%	11.1%	7.7%	5.5%	4.7%	5.2%	4.9%	5.6%	5.3%	5.0%	4.8%	4.3%
Subregional health services	13.4%	14.7%	10.3%	7.7%	6.7%	5.8%	6.8%	6.4%	6.2%	5.7%	6.3%	5.5%	4.6%
Tertiary health services	15.3%	11.4%	9.6%	7.0%	5.9%	4.9%	6.9%	5.8%	6.6%	6.9%	7.1%	5.9%	6.5%

Source: VAGO.

Figure 2G

Percentage of cases when the patient is being positioned and prepared in theatre, relative to session start time (minutes), 1 July 2014 to 31 December 2016 (elective sessions only)

	0	5	10	15	20	25	30	35	40	45	50	55	60
Major health services	8.8%	9.7%	11.8%	10.8%	10.4%	7.9%	8.2%	6.0%	6.1%	5.3%	5.2%	5.2%	4.6%
Regional health services	5.2%	10.2%	14.7%	15.7%	12.7%	9.3%	7.1%	5.2%	4.6%	3.9%	4.5%	4.2%	2.9%
Specialist health services	13.8%	17.4%	14.9%	9.9%	6.9%	4.8%	5.2%	4.3%	4.9%	4.4%	5.1%	4.4%	4.0%
Subregional health services	4.4%	10.4%	13.4%	11.8%	9.2%	8.0%	7.4%	5.7%	7.1%	6.0%	6.9%	5.8%	4.0%
Tertiary health services	14.0%	12.8%	12.4%	9.3%	7.5%	5.3%	6.3%	5.2%	5.9%	5.9%	5.7%	5.0%	4.8%

Source: VAGO.

Figure 2H

**Proportion of cases when surgery has started, relative to session start time (minutes),
1 July 2014 to 31 December 2016 (elective sessions only)**

	0	5	10	15	20	25	30	35	40	45	50	55	60
Major health services	6.0%	6.7%	11.2%	12.0%	12.1%	8.9%	9.2%	6.7%	6.4%	5.9%	5.7%	5.1%	4.1%
Regional health services	1.4%	4.9%	9.6%	13.6%	14.4%	11.7%	10.2%	7.8%	6.7%	5.8%	5.5%	5.1%	3.2%
Specialist health services	0.8%	3.6%	10.1%	14.2%	15.8%	12.8%	10.1%	7.1%	6.0%	5.4%	5.1%	5.2%	3.8%
Subregional health services	1.4%	3.9%	7.5%	10.5%	12.9%	10.9%	10.5%	8.9%	8.3%	6.8%	7.5%	6.7%	4.2%
Tertiary health services	7.8%	8.5%	11.8%	11.7%	10.8%	8.8%	8.6%	6.6%	6.3%	6.0%	5.3%	4.6%	3.4%

Source: VAGO.

Reasons for late starts

Most health services can record the reason a session started late, depending on their IT system. We have identified two key flaws in health services' current practices for capturing this data:

- the health service does not capture the reasons for late starts
- the reasons captured do not identify whether the delay was within the control of the health service.

This lack of clarity means health services cannot always identify the reason for a delay, which hampers their efforts to improve performance.

For sessions with a recorded reason for the delay, 81 per cent were within the health services' control, as shown in Figure 21. The reasons given for the other 19 per cent of delays were either not specific enough, or were outside health services' control.

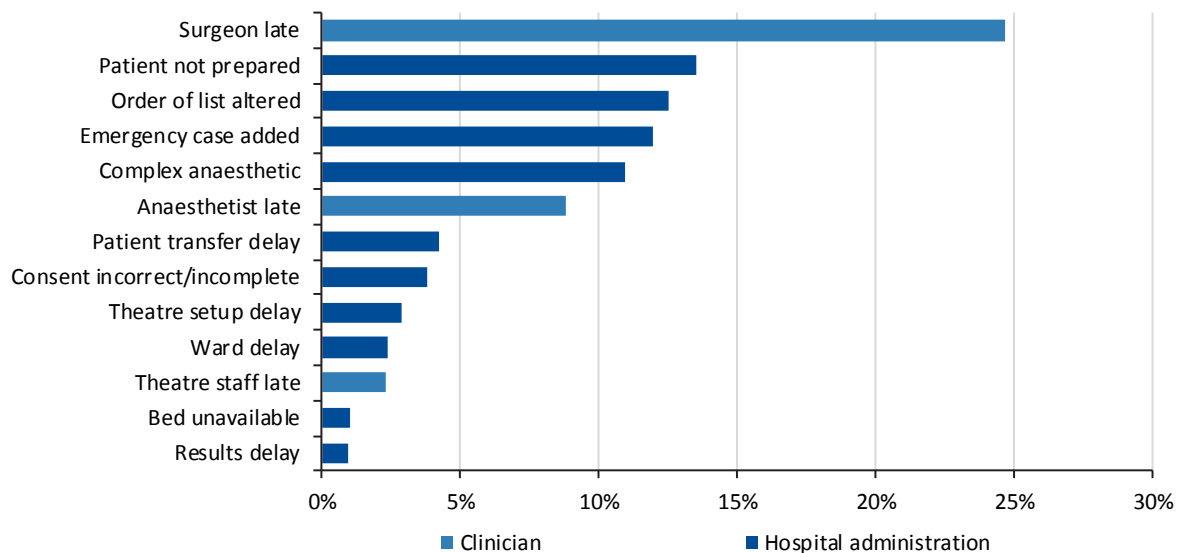
The surgeon being late to the session is the most common reason for sessions starting late. The audited health services reported that they have governance arrangements to provide feedback to surgeons via department heads if they identify a performance issue with a surgeon. However, the prevalence of this issue across the sector indicates that current practices are not driving changes in behaviour.

Between December 2014 and May 2015, Austin Health audited its late starts against a 15-minute threshold. Surgeon lateness caused 27 per cent of their delays and was the leading driver of theatre inefficiency. Austin Health discussed the data with the surgeons involved and identified that early morning meetings frequently delayed on-time starts. To rectify this, management adjusted surgeons' start times and rescheduled meetings.

Austin Health's late start audits further emphasise the importance of accurate data entry. Despite exceeding the 15-minute buffer, 23 per cent of delayed sessions were recorded as 'started on time'. This hinders accurate analysis of the data, making trends difficult to identify and address.

Austin Health currently reports daily on the reasons sessions start late and has governance processes in place to provide feedback to individuals who consistently arrive late.

Figure 21
Reasons for delays in morning elective sessions on business days, 1 July 2014 to 31 December 2016



Note: Reasons for delays outside the control of health services have been omitted from this figure.

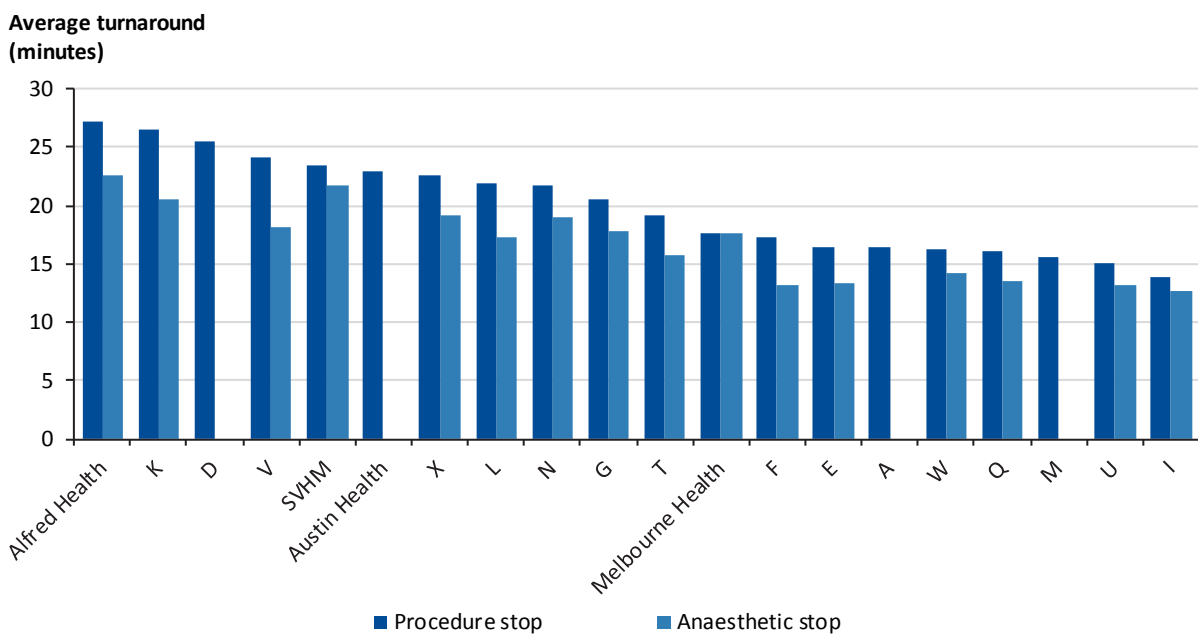
Note: Late starts have been measured against morning elective sessions only, as these are least likely to be affected by emergency surgery or earlier sessions overrunning.

Source: VAGO.

Turnaround times

Turnaround time is the time taken for staff to clean and prepare the theatre for the next surgery. Victoria does not have a benchmark for assessing turnaround time performance. Queensland Health recommends a turnaround time of 15 minutes. Victoria’s average turnaround time between surgeries is 17–21 minutes, depending on the measure used. Turnaround time varies between health services, as shown in Figure 2J.

Figure 2J
Turnaround time by health service, 1 July 2014 to 31 December 2016



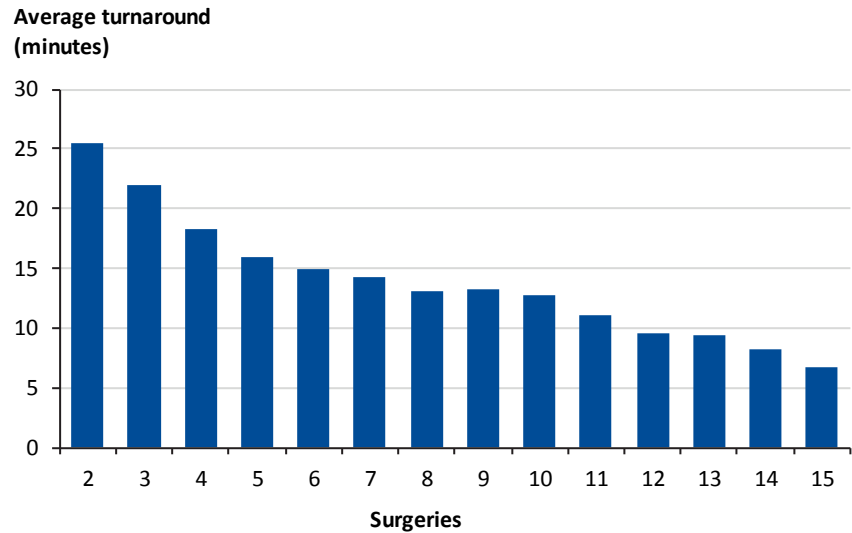
Note: Not all health services provided data for ‘anaesthetic stop’, which is a more accurate measure of turnaround time because it is closer to when a patient leaves the operating theatre and staff can begin to prepare it for the next patient.

Note: Health services’ performance can be interpreted differently depending upon the points in the procedure used to measure turnaround time and infrastructure. For example, Alfred Health, which does not have anaesthetic bays on all theatres, measures turnaround time from when the patient leaves theatre until the next patient enters. Using this definition leads to a different performance result—internally, Alfred Health reports a turnaround time of 15.6 minutes.

Source: VAGO.

Turnaround time almost halves as the number of elective surgeries performed in a session rises, as shown in Figure 2K. More scheduled surgeries in a session typically indicates that less complex, routine operations are being performed.

Figure 2K
Turnaround time in elective surgeries on business days, 1 July 2014 to 31 December 2016



Source: VAGO.

Session underruns

Across Victoria, 55.3 per cent of elective surgery theatre sessions finished before their scheduled time—known as an ‘underrun’—at an average of 31.8 minutes.

Although a degree of underrun is inevitable, Figure 2L shows that 11 per cent of sessions finished more than 90 minutes early, which is enough time to perform many types of surgery.

Figure 2L
Session underrun measured by surgery stop time, 1 July 2014 to 31 December 2016

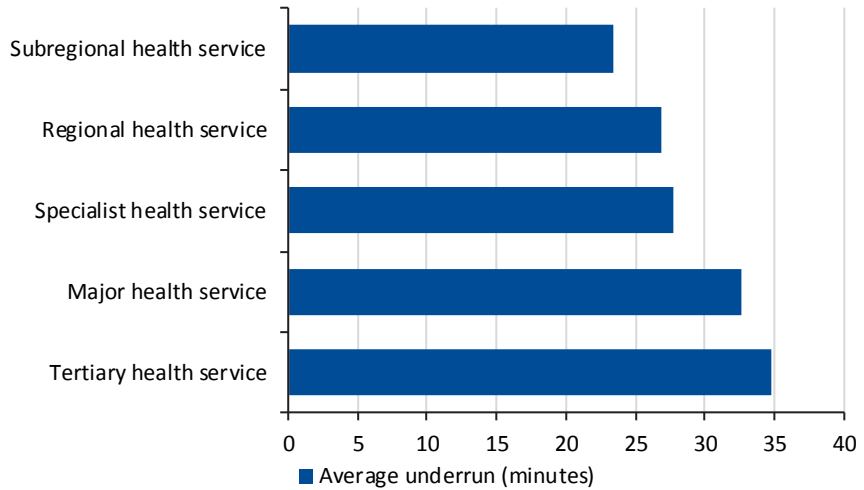
Underrun threshold	Tertiary health service	Major health service	Specialist health service	Regional health service	Subregional health service	State average
More than 30 minutes	34%	39%	31%	30%	21%	34%
More than 60 minutes	22%	21%	16%	16%	17%	21%
More than 90 minutes	13%	10%	8%	9%	9%	11%

Note: The totals are not cumulative—they display the percentage of sessions that underran against each threshold.

Source: VAGO.

Figure 2M shows performance by peer group.

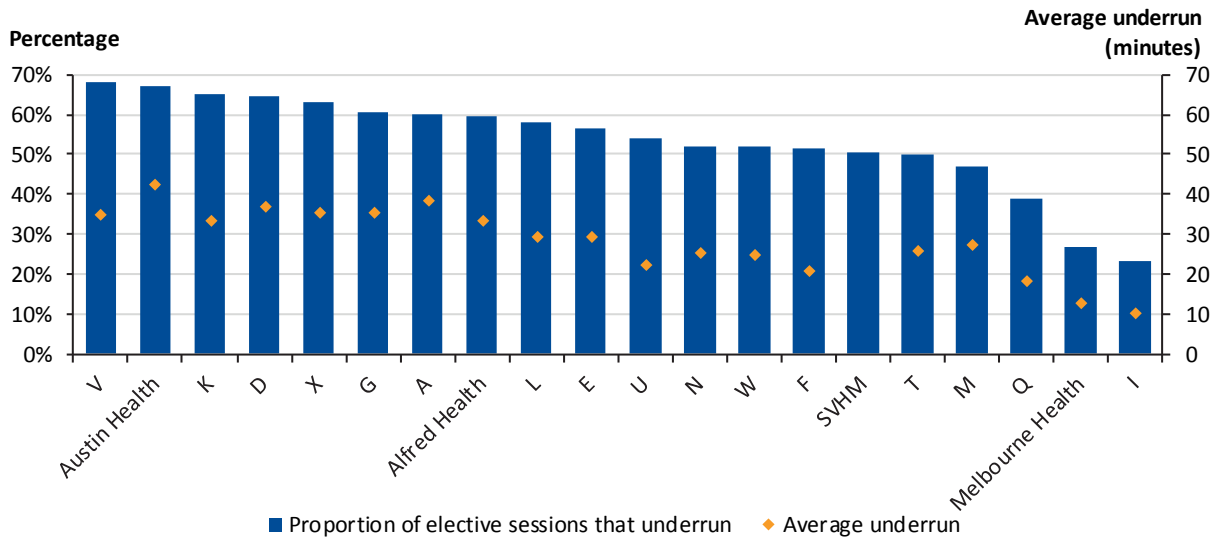
Figure 2M
Elective session underrun, by peer group, 1 July 2014 to 31 December 2016



Source: VAGO.

The frequency and number of underruns vary between health services, as shown in Figure 2N.

Figure 2N
Elective session underrun by health service, 1 July 2014 to 31 December 2016



Note: We were unable to calculate an underrun average for SVHM due to issues matching data with data collected from other health services.

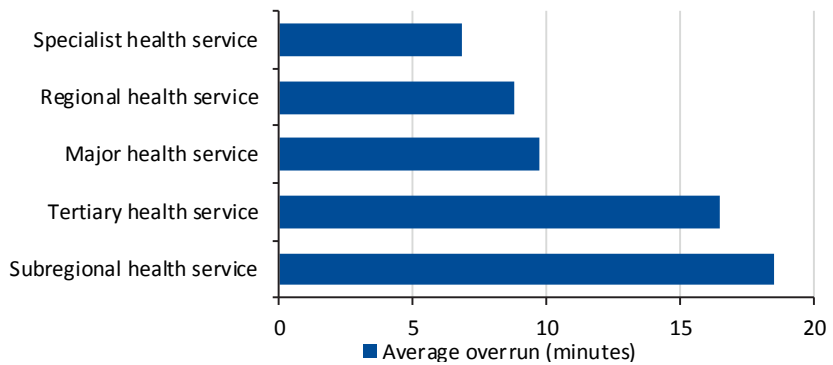
Note: Data reports sessions as finishing at the time of the 'surgery stop' timestamp. This will lower the apparent performance of health services because the patient does remain in theatre after this time while the anaesthetist concludes his or her work.

Source: VAGO.

Session overruns

In Victoria, 16.3 per cent of elective sessions overrun their scheduled finishing time by an average of 11.6 minutes. Figure 2O shows the overrun by average minutes across peer groups. Health services aim to finish sessions on time, although surgery may take longer than anticipated or there may be more demand for emergency surgery than forecast. In this scenario, operating suite managers have to choose between either running late, with an impact on cost and staff, or cancelling patients awaiting elective surgery. The decision to cancel is governed by internal policies, and the rate of cancellation is included in a health service's SOP and monitored by DHHS.

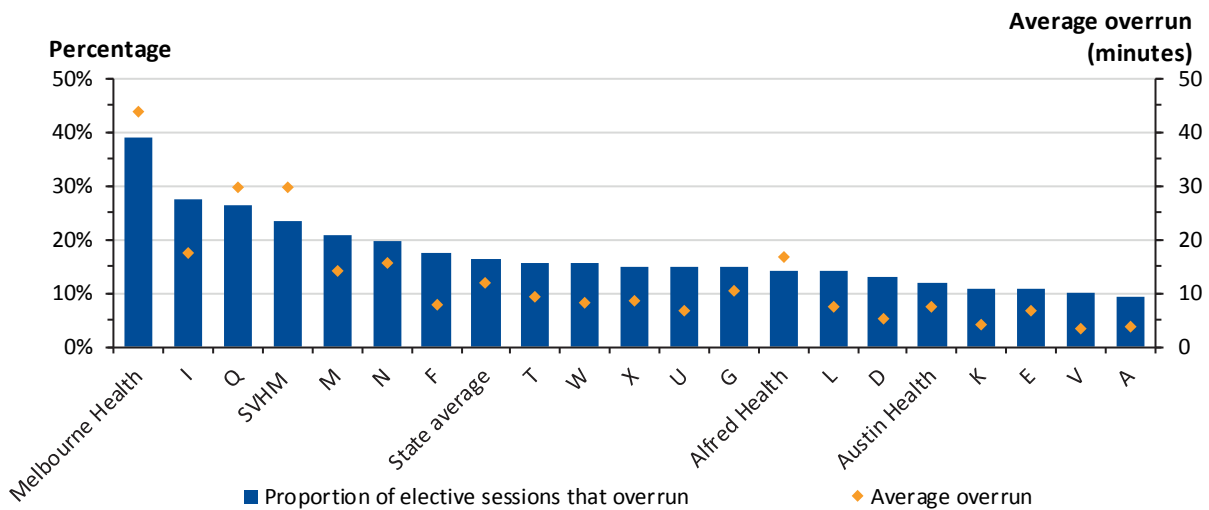
Figure 2O
Elective session overrun by peer group, 1 July 2014 to 31 December 2016



Source: VAGO.

Overruns vary significantly between health services, as shown in Figure 2P.

Figure 2P
Elective session overrun by health service, 1 July 2014 to 31 December 2016



Note: Overrun results are measured to 'surgery stop' for the last operation performed in the elective session, whether it was an elective or emergency surgery.

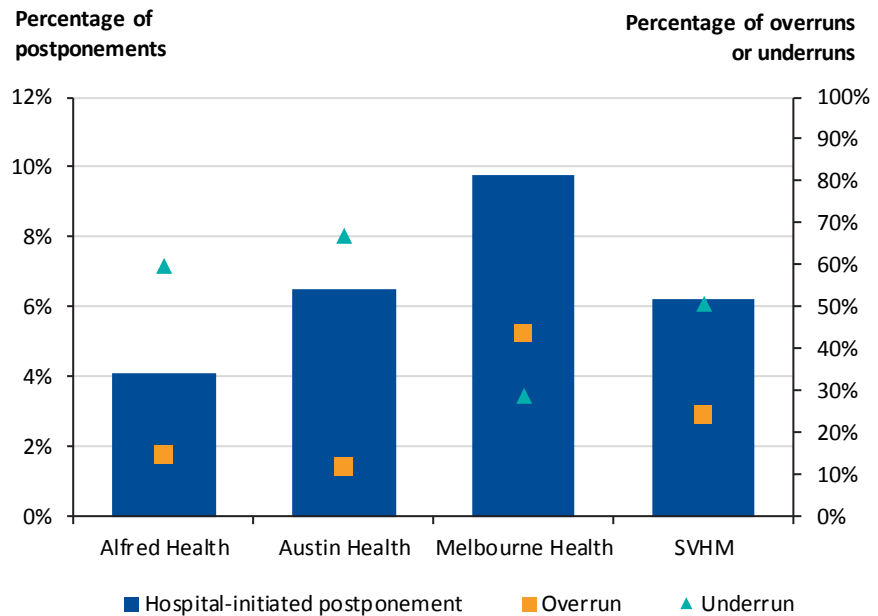
Source: VAGO.

Impact on postponements

Figure 2Q compares hospital-initiated postponements with the percentage of elective sessions that underran and overran at the audited health services. These measures describe how effectively health services book elective surgery lists and the impact emergency surgery has on planned elective surgery.

Health service performance against these measures is strongly correlated—for example, high numbers of underruns correlate with fewer postponements. However, a high underrun rate means that time within a surgical session is not efficiently utilised.

Figure 2Q
Audited health services' hospital-initiated postponements, underruns and overruns, 2015–16



Source: VAGO, based on hospital-initiated postponement data from health services' annual reports, 2015–16.

Barriers to benchmarking utilisation rates

Targets

DHHS does not set utilisation benchmarks in Victoria. Benchmarks for utilisation are not common in Australia or internationally. Where these benchmarks are present, they use different methodologies to measure utilisation. Figure 2R compares the publicly available measures from other jurisdictions.

Figure 2R
Theatre utilisation benchmarks

Agency	Measure	Methodology
New South Wales Agency for Clinic Innovation, 2015	Utilisation rate of 80%	Measures from when the patient enters the theatre until they leave.
Queensland Health Operating Theatre Efficiency Guideline, 2017	'Comparative elective theatre utilisation'—the target varies by the number of cases per session	Measures occupied theatre time against the expected occupation rate given the number of scheduled surgeries.
Queensland Health advice to Queensland Audit Office, 2016	Utilisation rate of 85%	A 'better practice' benchmark. Measures from when patients enter the theatre until they leave.
UK Audit Commission, 2003	Performance target of 77%	An estimated target based on the average performance of the health system. It measures from anaesthetic start to surgery stop and includes the amount of unused capacity due to session cancellation.

Source: VAGO, based on information from the Queensland Audit Office, *Theatre efficiency in Queensland public hospitals*; Queensland Health, *Operating Theatre Efficiency Guideline*; New South Wales Agency for Clinical Innovation, *Operating Theatre Efficiency Guidelines*; and UK Audit Commission, *Operating Theatres: Review of National Findings*.

We cannot compare Victoria's performance against these measures because they are all calculated based on different methodologies and points in the surgical procedure.

Variations in the process measures used

Process measures—such as timestamps—are important as they enable health services to monitor operating theatre efficiencies, particularly the utilisation rate. Timestamps capture key points in a patient's surgical journey, such as anaesthesia induction time, known as 'anaesthetic start'.

In 2012, DHHS published *A guide to surgical services redesign measures for improvement*. This guide recommended assessing surgical services through key performance indicators, as well as demand, capacity and process measures. DHHS recommended the timestamps outlined in Figure 2S.

Figure 2S
DHHS’s recommended minimum timestamps

Timestamp	Agreed definition
Anaesthetic start	Time when the anaesthetist begins preparing the patient for anaesthetic
Position/prep start	Time when the nursing or surgical team begins positioning or preparing the patient for the procedure
Procedure/surgery start	Time when the procedure is begun—for example, incision for a surgical procedure
Procedure/surgery stop	Time when the surgeons/physicians have completed all procedure-related activities on the patient
Anaesthetic stop	Time when the anaesthetist hands over care of the patient to a post-anaesthesia care team
Patient leaves recovery	Time when patient leaves recovery

Source: VAGO, based on DHHS, *A guide to surgical services redesign measures for improvement*.

In the devolved system, health services have customised timestamps to suit their needs, reflecting their practices, infrastructure and IT systems. Although the timestamp names are broadly similar, the underlying definitions can vary between health services—Figure 2T shows an example of the various definitions health services and DHHS use for a single timestamp.

Figure 2T
Different definitions of ‘surgery start time’ timestamp across agencies

Agency	Definition of ‘surgery start time’ timestamp
Alfred Health, Austin Health and Melbourne Health	When the surgical or nursing team begins positioning or preparing the patient for the procedure
SVHM	Following team ‘time out’ ^(a) , and immediately before the first surgical incision (positioning and preparing has already occurred)
DHHS	Time when the procedure is begun—for example, incision for a surgical procedure

(a) ‘Time out’ is a surgical safety checklist created by the World Health Organisation.

Source: VAGO, based on health services’ internal documents.

2.3 Unused capacity

Health services close their theatres for many reasons, including:

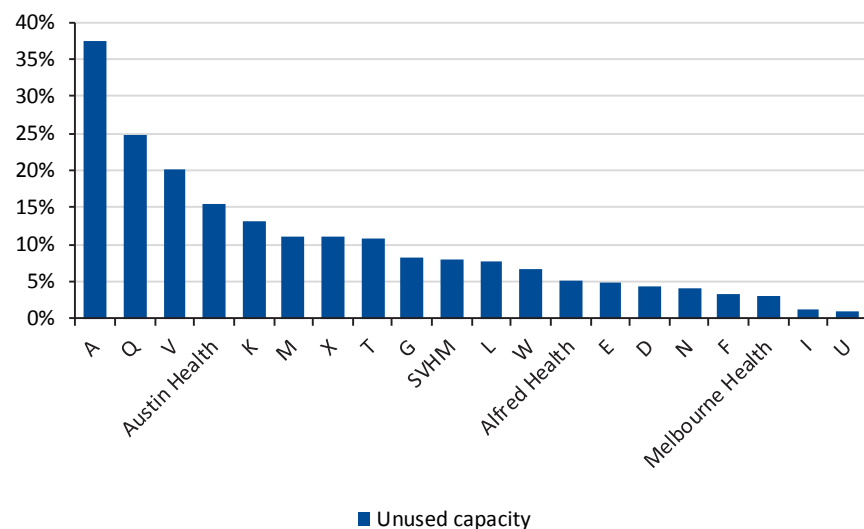
- theatres being serviced, repaired or upgraded
- inbuilt flexibility to respond to changing demand for surgery
- other capacity constraints in the hospital, such as a lack of available beds
- limited funds to fully staff theatres.

We measured unused capacity between 1 July 2016 and 31 December 2016, because this period most reflects currently available theatres. We excluded theatres that first opened during this period so they did not reduce the overall performance result.

We define a theatre as ‘unused’ if a health service did not run an elective or emergency surgery session for some portion of a business day.

Health services closed theatres on 9.5 per cent of theatre business days throughout Victoria. The distribution varied significantly between health services, as shown in Figure 2U.

Figure 2U
Percentage of business days where theatres were unused, by health service, 1 July to 31 December 2016



Note: Austin Health’s unused capacity is explained by four theatres being under-utilised. Its other theatres display a usage level comparable with those of the other audited health services.

Source: VAGO, based on health services’ operating theatre data.

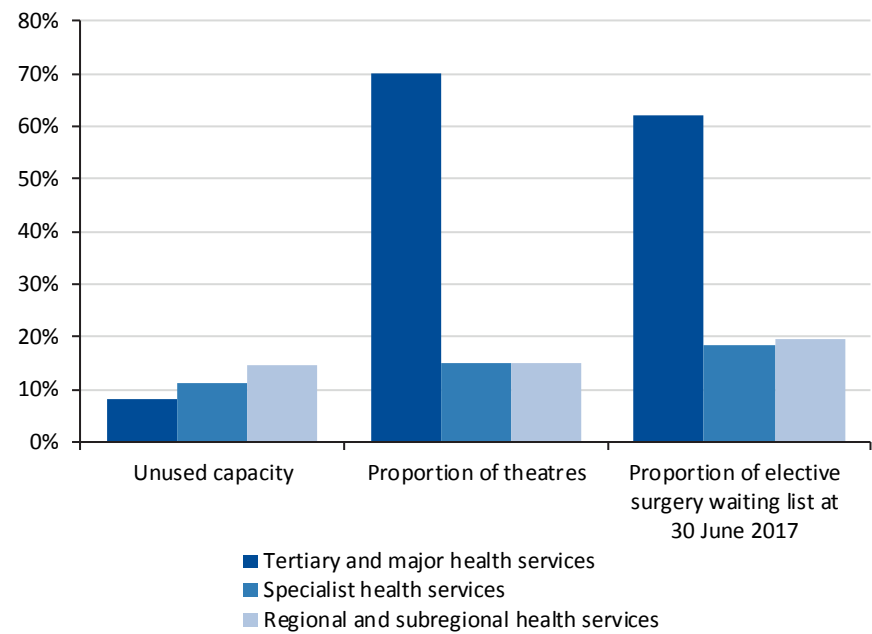
Figure 2V shows that regional, subregional and specialist health services have higher levels of available capacity than metropolitan and tertiary health services. These health services also closed theatres on more business days during the six months we reviewed—16.6 days per theatre compared to 10 days per theatre at major and tertiary health services.

Figure 2V also shows an alignment between theatres and waiting lists—70 per cent of the theatres and 62 per cent of the elective waiting list are at major and tertiary health services. However, the major and tertiary health services have limited unused capacity to deliver additional surgery.

To meet rising demand there are a number of options:

- increase theatre capacity through infrastructure investment
- use existing theatres more efficiently
- increase the amount of patients treated at health services with capacity.

Figure 2V
Available capacity and demand for elective surgery, 1 July 2016 to 31 December 2016



Source: VAGO, based on health service operating theatre data and DHHS data.

Among the audited health services, only Austin Health has some available capacity, as it has four under-utilised theatres, shown in Figure 2W. Austin Health confirmed it does not have enough funding to open these theatres more often.

Figure 2W

Austin Health operating theatres with high unused capacity, 1 July 2016 to 31 December 2016

Theatre	Unused capacity
The Surgical Centre, Theatre 1	60%
The Surgical Centre, Theatre 2	60%
The Surgical Centre, Theatre 3	34%
The Surgical Centre, Theatre 4	31%

Note: The four theatres are at the Heidelberg Repatriation Hospital.

Source: VAGO, based on Austin Health data.

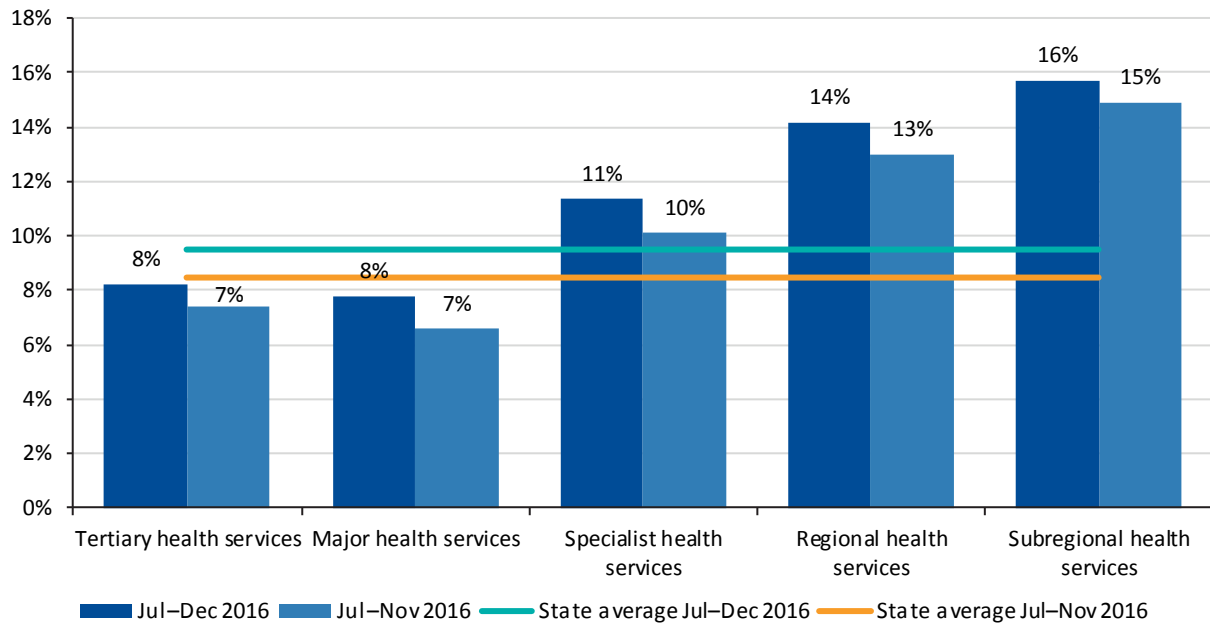
Austin Health could treat more patients in these theatres with more funding. As these theatres are suitable for routine elective surgery, Austin Health would require both enough patients requiring low-acuity treatment on its waiting list and sufficient bed capacity to maximise the use of these theatres. As Austin Health already has good access to surgery, making this capacity available to patients from health services with lower access would lead to a better outcome for Victoria.

There are two key barriers to this occurring:

- unused capacity is not identified at the system level due to a lack of data
- there are barriers to moving patients between health services, as discussed in Section 4.2 of this report.

Health services run fewer sessions during the Christmas period, as staff often take leave and patients delay non-urgent elective surgery. Excluding this period, Figure 2X shows that unused capacity is actually lower than the overall data suggests during most of the year.

Figure 2X
Unused capacity by peer group



Source: VAGO.

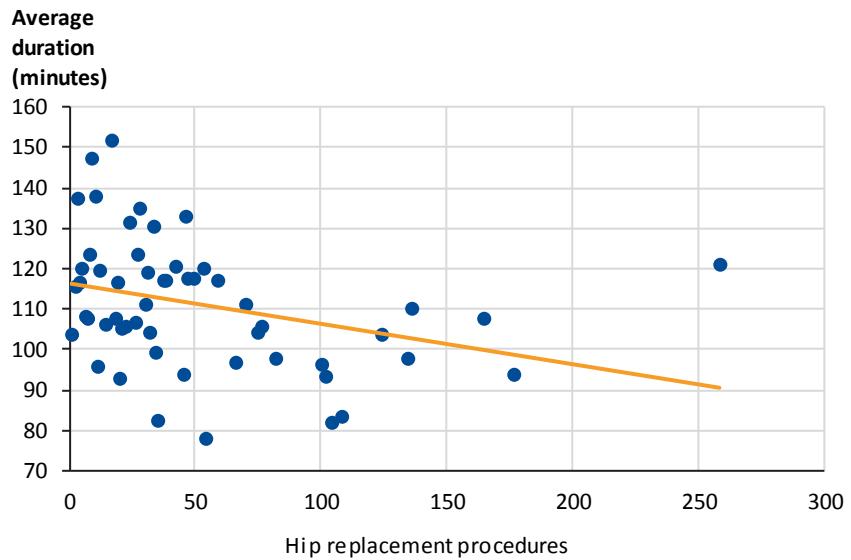
2.4 Efficiency of surgery

Length of surgery is not an appropriate efficiency measure, as it may encourage surgeons to rush and potentially compromise safety. However, health services could review the cost-efficiency of their surgeons' performance to identify practices that may improve efficiency.

Figure 2Y shows that surgeons who perform operations more frequently tend to perform surgery faster. This enables more operations to be performed within a surgical session.

Appendix C provides other examples of the relationship between frequency and operation length. Graduate surgeons—known as registrars—take longer to perform an operation, as discussed in Part 3 of this report.

Figure 2Y
Hip replacements performed by consultants at one the health services
in the ESIS, 1 July 2014 to 31 December 2016



Source: VAGO.

2.5 Cost per hour

The average direct cost of a ‘productive hour’ of theatre time in Victoria is \$2 004. The lowest cost health service ran at \$1 647 per hour and the highest cost at \$2 468.

The cost per hour includes costs directly recorded by health services as occurring in theatres—salary costs for surgeons, anaesthetists, nurses and technicians, and sterilising services. It does not include the costs of consumables, pharmaceuticals or prostheses, as these vary by case. Excluding them enables us to better compare health services.

A productive hour is time spent performing all surgery, including emergency sessions. We calculated the state’s overall productivity rate at 70 per cent of total surgical session time within business hours.

Figure 2Z shows the cost per hour for the health services that provided us with usable data. A challenge in comparing data is the variation in methods health services use to record their financial information, despite DHHS mandating a chart of accounts, as discussed in Appendix D.

Figure 22
Cost per hour of surgery

Health service	Total in-surgery hours in business hours	Productivity rate	Cost per hour		
			At current productivity rate	At 80 per cent productivity rate	At 100 per cent productivity rate
W	6 026	79%	\$2 468	\$2 431	\$1 945
T	39 954	76%	\$2 357	\$2 243	\$1 795
X	51 492	72%	\$2 178	\$1 963	\$1 571
I	15 073	81%	\$2 161	\$2 184	\$1 747
V	14 673	66%	\$2 158	\$1 784	\$1 427
N	34 535	71%	\$2 064	\$1 827	\$1 461
A	19 568	87%	\$2 054	\$2 234	\$1 787
K	14 340	59%	\$2 039	\$1 514	\$1 211
D	18 559	60%	\$2 036	\$1 529	\$1 223
Statewide	679 678	70%	\$2 004	\$1 796	\$1 437
Q	10 731	73%	\$1 994	\$1 807	\$1 446
F	17 513	80%	\$1 975	\$1 983	\$1 587
Alfred Health	57 254	72%	\$1 959	\$1 752	\$1 401
L	105 723	71%	\$1 889	\$1 682	\$1 346
E	52 690	69%	\$1 877	\$1 622	\$1 297
G	63 499	73%	\$1 857	\$1 694	\$1 355
SVHM	40 420	66%	\$1 712	\$1 412	\$1 130
Melbourne Health	52 872	77%	\$1 655	\$1 593	\$1 275
Austin Health	64 756	71%	\$1 647	\$1 457	\$1 166

Note: We excluded five health services as we could not reconcile their financial or theatre data with that provided by other health services to enable an accurate comparison.

Source: VAGO.

Any increase in productivity lowers the average cost per hour—for example, raising the state’s average productivity rate to 80 per cent would enable 10 per cent more surgery to be delivered within the same cost base, thereby reducing the average cost per hour by \$208.

Comparing the cost at current productivity rates to an 80 per cent benchmark shows there is considerable opportunity for most health services to lower their cost per hour.

The difference in cost per hour of surgery time is driven by:

- underlying costs, such as salary rates
- the amount of out-of-hours work conducted at higher cost
- the productivity rate of theatre sessions.

Health services would reduce their cost per hour by improving their performance against any of these three factors. Productivity rate is the factor that health services are most likely to be able to influence.

3

Management practices

Efficient and effective management of resources requires clear objectives, evidence-based resourcing models, relevant and reliable data to evaluate performance, and sound governance structures to control resource allocation.

In this part of the report, we assess how health services' management practices affect the efficient use of their operating theatre resources.

3.1 Conclusion

Driving and sustaining improved operating theatre efficiency is challenging and needs to be underpinned by a comprehensive suite of reliable, accepted performance measures that are widely shared and actively monitored.

More attention needs to be given to understanding and addressing systemic issues that adversely affect efficiency. Health services do not have a strong understanding of the impact of training of registrars on their theatre efficiency levels or cost base. There are opportunities for health services to improve efficiencies through strategies such as greater specialisation within a surgical unit and prioritising their use of procedure rooms for short, clinically simple cases.

A broader systemic issue for DHHS as system manager is the impact of patient choice on capacity-constrained hospitals.

3.2 Management approaches and practice

We examined how four health services—Alfred Health, Austin Health, Melbourne Health and SVHM—manage their operating theatres at both the executive and operational levels to achieve efficient outcomes. We also consulted with other health services outside the audited group to identify a range of management structures across the sector.

Allocating theatre resources

Health services allocate theatre resources between emergency and elective surgery and for different surgical specialities. They adjust the allocation to meet the changing demand for elective surgery, waiting lists and emergency forecasting. Health services allocate resources over varying time frames, and management groups meet daily, weekly and monthly to adjust allocations as required.

Health services manage the allocation of theatre resources through:

- operating suite floor managers controlling on-the-day theatre allocation
- executive-level management forums evaluating health service performance and forecasting resource allocation.

DHHS issues policies that influence some aspects of how health services allocate resources. For example, the Elective Surgery Access Policy 2015 directs health services to treat patients in turn. Certain circumstances may prevent patients' being scheduled for surgery according to waiting time:

- when a patient's condition has deteriorated
- when the health service has previously postponed the patient's surgery
- a patient being unavailable for surgery
- availability of resources (for example, theatre time, staff, equipment and hospital capacity)
- when there are sound clinical reasons
- teaching and training needs.

When scheduling patients for surgery, health services are required to negotiate with the patient to agree on a mutually acceptable admission date. The policy also requires health services to have local policies that comply with its directions.

Where DHHS does not establish formal policy requirements, the audited health services typically lack comprehensive, finalised policies that govern resource allocation. For example, there is limited guidance for decision-makers on allocating theatres between emergency and elective surgery and between types of elective surgery. Instead, the health services rely on experienced professionals using their best judgement and available data to allocate resources.

The lack of policies affects the transparency of decision-making and the evaluation of resource allocation decisions. It also diminishes the organisational sustainability of the health service if key personnel leave.

Monitoring efficient theatre performance

Figure 3A lists measures that the four audited health services use to assess the efficiency of their operating theatres. However, as health services have developed their measures independently, the definitions and assumptions underlying the measures are not necessarily comparable and, as a result, some health services have better information than others to drive decision-making.

Figure 3A
Comparison of efficiency metrics used at the audited health services

Metric	Melbourne Health	SVHM	Austin Health	Alfred Health
Late start analysis	✓	✓	✓	✓
Morning session overrun			✓	✓
Utilisation rate	✓	✓	✓	✓
Percentage of surgery completed within session			✓	✓
Cases with overrun greater than 30 minutes				✓
Total elective cases		✓	✓	✓
Total emergency cases		✓	✓	✓
Total scheduled surgical hours			✓	✓
Total overrun hours analysis		✓	✓	✓
Surgical utilisation rate	✓	✓	✓	✓
Productive/contact time	✓		✓	
Turnover time		✓	✓	

Note: Austin Health uses a measure called 'contact hour' which has an underlying definition similar to 'utilisation rate'.

Source: VAGO, based on audited health services' reports.

Generally, reporting at the audited health services enables management to identify inefficient practices. These internal reports focus on lost theatre time, such as late starts and underruns. These are valuable measures, as they target waste, do not affect patient safety and are within the health services' control.

Executives advised that they regularly provide feedback to surgical units that demonstrate ongoing performance issues, such as starting late. However, continued underperformance indicates that driving and sustaining improved efficiency is challenging, and health services report that projects to improve efficiency take significant management effort and years to implement.

The health services advised that key barriers include clinicians rejecting data as inaccurate and managers not maintaining enough focus on issues to sustain performance improvements.

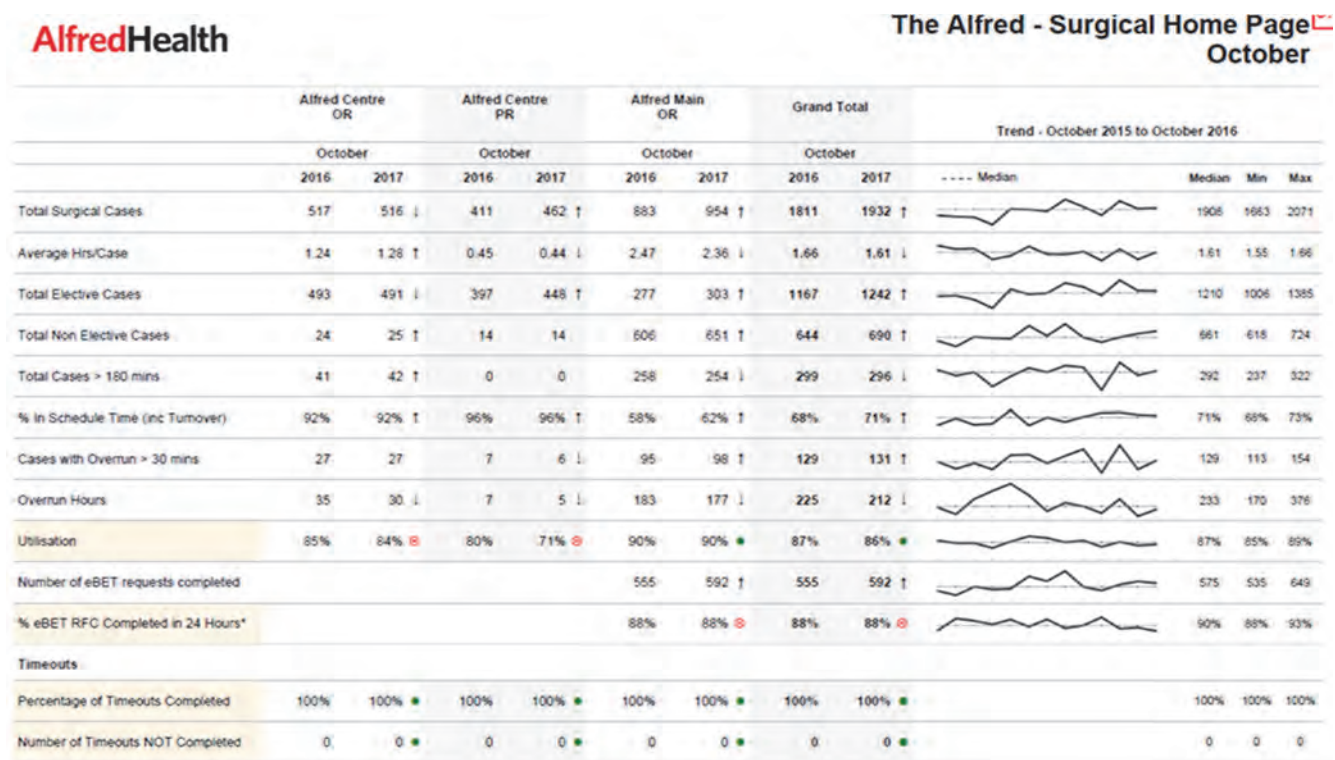
Alfred Health

Alfred Health’s performance reports provide comprehensive information to theatre teams and managers and are an example of better practice. The reports convey a clear visualisation of changing waiting list numbers, as shown in Figure 3B. Alfred Health’s reports also provide multiple measures for efficiency—such as utilisation and overrun hours—as demonstrated in Figure 3C. This clear and concise format enables managers to identify trends over time and inefficiencies.

Staff use these reports in multiple management forums, including their monthly Theatre Reference Group, which focuses on managing the health service’s resources. The group used the reports to identify a surgical unit that started 75 per cent of its sessions late. As a result, the health service identified emergency surgery and earlier sessions overrunning as the drivers of this inefficiency, which Alfred Health could address through process changes.

Data-driven reporting has enabled Alfred Health to identify inefficiency and has led to management intervening to improve performance.

Figure 3B
Alfred Health’s performance report



Source: Alfred Health.

Figure 3C
Alfred Health's visual representation of its waiting lists

Alfred Health

	2016												2017												Average	Trend
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan							
Registrations	1,141	1,160	1,120	1,098	1,138	1,150	784	1,271	853	1,162	1,216	1,025	1,054	1,320	1,007	1,276	1,123	1,026	241	1,108						
Avg per work day	49.6	56.7	50.9	52.3	56.8	53.8	41.3	60.5	42.7	61.2	55.3	48.8	50.2	57.7	48.0	60.8	53.5	51.3	40.2	52.9						
Admissions	1,015	973	955	921	930	906	797	987	907	912	1,001	946	914	1,048	992	957	917	897	164	943						
Avg per work day	44.1	46.3	43.4	43.9	46.5	43.1	41.5	47.0	45.4	45.6	45.5	45.0	43.5	45.5	47.2	45.6	43.7	44.5	27.3	44.9						
Wait List (end of mth)	1,959	1,991	2,032	2,013	2,007	2,157	2,056	2,204	2,032	2,126	2,136	2,050	2,007	2,041	1,931	2,115	2,106	2,081	2,182	2,063						

The Alfred - By Unit

*variance between current month and previous month

Unit		2016												2017												Waitlist Variance*	Trend
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan							
BES	Registrations	87	79	84	72	79	96	76	90	93	98	82	82	90	67	65	60	88	70	19							
	Admissions	86	60	64	80	80	75	66	90	81	82	72	83	84	73	90	60	70	68	15							
	Wait List (end of mth)	84	107	122	106	94	88	91	102	101	122	117	110	97	94	87	63	65	59	66	8						
BURN	Registrations	12	7	10	8	11	4	7	7	5	7	8	8	5	12	13	7	5	1	1							
	Admissions	4	5	4	10	7	10	9	9	3	6	7	6	4	9	15	8	4	2	1							
	Wait List (end of mth)	16	14	17	17	18	10	10	6	8	10	8	7	7	10	7	7	8	8	0							
CAGE	Registrations																			1							
	Admissions																			1							
CRS	Registrations	65	57	56	53	43	56	34	58	37	65	57	43	52	54	62	68	45	48	4							
	Admissions	38	43	43	35	43	39	34	57	49	49	55	55	29	45	49	43	49	61	14							
	Wait List (end of mth)	75	73	80	78	81	80	81	68	65	70	76	56	74	75	86	98	92	67	64	-3						
CTHR	Registrations	76	65	77	66	60	75	33	70	42	67	55	70	62	70	58	69	75	56	14							
	Admissions	56	59	58	62	60	63	60	54	49	60	47	41	49	62	64	65	49	57	14							
	Wait List (end of mth)	70	63	75	86	74	72	51	62	47	50	43	57	57	62	48	55	66	57	67	10						
DERM	Registrations	9						1												1							
	Admissions	2	10																								
	Wait List (end of mth)	9						1									1	1	1	1	0						
ENT1	Registrations	40	49	39	24	40	36	23	42	12	30	32	34	28	34	34	30	43	49	11							
	Admissions	20	39	47	35	25	32	16	25	29	30	34	20	27	36	39	35	18	30	4							
	Wait List (end of mth)	128	141	128	106	115	116	112	124	105	101	82	85	87	66	60	59	80	97	104	7						
ENT2	Registrations	13	7	17	23	4	16	6	23	8	17	23	10	12	20	14	19	14	11	2							
	Admissions	15	15	10	14	11	9	10	14	14	14	11	14	14	14	11	22	13	12	1							
	Wait List (end of mth)	40	35	43	53	44	49	44	48	41	42	56	46	38	51	44	45	41	38	41	3						
FMAX	Registrations	19	17	18	20	15	17	11	10	16	19	14	19	14	17	13	23	10	16	1							
	Admissions	16	15	16	15	12	11	7	9	16	15	8	21	13	16	11	16	12	11	3							
	Wait List (end of mth)	9	8	10	8	6	10	11	10	9	10	15	14	15	15	14	19	16	14	11	-3						
GSSG	Registrations																			1							
	Admissions																			1							

Source: Alfred Health.

Austin Health

Austin Health uses a range of reporting to monitor its performance efficiency. This includes daily reporting that captures reasons why sessions started late, consolidated reports used in performance meetings and a live dashboard that tracks patients waiting for and progressing through surgery, as shown in Figure 3D. The dashboard enables theatre managers to understand surgical demand in allocating theatre resources on the day and supports efficiencies, as demonstrated by Austin Health's lower overrun and hospital-initiated postponement rates.

Figure 3D

Austin Health's live dashboard which tracks patients waiting for and receiving surgery



Source: Austin Health.

Data-driven reporting is well established at Austin Health and enables staff to track, identify and address performance issues.

In 2013, Austin Health identified that late starts were significantly disrupting its theatre utilisation rate. This prompted the 'start on time' initiative, which ran from 2013 to 2015. Staff identified vague definitions of key reporting terms, poor inpatient processing, and unreliable data entry as barriers to efficiency.

In response, management formally outlined its 'start time' measure and altered the nurses' rosters in the foyer to ensure the timely transfer of patients. Management also increased staff education about capturing data—an issue that remains particularly important, as tracking the reasons for delays requires complete, consistent and accurate data. Floor coordinators also troubleshoot barriers to start time performance on a daily basis and broadcast a reminder on the operating suite's announcement system.

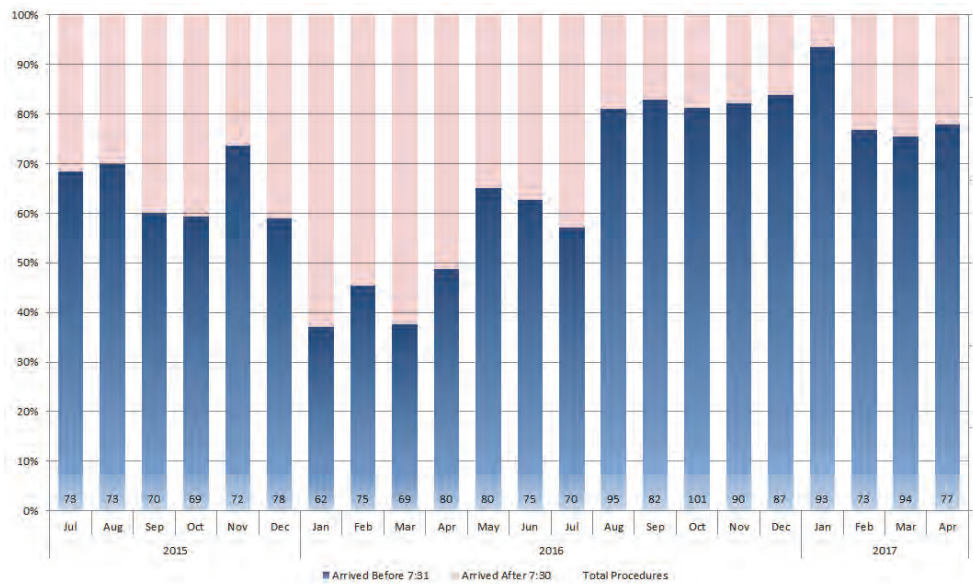
Although the project formally concluded in 2015, Austin Health has sustained these changes and regularly audits its on-time start rate. This shows the importance of continued managerial effort in driving efficiency.

Melbourne Health

Melbourne Health has improved its systems for reporting performance data, including developing new tools for internal performance reporting over the past three years. By developing better data, Melbourne Health has been able to improve efficiency.

To increase its ‘on-time start rate’, Melbourne Health used data to identify that 58 per cent of inpatients arrived late to the anaesthetic bay from the wards. This was primarily due to poor communication and staff shortages. In mid-2016, Melbourne Health improved its ward notification system, changed its rostering arrangements, organised additional meetings, and emphasised the importance of accurate data entry. This increased its on-time start rate, as shown in Figure 3E.

Figure 3E
Melbourne Health—improvement in patients arriving on time from hospital wards



Source: Melbourne Health.

St Vincent’s Hospital Melbourne

SVHM has an ongoing and wide-ranging project that began in 2014 to improve its operating theatre performance by evaluating its data integrity, performance measures and system reporting. SVHM redeveloped its data collection and quality assurance policies, redefined performance measures and increased staff training as part of the project.

In 2017, SVHM created and is testing data visualisation tools to monitor and evaluate performance, as described in Figure 3F. The time and effort required to implement this change demonstrates the barriers to improvement in health services, although SVHM’s current framework should enable it to evaluate and drive efficient performance in the future.

Figure 3F

Case study: Testing business intelligence tools at SVHM

SVHM is refining a business intelligence tool to create reports and a smart phone application to provide live performance data to managers. Reporting includes measures such as theatre utilisation rate and the number of surgeries performed.

As part of the project, the hospital formalised business rules and definitions for its data. Key steps in the process included:

- working with clinicians to gain agreement on performance measures
- improving the quality of data captured in the operating theatre system
- developing reporting tools for performance evaluation
- sharing information more widely among staff.

SVHM staff engaged in extensive consultation to complete each step of the process.

Using the business intelligence tool, SVHM quantified utilisation rates across specialities. As a pilot, the project team provided the head of the lowest-performing surgical unit with the utilisation results for the team—59 per cent—and saw performance improve to 73 per cent and 76 per cent in the following months. Ongoing monitoring and system change enabled SVHM to sustain its positive performance.

Source: VAGO.

The efficiency initiatives at SVHM show that good data improves performance, and that continuous focus is required to sustain change.

3.3 Influences on productive efficiency

Health services and experts have identified a range of factors that influence operating theatres' productive efficiency:

- the need to train registrar surgeons
- theatre capacity constraints
- patients receiving treatment outside of their local hospitals
- the specialisation of surgeons
- procedure room usage.

The audited health services are aware of these issues, but have not quantified their impact. For this audit, we used data from the 23 ESIS health services to measure the influence of these factors on efficiency.

Training registrar surgeons

Training registrar surgeons is an important aspect of the public healthcare system. However, it limits the productive efficiency of operating theatres.

Using data to quantify the impact of registrars' involvement—such as increased operating time—enables health services to evaluate the cost of teaching. It also assists in the efficient planning of surgical sessions and can help health services reduce the prevalence of overruns.

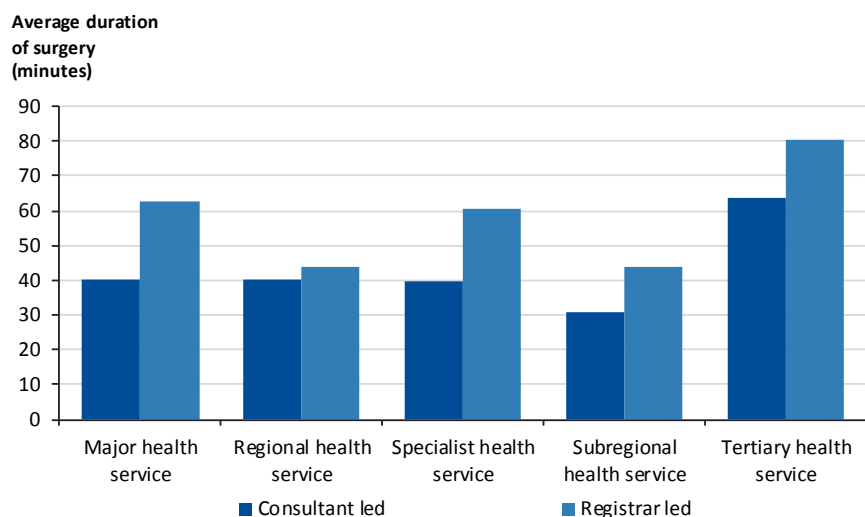
We found that operations led by a registrar are, on average, 15 minutes longer than operations led by a fully qualified surgeon, known as a consultant.

Figure 3G shows the impact of surgery length across peer groups.

In 2015–16, registrars led 74 000 operations. At an average of 15 minutes more time per surgery, the training added an additional 19 050 hours of theatre time to these surgeries. With theatre costing an average of \$2 004 per hour for staff, this training cost about \$37 million. Consultant-led operations in which they teach registrars will also incur an additional time burden that is not identifiable in the existing data.

Health services have not demonstrated a strong understanding of the impact of training on their theatre efficiency levels or cost base.

Figure 3G
Comparison of the length of operations for consultants and registrars in 2015–16



Source: VAGO.

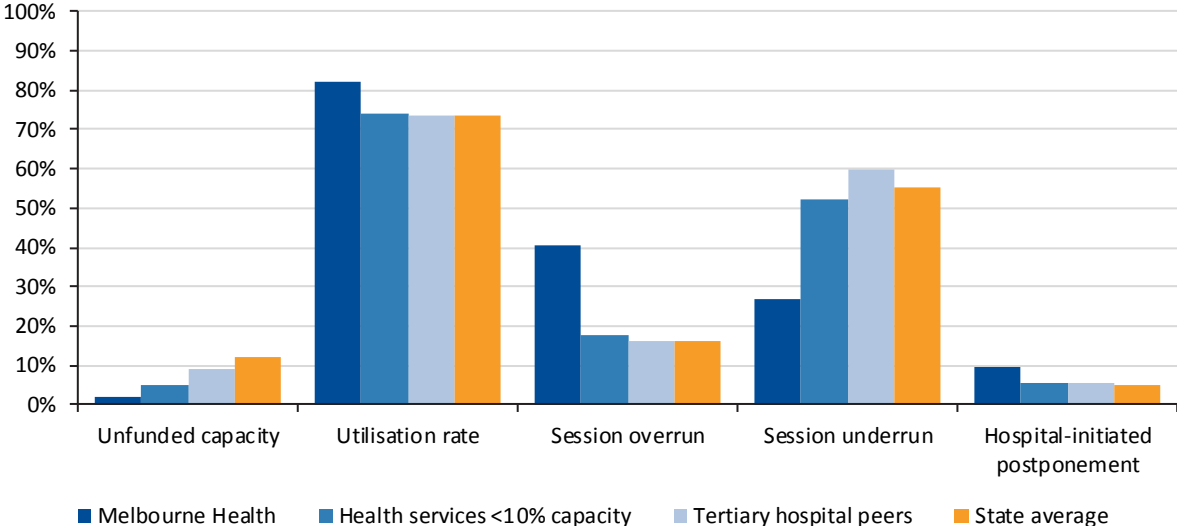
Capacity constraints

We have identified a relationship between physical operating theatre capacity and efficiency—as the number of unused theatre days decreases, theatre inefficiencies rise.

Melbourne Health runs its theatres at 97 per cent capacity, which is the highest of the audited health services. Melbourne Health has advised that this is necessary to meet its high surgical demand.

Figure 3H compares capacity and efficiency measures at Melbourne Health with other tertiary hospitals, health services with less than 10 per cent unused capacity, and the state’s average.

Figure 3H
Comparison of operating theatre efficiency measures



Note: Unfunded capacity data from 1 July 2016 to 31 December 2016; hospital-initiated postponement data for 2015–16; utilisation, overrun and underrun data for 1 July 2014 to 31 December 2016.

Source: VAGO.

The data shows a clear correlation between decreased capacity and rising inefficiencies. This indicates that health services require some unused capacity to create flexibility and stabilise performance. In particular:

- As Melbourne Health runs at 97 per cent capacity, it is difficult for management to accommodate increased surgical demand and cover periods of theatre maintenance.
- Melbourne Health manages its high emergency demand by adding emergency cases to the end of its elective sessions, which creates overruns. Melbourne Health overruns 41 per cent of its elective sessions by 44 minutes, compared to the state’s average of 16 per cent at 12 minutes.
- By adding emergency cases to the end of its elective sessions, Melbourne Health rarely underruns and its utilisation rate is higher than its peers and the state average. It underruns 27 per cent of its sessions by 13 minutes against the state’s average of 55 per cent at 32 minutes.
- Melbourne Health’s hospital-initiated postponements—the deferral of an elective patient’s scheduled admission date—was 9.8 per cent in 2015–16 against the state target of 8 per cent and state average of 5 per cent. Melbourne Health’s performance in 2016–17 fluctuated across the course of the year, from a high of 9.4 per cent in the first quarter to 6.3 per cent in the final quarter.

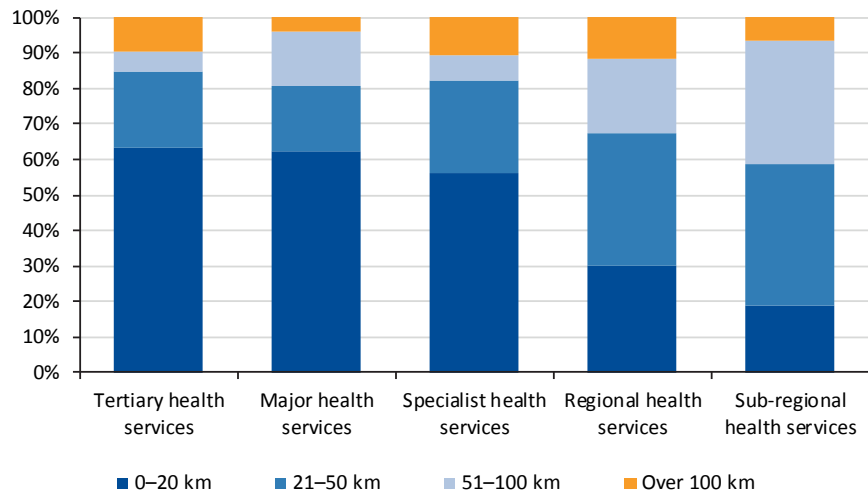
Patients not being treated at their local health service

Patients, in consultation with their general practitioner (GP), decide where they will be referred for their elective surgery.

Figure 3I shows that 40 per cent of patients treated at major and tertiary health services—located within greater Melbourne—lived more than 20 kilometres away from where they had their surgery.

Patients at regional and subregional health services travel further for surgery, which is a result of the greater distance between health services and the larger areas that regional services cover.

Figure 3I
Distance elective surgery patients travel (kilometres) by peer group,
1 July 2014 to 30 June 2016



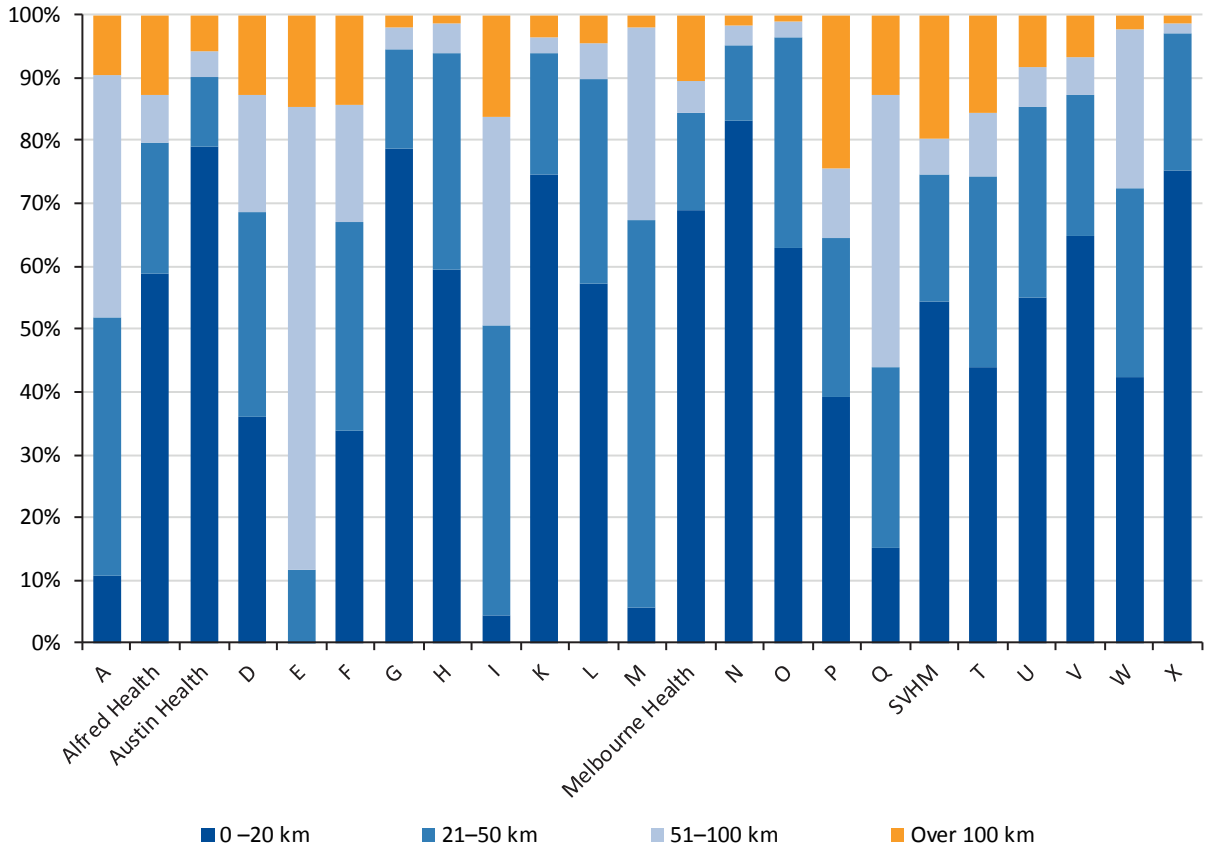
Source: VAGO, based on DHHS VAED data.

By knowing where their patients come from, health services can better understand growth and engage with health networks to influence outcomes.

Austin Health receives 80 per cent of its patients from within a 20-kilometre radius, giving it the opportunity to engage with local GPs to drive behaviour such as ensuring that referrals contain complete information and that patients have undertaken required testing before attending a specialist clinic appointment.

At the health service level, the distance that patients travel varies significantly, and is influenced by patient choice, localised population growth, type of service provided and the distance between hospitals, as seen in Figure 3J.

Figure 3J
Distance elective surgery patients travel (kilometres) by health service, 1 July 2014 to 30 June 2016



Source: VAGO, based on DHHS VAED data.

Health services do not have geographical ‘catchments’ or control over whether a GP refers a patient to their clinics for assessment. Health services have advised that patients may choose a health service based on factors such as professional relationships between clinicians, surgeons working at different locations, ability to provide treatment in a timely manner, health service reputation and patient preference, as well as proximity.

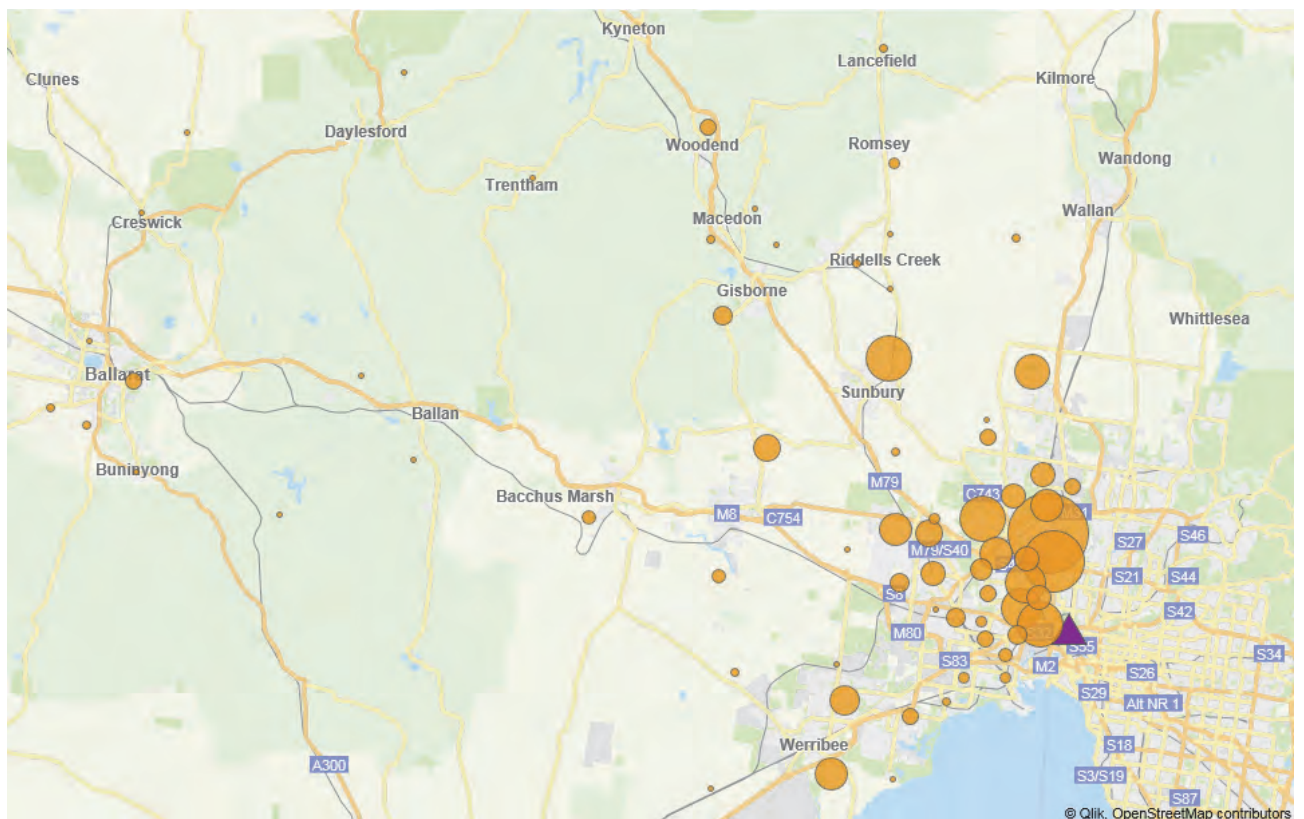
The cost of providing treatment is broadly similar across health services, so as long as a health service has capacity, the impact of patients choosing not to be treated locally is minimal.

However, an inefficiency arises if a tertiary hospital treats a ‘routine’ patient and consequently cannot treat a complex case within clinically recommended time frames.

Melbourne Health has limited available capacity and uses its theatres for both emergency and elective surgery. Figure 3K shows that Melbourne Health treated 1 670 elective orthopaedic patients from Melbourne’s inner west, north-west and the Ballarat region, between 1 July 2014 and 31 December 2016. Ballarat Health, Barwon Health, Western Health and Northern Health are non-tertiary health services closer to the patients’ homes, which could have treated these elective orthopaedic patients.

From the available data, we could not identify if these patients had additional clinical needs requiring treatment in a tertiary hospital or were routine cases.

Figure 3K
Elective orthopaedic surgery delivered by Melbourne Health for patients from Melbourne’s north west, 1 July 2014 to 30 June 2016



Key: ● Postcodes—the larger the circle the greater the number of patients from that postcode
 ▲ Melbourne Health

Source: VAGO.

Specialisation of surgeons

Victorian health services provide surgery according to their capability, capacity, profile and demand. As a result, surgeons may perform some operations infrequently, resulting in increased surgical times. Health services may improve their productive efficiency by encouraging specialisation within a surgical unit.

We compared the length of time it takes surgeons to complete six common operations against the number of operations performed. The operations were:

- appendectomy
- fractured neck of femur
- hip replacement
- knee replacement
- cataract surgery
- coronary artery bypass.

Figure 3L shows the difference in average operation time between the 10 highest-volume surgeons and those who performed the operation not more than 10 times.

Figure 3L
Average length of surgery (minutes), by type of operation, comparing high- and low-volume surgeons, 1 July 2014 and 31 December 2016

Surgeon cohort	Appendectomy	Fractured neck of femur	Hip replacement	Knee replacement	Cataract surgery	Coronary artery bypass
Top 10 by volume	47.7	59.8	99.0	92.3	20.6	223.4
≤ 10 operations	53.1	62.7	119.5	118.6	25.9	220.6
Difference	11%	5%	21%	28%	26%	-1%

Source: VAGO.

In three types of operations, the surgeons' average surgical time fell by over 20 per cent as the number of operations increased.

This is beneficial, as in cataract surgery, where saving five minutes per operation may enable health services to book additional cases. Conserving over 20 minutes per hip and knee replacement may allow health services to schedule short, simple operations at the end of existing surgical sessions. Both scenarios allow health services to maximise the amount of surgery generated from their available theatre time.

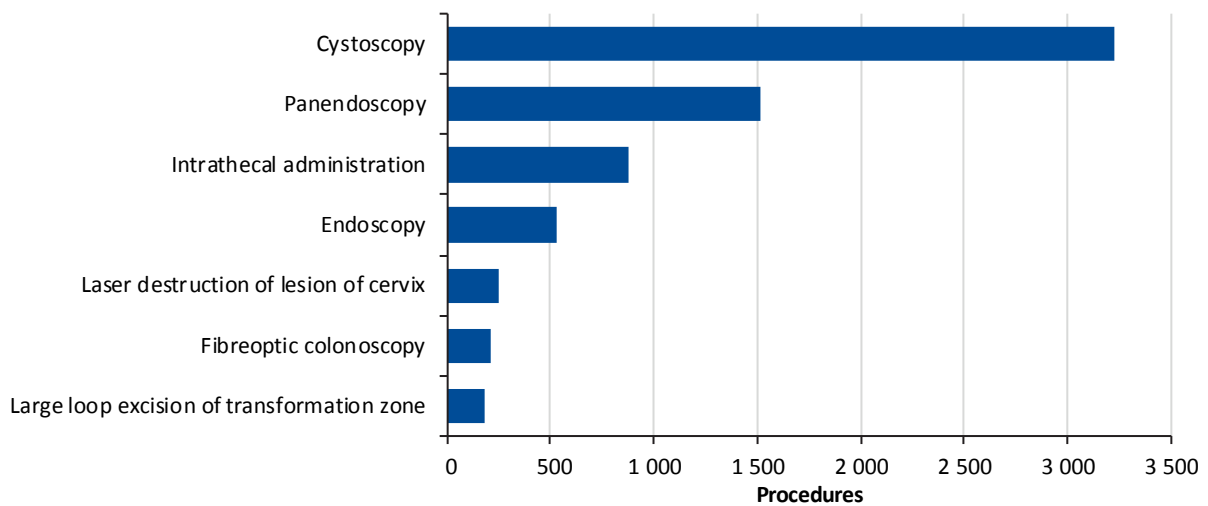
In two types of surgery, the time saved is marginal, and we observed a minor increase in time for coronary artery bypass operations.

Reducing the number of surgeons performing low-volume activity also addresses recommendations from the 2016 review of patient safety, *Targeting Zero: Supporting the Victorian hospital system to eliminate avoidable harm and strengthen quality of care*, which identified a relationship between surgeons performing an operation irregularly and adverse safety outcomes.

Procedure room usage

Many health services have procedure rooms in their hospitals. These sterile spaces are less equipped than operating theatres and accommodate simple procedures, such as cystoscopies and endoscopies. Surgeons sometimes perform these procedures in operating theatres, and a patient’s clinical needs may make this necessary. Efficiency may increase if health services prioritise procedure rooms for short, clinically simple cases—this creates space in operating theatres for more complex surgery. Between 1 July 2014 and 31 December 2016, over 15 000 procedures that required less than 15 minutes each for anaesthesia and operative time occurred in fully equipped operating theatres. Figure 3M shows the most common procedures in this group—these types of operations are often booked in procedure rooms and are of limited complexity.

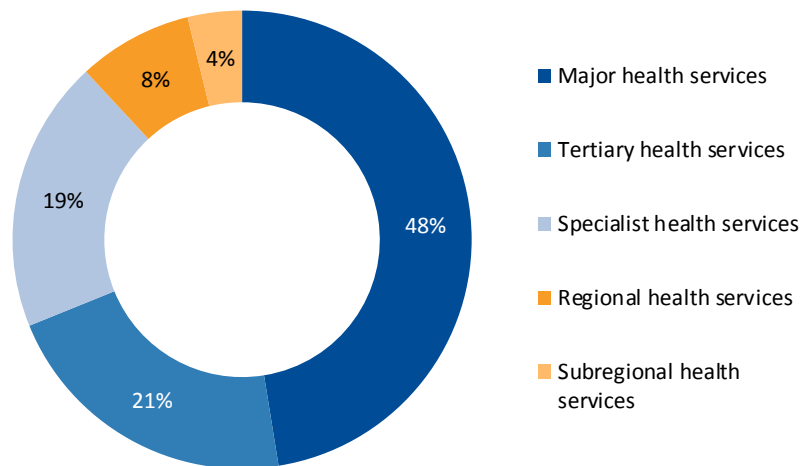
Figure 3M
Short procedures occurring in operating theatres, 1 July 2014 to 31 December 2016



Source: VAGO, based on health services’ data.

Health services across all peer groups deliver short procedures in fully equipped operating theatres, as shown in Figure 3N.

Figure 3N
Short elective procedures in operating theatres, by peer group,
1 July 2014–31 December 2016



Source: VAGO.

From the data, we cannot verify whether these procedures required an operating theatre due to increased complexity of the individual patient. Health services should re-evaluate their allocation policies to ensure that procedure rooms and operating theatres are appropriately booked.

4

System design

Under Victoria's devolved governance model, DHHS does not control the operating models health services choose or how they meet their targets.

In this part of the report, we examine how DHHS and health services design systems to allocate theatre resources and drive the productivity of Victoria's public operating theatres.

4.1 Conclusion

The current health system design does not support the efficient use of operating theatres. Victoria is not meeting its access targets for semi-urgent and non-urgent elective surgery, because resource allocation focuses instead on achieving waiting list targets. The funding model and the targets set for health services by DHHS do not provide incentives for health services to be as productively efficient as possible.

The lack of centralised control of data quality, definitions and performance measures inhibits benchmarking and sharing of better practice across the sector. DHHS needs to improve operating theatre efficiency by collecting information that would enable health services to identify inefficiencies and by supporting the transfer of good ideas and practices between health services.

DHHS's current information on theatre usage and demand for surgery is incomplete, which inhibits its ability to plan for capital investment and budget allocation. DHHS does not measure access to emergency surgery, so it is not possible to assess whether enough theatre resources are being allocated to treat emergency patients within required time frames.

4.2 Health service organisation

Victoria's health services use a range of models to manage their theatre resources to deliver emergency and elective surgery across different surgical specialities. Elective and emergency surgery compete for the same finite theatre resources, although only access to elective surgery is measured directly. As a result, it is not possible to assess whether health services are allocating resources efficiently between the two surgery streams. Health services therefore risk misallocating theatre resources, resulting in patients waiting beyond clinically recommended time frames for surgery.

Theatre resource allocation

DHHS produced *Good practice in management of emergency surgery: A literature review* in 2010, which described four models used by Victorian health services to allocate theatre resources between elective and emergency surgery:

- using dedicated emergency surgery lists or theatres
- reserving capacity in elective surgery lists to allow flexibility in the schedule for emergency cases
- balancing business-hours and out-of-hours work by using twilight lists or out-of-hours operating theatre sessions for emergency surgery
- clearly separating elective and emergency surgery resources to reduce the impact that emergency cases have on elective sessions, and vice versa.

The review did not evaluate the outcomes of each model or make recommendations to health services on which model they should use. All four models are in use in Victoria, with most health services using components of several models in a hybrid approach.

Health services identified infrastructure, case load and historical precedent as key drivers in their choice of resource allocation model. Rather than finding consistency between health services with similar circumstances, we observed that health services with similar case loads or infrastructure adopt significantly different models. This indicates that historical precedent can have a strong influence—health services maintaining a ‘this is how we do it’ ethos—which may not deliver the best allocation of resources.

Figure 4A shows how the audited health services allocate their theatre resources alongside their overrun results. The table shows a clear correlation between separating the two surgical streams and overrun results for both elective and emergency surgery.

A comprehensive analysis of the relationship between the models, case loads, infrastructure and outcomes would improve the sector's understanding of the benefits of each model in different circumstances.

Figure 4A

Overruns in elective and emergency surgery at the audited health services

Health service	Model	Hospital	Main use	Overrun (percentage of sessions)	Average overrun (minutes)
Alfred Health	<ul style="list-style-type: none"> Physical separation of elective and emergency surgery Balance in-hours and out-of-hours emergency surgery 	Alfred Main	Emergency and complex elective surgery	20.5%	16.0
		Alfred Centre	Routine elective surgery	8.9%	22.7
		Sandringham Hospital	Emergency and routine elective surgery	12.6%	4.6
Austin Health	<ul style="list-style-type: none"> Physical separation of elective and emergency surgery Balance in-hours and out-of-hours emergency surgery 	Austin Hospital	Emergency and complex elective surgery	17.5%	12.9
		Heidelberg Repatriation Hospital	Routine elective surgery	5.2%	1.4
Melbourne Health	<ul style="list-style-type: none"> Dedicated emergency sessions Balance in-hours and out-of-hours emergency surgery 	Royal Melbourne Hospital	Emergency and all elective surgery	37.5%	40.5
SVHM	<ul style="list-style-type: none"> Dedicated emergency sessions Balance in-hours and out-of-hours emergency surgery 	St Vincent's Hospital	Emergency and all elective surgery	24.3%	29.6

Source: VAGO.

Health services frequently review their theatre resources allocation, such as the number of sessions assigned to each speciality, compared to demand. However, we found limited evidence of health services evaluating how their chosen model affects efficiency.

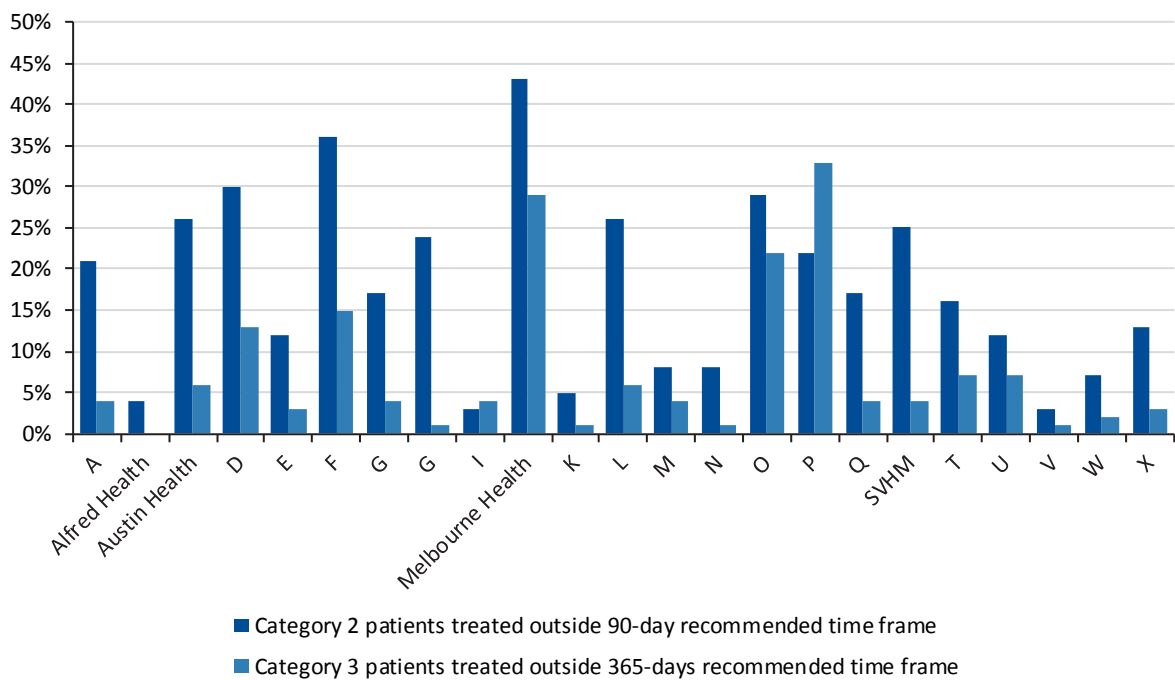
The 2011 paper *Streamlining elective surgery care in a public hospital: The Alfred experience* shows how this evaluation could occur by quantifying how physically separating elective and emergency surgery improved efficiency at Alfred Health.

Elective surgery access

Access to elective surgery varies between health services and across different types of elective surgery.

Figure 4B shows the percentage of patients waiting longer than their recommended time in category 2 (treat within 90 days) and category 3 (treat within 365 days) at the health services that submit data to ESIS.

Figure 4B
Percentage of category 2 and 3 patients treated outside clinically recommended time frames, 1 April to 3 June 2017



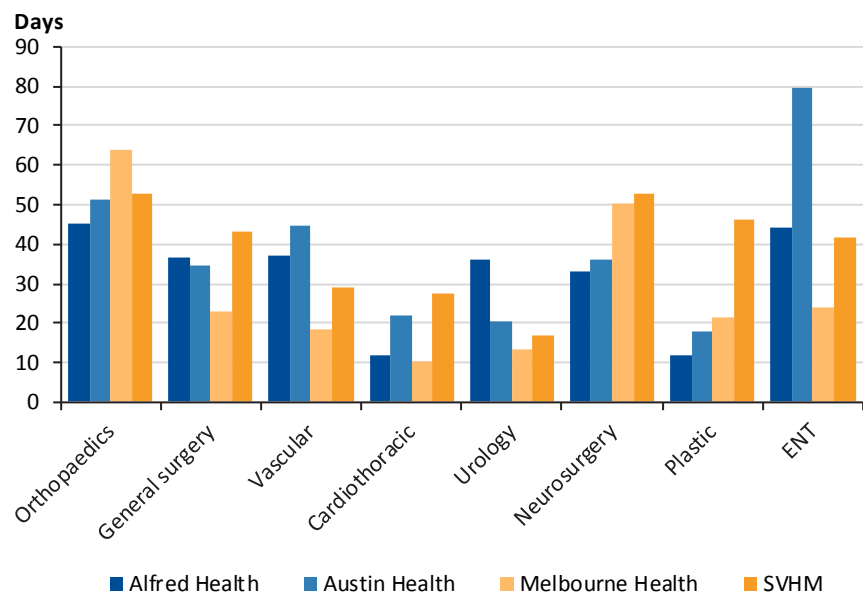
Source: VAGO, based on DHHS data.

A comparison of Alfred Health’s and Melbourne Health’s access outcomes shows that patients at Melbourne Health have a much higher likelihood of waiting longer than the clinically recommended time frames for their surgery. The distribution of theatre resources is important in this example—during 2105–16, Alfred Health’s elective surgery waiting list grew by 28 per cent but the health service managed it with comparably higher funding and with access to 19 theatres compared to Melbourne Health’s 12.

Access to different surgery types also varies across health services. Allocative efficiency would ensure that patients waiting for the same type of surgery received it in a similar time frame, regardless of which health service performed the surgery.

Figure 4C shows the difference across several major surgical types at the audited health services. It shows that the median wait time for an ear, nose and throat (ENT) operation at Austin Health was nearly twice as long as at SVHM. However, the situation is reversed for plastic surgery, with the median wait time at SVHM less than half that of Austin Health.

Figure 4C
Median wait for surgery by speciality, April 2016 to March 2017



Note: DHHS reports quarterly on median waiting times. This graph reports the median result of those published figures over the year to 31 March 2017.

Source: VAGO, based on DHHS data.

Key drivers of this variation are a mismatch between the demand for and supply of a surgery type at a health service, the way a health service allocates resources between surgery types, and the system’s inability to distribute patients because its design incorporates patient choice and devolved governance.

Victoria runs a devolved health system in which health services are responsible for managing their own resources and waiting list. Victorian GPs can refer patients to any health service, regardless of capacity and wait times, although GPs should consider this information. The health system could encourage allocative efficiency by improving dissemination of waiting time information and by moving patients between health service waiting lists.

Across the ESIS health services, between 3 000 and 4 000 patients a year receive elective surgery at a different hospital to the one at which they were waiting. Health services or DHHS may facilitate this reassignment of patients.

This represents approximately two per cent of the elective surgery performed by the ESIS health services. DHHS’s Elective Surgery Access Policy is designed to support the transfer between health services of patients who have been on the waiting list for a long time.

Health services have advised us that there are barriers to moving patients, such as:

- patients being unwilling to transfer due to geographic inconvenience or clinician preference
- local clinicians needing to maintain continuity of care up to surgery and beyond
- difficulties in negotiating clinical responsibility, funding and costs between health services
- performance reporting mechanisms that attribute the patients' waiting times to the treating health service, rather than the one that managed the patient before surgery.

None of these barriers are insurmountable, but health services need to expend additional resources to facilitate a transfer.

Emergency surgery access

Victoria does not have access measures for emergency surgery. Establishing access measures would direct health services' focus to balancing resources between elective and emergency patients. Health services could use access measures to evaluate whether patients receive emergency surgery in time to avoid worse clinical outcomes.

In 2012, DHHS released *A framework for emergency surgery in Victorian public health services*, which explains the challenges for health services:

'In many health services, both elective and emergency caseloads share the same operating theatres, surgeons and teams ... A balanced approach in the provision of emergency and elective surgery can facilitate improved access, and result in improved patient outcomes, decreased cancellations of elective and emergency surgery, shorter waiting times and reduced rates of emergency surgery being undertaken after hours.'

This document recommended a six-tier category system linking clinical urgency to waiting times. The system is designed to ensure that clinical urgency is the key driver of decisions in allocating theatre resources.

DHHS is currently working with the Victorian Surgical Services Advisory Committee to gain agreement on appropriate access targets based on the 2012 framework. Underpinning this work is new evidence concerning access times for particular emergency surgery types—this evidence became available when DHHS began collecting surgery start times for emergency surgery cases. DHHS has found that procedure-focused access measures could provide incentives for health services to focus on improving procedures.

Health services have found that emergency access measures would help them balance resource allocation. They report that some clinicians seek additional emergency surgery theatre time for their speciality, without being able to prove the need.

In 2017, SVHM began to use a set of internal measures of emergency access, as shown in Figure 4D, which enables it to evaluate resource allocation between emergency and elective surgery based on quantifiable need.

Figure 4D
SVHM's emergency priority codes

Priority codes	KPI (to anaesthetic preparation)	Examples
0 Immediate	Within 30 minutes	The patient is at immediate risk of loss of life, shocked or moribund, resuscitation not providing positive physiological response <i>Abdominal trauma, burr holes, vascular repairs, compartment syndrome</i>
2 Urgent	Within 120 minutes	The patient is physiologically stable but the surgical problem may undergo significant deterioration if left untreated <i>Peritonitis, ischaemic bowel, strangulated hernia, severe sepsis</i>
3 Urgent	Within 6 hours	The patient's condition is stable—no deterioration is expected <i>Localised peritonitis, incarcerated hernia</i>
4 Urgent	Within 12 hours	The patient's condition is stable—no deterioration is expected <i>Bowel obstruction no ischemia, appendectomy, sick gall bladders, compound fractures, contaminated wounds</i>
5 Urgent	Within 24 hours	The patient's condition is stable—no deterioration is expected but the patient is not suitable to be discharged <i>Most fractures, most acute gall bladders</i>
8 In hours urgent	Within 72 hours	The patient is stable, however, due to co-morbidities/support systems required, surgery needs to be performed in hours
12 Not ready for surgery/knowledge of potential surgery		May be a case being transferred from another hospital, in which the other hospital is flagging that the patient requires surgical access

Source: VAGO, based on information from SVHM.

4.3 Health system governance

DHHS's strategic documents identify efficient use of resources and equity of access as key goals for the health sector. DHHS's governance of the system needs to be based on robust data and performance management frameworks to achieve these objectives.

Data management

DHHS collects multiple datasets to enable it to count, classify and cost activity across the health system. The datasets most relevant to this audit are:

- Victorian Admitted Episodes Dataset (VAED)—provides a comprehensive dataset of the use of health services in Victoria
- Victorian Emergency Minimum Dataset (VEMD)—comprises data on presentations at emergency departments
- Victorian Cost Data Collection (VCDC)—collects data on the cost and mix of resources used to deliver patient care
- Elective Surgery Information Systems (ESIS)—collects elective surgery waiting list data from participating Victorian public health services
- Victorian Integrated Non-Admitted Health (VINAH)—collects data across a range of services, including specialist clinic information.

DHHS uses these datasets to recalculate the ABF price and weighting to drive efficiency.

DHHS does not collect operating theatre system data from health services. DHHS began to collect surgery start times for emergency surgery from health services in 2016–17, although it does not collect the full range of timestamps needed to analyse theatre efficiency, or any timestamps for elective surgery.

The lack of a statewide dataset is the key barrier to measuring theatre efficiency, benchmarking health service performance, and identifying and disseminating better practice.

DHHS's datasets also do not identify if there is unused capacity in the health system because they do not record if a theatre is staffed and available to perform surgery.

Performance management

DHHS has a detailed performance management framework for health services, outlined in the *Victorian health services performance framework* and *Victorian health agency monitoring and intervention*. DHHS routinely provides performance information to health services and assesses them against the targets in their SOPs. However, it does not assess theatre efficiency.

Measuring productive efficiency

DHHS's *A guide to surgical services redesign measures for improvement* recommends minimum timestamps that health services should capture and recommends multiple measures of theatre efficiency, such as utilisation rate, underruns and overruns.

DHHS does not require health services to use these measures or set efficiency targets in their SOPs. Health services are using some of the recommended measures internally, as discussed in Part 3 of this report.

The New South Wales Agency for Clinical Innovation and Queensland Health produced operating theatre efficiency guidelines, in 2014 and 2017 respectively, which contained recommendations similar to those in DHHS's guide.

Queensland Health collects nine theatre timestamps—including 'in anaesthetic time' for anaesthetic start, 'in operating room time' when a patient enters the theatre and 'procedure start time' when the patient is positioned and prepared. Queensland Health provides definitions for each timestamp, which health services incorporate into their IT systems and processes to ensure consistency. Queensland Health and its health services can use this information to measure and benchmark theatre efficiency.

Queensland Health has begun to evaluate health services' theatre efficiency against utilisation measures including overall utilisation rates and late starts, with plans to incorporate this into its reporting regime.

These measures target wasted surgical time and identify how a health service can become more efficient in its theatre usage. Similar measures would be effective in Victorian hospitals too, although Victoria lacks a common dataset and definitions to enable their implementation in the short term.

Supporting productive efficiency

DHHS has supported projects that target theatre efficiency under various programs, including through its Redesigning Hospital Care Program and through Better Care Victoria's current funding mechanisms.

DHHS funded nine health services to participate in the United Kingdom National Health Service's Productive Operating Theatre program. Health services chose projects based on their perceived efficiency risks and measured improvements in hospital-initiated postponements, start on time and utilisation measures. The benefits of support programs can be maximised by communicating successful elements of the projects, and DHHS has published case studies of a range of successful interventions.

DHHS currently funds health services to participate in benchmarking programs run by private providers. This enables health services to compare some aspects of their performance, although the benefits are limited for a number of reasons:

- programs rely on health services providing accurate data
- not all health services participate
- data is anonymised and does not necessarily benchmark factors that drive theatre efficiency, such as turnaround times or underruns.

Benchmarking and sharing better practice

The Victorian health sector does not have the data or systematic processes for identifying better practice and sharing knowledge to improve operating theatre efficiency.

Benchmarking

Health services are able to measure their own performance, but are unable to benchmark their results because they do not have access to their peers' information. Health services are keen to have this information to help them understand how they are performing and to identify strategies they could learn from high performers.

For this audit, we collated theatre data from the 23 ESIS health services from 1 July 2014 to 31 December 2016 and compared performance across peer groups and state averages. Using this data, we created visual dashboards that enabled us to analyse performance at the state, peer group and health service levels across the measures in Part 2 of this report.

We provided the four audited health services with data that compared their performance with those of their peer group and state averages. This led Austin Health and Alfred Health to identify areas they could re-evaluate to improve their efficiency. If this dataset existed for all of Victoria, more health services would be able to identify areas for improvement.

Sharing better practice

DHHS leads forums within the sector that examine health service practices, including the Victorian Surgical Services Advisory Committee and the Elective Surgery Group. These forums enable DHHS and health services to discuss issues relating to health service performance. They have led to projects that could improve theatre efficiency, such as improving the categorisation of elective surgery and developing emergency surgery access measures.

However, health services advised us that the existing forums do not facilitate benchmarking, the identification of better practice or the exchange of ideas between health services, although they do focus on beneficial projects. Health services advised that theatre efficiency would be improved through detailed discussion of what works in managing theatre resources. Health services have stated that knowledge is being informally shared through staff movement, professional relationships and ad hoc forums.

The Victorian Agency for Health Information and Better Care Victoria—now incorporated into Safer Care Victoria—are new agencies that may support the sharing of better practice and establish datasets to evaluate performance in future.

Allocative efficiency

DHHS reports on measures—waiting list numbers and access targets—that drive and evaluate the health system’s allocation of resources to elective surgery. Of the two measures, access targets evaluate whether patients receive treatment within clinically recommended time frames and is a better measure of allocative efficiency.

The waiting list target focuses on delivering an amount of surgery, without considering the timeliness or the type of surgery delivered. The emphasis DHHS places on the waiting list target in planning the level of funded activity across the state does not support Victoria to achieve its elective surgery access targets.

DHHS’s forecasting of the amount of surgery required to maintain the state’s waiting list target is based on robust historical data, resulting in the state balancing additions to and removals from the waiting list. The state finished only 0.63 per cent away from its overall target in 2015–16.

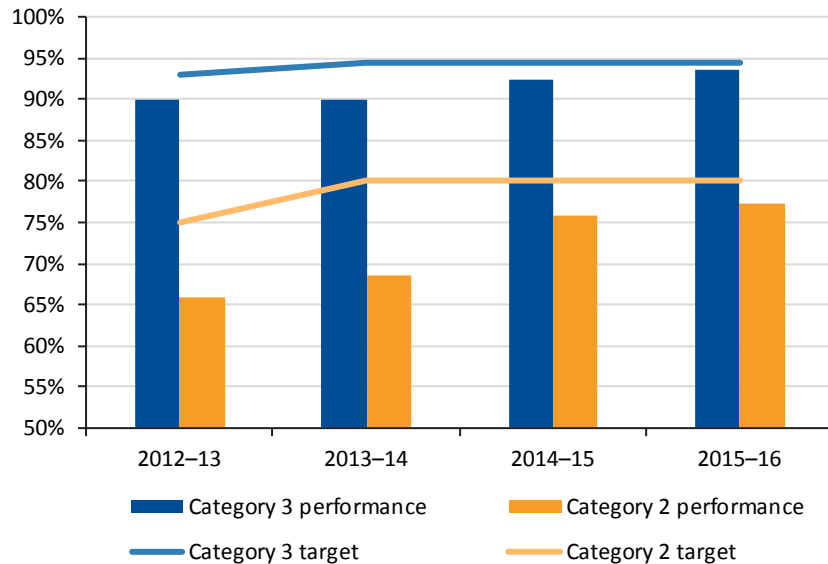
DHHS’s analysis includes:

- counting and costing previous activity based on DHHS datasets
- forecasting growth across elective and emergency surgery
- analysing health service performance and necessary growth to maintain delivery levels
- engaging with health services.

The resulting advice quantifies the amount of surgery required to meet anticipated demand across emergency and elective surgery.

However, although the advice describes access levels and a proposed target, it does not quantify how different levels of resource allocation will affect Victoria’s performance across its access targets. The state has not achieved its access targets for treating semi-urgent (category 2) and non-urgent (category 3) patients over the four years to 2015–16, as shown in Figure 4E. The state met its category 1 access target of 100 per cent in each of these years.

Figure 4E
Access to elective surgery compared to the state's targets



Source: VAGO, based on DHHS annual reports and Victorian State Budget papers.

Against the access criteria, the health system is not allocatively efficient because it is not meeting its targets and patients are waiting longer than the clinically recommended time frames for surgery.

Productive efficiency

Although Victoria has a devolved system of health service management, DHHS's performance measures and funding model could provide incentives for health services to use their theatre resources efficiently.

While Victoria's operating theatres demonstrate good overall utilisation rates at the state level, there are opportunities to improve the causes of inefficiency, such as late starts and underruns. Health services have identified that improving performance in these areas is possible, although it requires significant management effort to drive change in processes and culture. Further, they have found that the gains can be lost if management focus is not maintained. The persistence of these inefficiencies indicates that the design of the health system does not provide sufficient incentives for health services to address theatre efficiency issues.

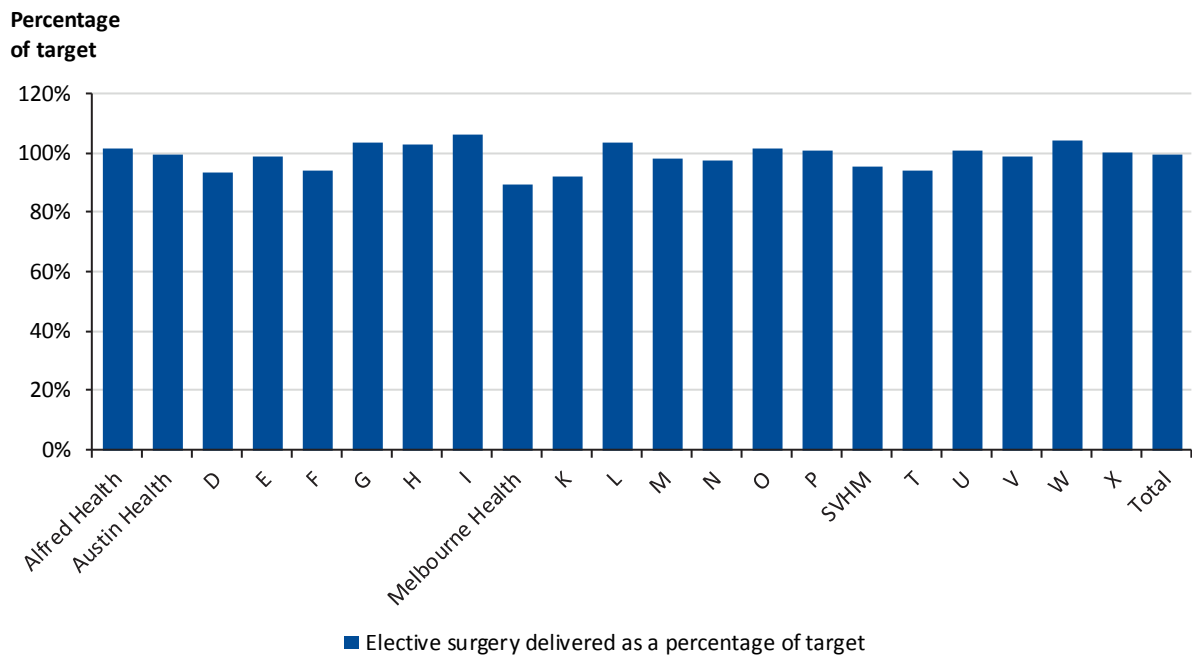
DHHS can affect health service practices in two key ways—through the SOPs and through its funding mechanism. How DHHS designs these tools affects the productive efficiency of operating theatres.

SOP targets

To deliver the state’s elective surgery waiting list target, DHHS sets access targets and negotiates with each health service to deliver a set amount of elective surgery. While the target for the amount of elective surgery could act as a minimum level of surgery delivered, we found that it is instead acting as a goal that drives resource allocation levels for elective surgery. This level of surgery is calculated based on waiting list targets, not to meet access targets.

Figure 4F shows that health services delivered surgery at or close to their targets in 2015–16.

Figure 4F
Elective surgeries delivered as a percentage of the health services’ targets, 2015–16



Source: VAGO, based on health services’ SOPs and annual reports 2015–16.

Health services could reduce the cost of performing surgery by becoming more efficient, which would enable them to fund more treatment—both surgery or other treatment—from among their competing demands for service. It is understandable that once a health service meets its elective surgery target it will direct resources to the areas of highest clinical priority, which may or may not be additional elective surgery.

Becoming more efficient in delivering elective surgery is one way that health services could improve performance against their targets using existing resources, although current targets do not explicitly link the delivery of elective surgery to resources consumed.

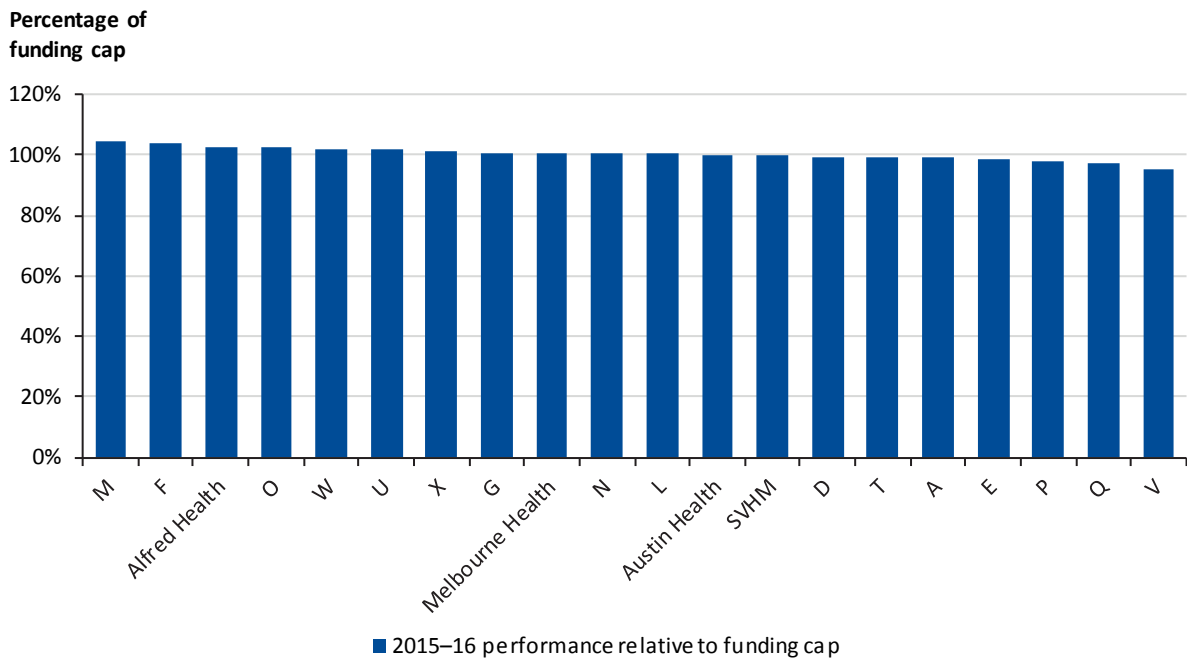
Targets that require health services to maximise the amount of surgery performed during a session—such as a late start target—would focus health services on minimising wasted surgical time to become more efficient.

Funding

The funding model provides incentives for health services to deliver ABF activities, including surgery, to the amount that will maximise revenue and funding growth—104 per cent of their capped funding. Once health services reach their capped activity level, DHHS does not fund them to deliver additional activity—surgery or other treatment. Health services may therefore not have sufficient budget to open theatres and deliver more surgery, even when they create theatre capacity by becoming more productively efficient.

In 2015–16, only one health service exceeded its final cap—at 104.2 per cent, as shown in Figure 4G. The audited health services told us about their efforts to balance the provision of additional surgery to deliver clinical outcomes with financial constraints due to the capped funding.

Figure 4G
Health service output relative to their funding cap, 2015–16

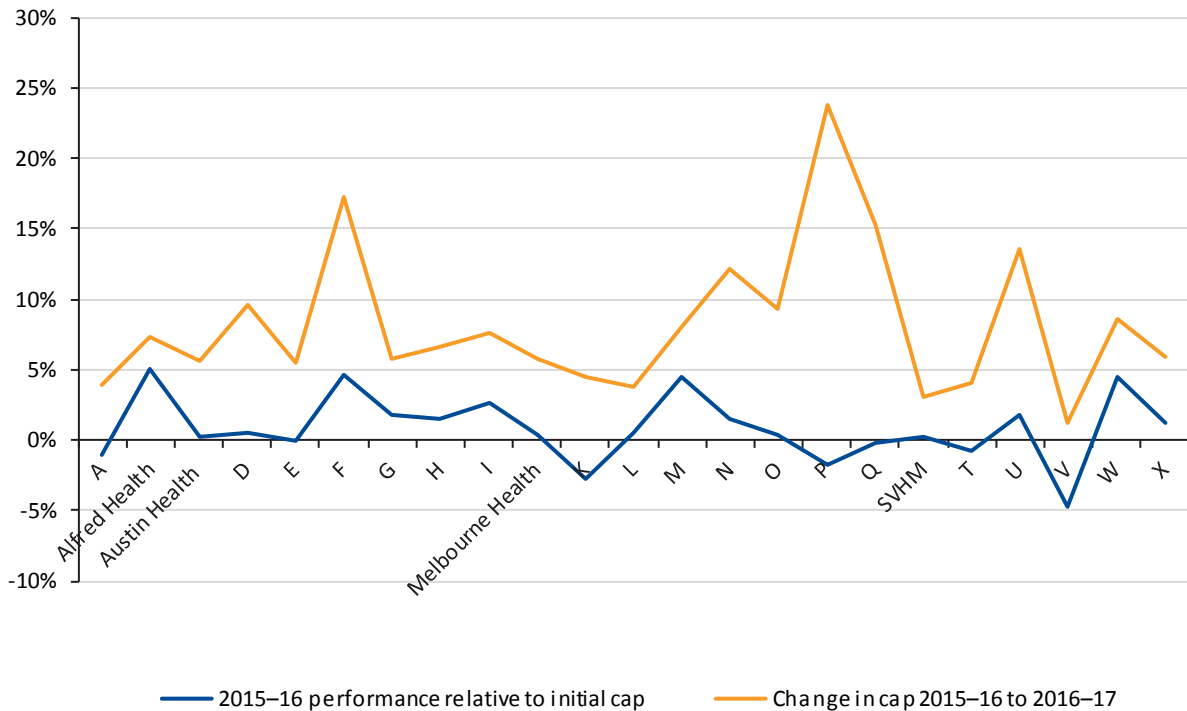


Source: VAGO, based on health services’ annual reports 2015–16.

DHHS may adjust a health service’s cap during the year, subject to available budget and competing priorities, although health services cannot rely on this adjustment occurring. In 2015–16, the highest adjustment to a health service’s cap was 2.4 per cent, but most adjustments were less than 1 per cent.

DHHS may also alter a health service’s cap year to year, based on performance. This means that a health service that delivers above 100 per cent of the cap may receive greater funding in following years. Figure 4H shows that funding growth in 2016–17 did largely follow performance above the cap in 2015–16.

Figure 4H
Changes to health services ABF caps, 2015–16 to 2016–17



Note: The large increases at health services F and P reflect extra funding to staff newly opened theatres.

Source: VAGO, based on health services’ annual reports.

Funding adjustments

Extra funding may become available during the year, which DHHS distributes to health services so they can deliver more surgery. DHHS does not link additional funding to efficient performance.

In 2016–17, \$162.87 million of federal National Health Reform funding became available to DHHS mid-year. DHHS allocated \$35.62 million of this to support health services to manage risks in the delivery of their SOPs. DHHS made an additional \$22.93 million available for mid-year review requirements.

DHHS considered a range of demands and risks that it and the health services identified when deciding how to distribute this funding, including:

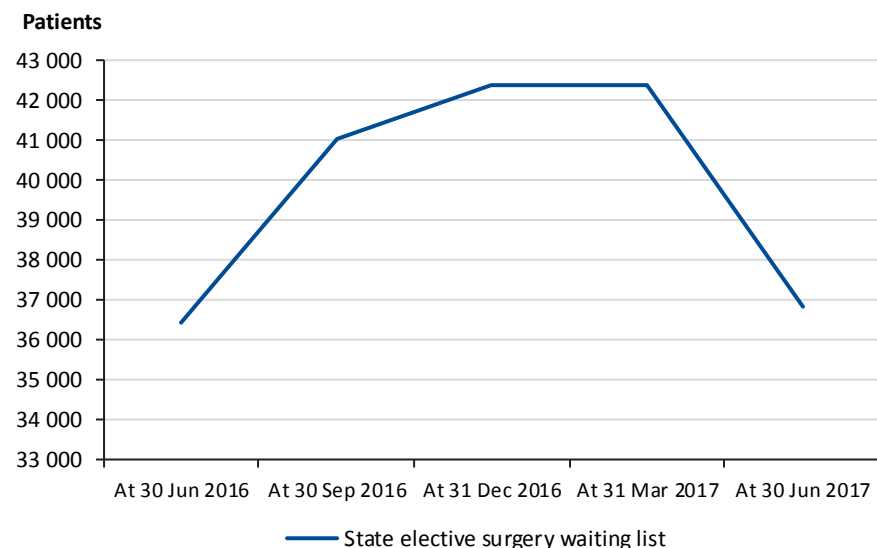
- health services' cashflow and budget position
- health services' activity levels
- previous funding commitments
- minor capital support requested for critical items
- health services' requests for funding to deliver additional surgery.

Although the priorities for funding are clear, the funding policy provides limited guidance on how DHHS should allocate funds between competing priorities. Eight health services bid unsuccessfully for additional funding to deliver more surgery. If funded, these health services could have maximised the delivery of surgery from their theatre infrastructure and overheads, thereby increasing efficiency.

DHHS may also provide funding tied directly to activity—usually later in the financial year—which focuses on helping health services and the state meet waiting list targets.

In March 2017, DHHS funded health services to treat an extra 2 245 patients during the last quarter of 2016–17 at a cost of \$18.1 million. This additional activity enabled the state to meet its end-of-year waiting list target, although, as Figure 4I shows, the number of people waiting for elective surgery fluctuates significantly during the year.

Figure 4I
Patients on the elective surgery waiting list, 2016–17

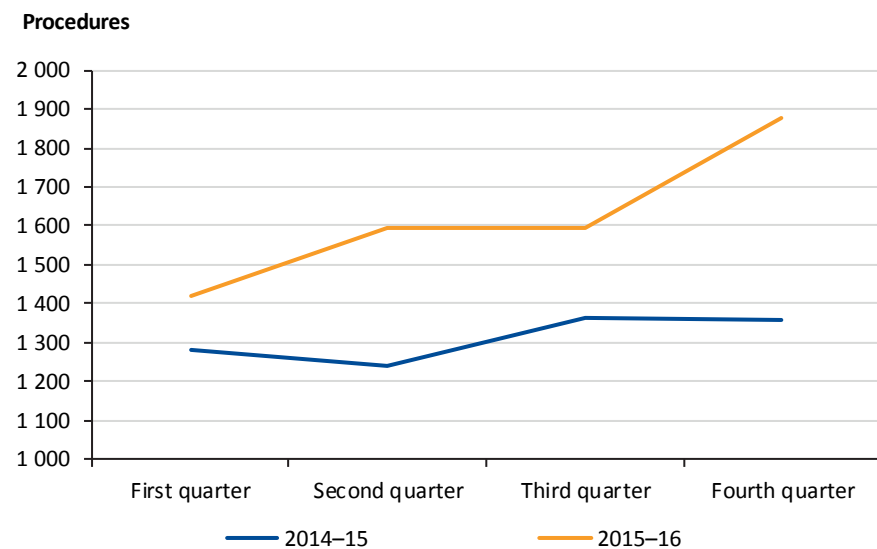


Source: VAGO, based on DHHS data.

Health services used different methods to deliver additional funded surgery in the final quarter of the year, including out-of-hours surgery, outsourcing to private hospitals, and staff working extra shifts within business hours. Health services have identified that funding surgery in this way increases costs—for example, the cost of penalty rates to deliver surgery out of hours. Health services have advised that they could plan for and deliver this activity at lower cost if DHHS provided funding earlier in the financial year.

Figure 4J shows the increase in weekend elective surgery that occurs later in the year to support the additional delivery. Private hospitals treated 645 public patients in 2016–17. We could not quantify the number of additional shifts worked within business hours from available data.

Figure 4J
Weekend elective surgery, 2014–15 and 2015–16



Source: VAGO.

4.4 Health system planning

DHHS is responsible for leading the growth of theatre capacity to meet rising demand for surgery, including capital infrastructure development and funding health service activity.

DHHS can create capacity within existing infrastructure by supporting health services to improve their theatre efficiency and ensuring sufficient funding is available to staff theatres.

There are limitations to DHHS’s data and its usage which affect its understanding of theatre capacity and demand for surgery in Victoria.

Understanding operating theatre capacity

DHHS maintains a census of operating theatres in Victoria, which it uses to identify the number of available theatres. However, DHHS does not collect information on how health services are using and staffing their theatres.

The amount of surgery performed in operating theatres, and consequently their capacity to meet demand, is dependent on how efficiently health services manage their theatres. DHHS does not have access to the data required to assess theatre efficiency.

The absence of this data creates two key risks for DHHS:

- **Existing theatres are closed**—additional recurrent funding for clinical staff could deliver more surgery without further capital investment and would maximise surgical output from the same overhead costs.
- **Theatre resources are not being efficiently utilised**—where productive efficiency is low, performance improvements would increase capacity without additional infrastructure and would reduce wasted recurrent funding.

By collating operating theatre data, we have identified that there is limited additional physical capacity in tertiary and major health services, which manage the majority of the metropolitan theatre infrastructure. To deliver more surgery, DHHS will need to invest in additional infrastructure or provide incentives for health services to use existing theatres more efficiently. Any increase in surgical output would need to reflect other potential capacity constraints such as available intensive care units and ward beds.

Understanding demand

DHHS uses historical data and growth projections to forecast future demand for emergency and elective surgery. Key determinants include the amount of surgery that health services have previously delivered, the elective surgery waiting list, population growth and system changes such as ongoing work to improve access to specialist clinics.

There are several key risks inherent in the existing system due to gaps in the information available to DHHS:

- There are 37 health services that perform surgery but that do not provide data to the ESIS dataset. As a result, DHHS has limited information about demand for surgery at these health services.
- Patients are added to a health service's waiting list by either attending a public specialist clinic appointment or by a surgeon's private rooms referring them to the health service for surgery. Health services, particularly tertiary health services, may also receive transfers from lower-acuity hospitals that are unable to provide treatment to emergency patients. DHHS expects that health services' recent increased focus on improving access to clinics will raise the number of patients on the waiting list. However, the anticipated size of the increase is unknown, as DHHS has not estimated the increase in clinic appointments or the proportion of patients who will require surgery.
- DHHS uses general population growth and change in health service demand to forecast surgery activity at individual health services. DHHS could strengthen its analysis by using the geographical information available in its VAED dataset as part of its planning for funding growth and capital expansion.

Appendix A

Audit Act 1994 section 16— submissions and comments

We have consulted with DHHS, Alfred Health, Austin Health, Melbourne Health and SVHM, and we considered their views when reaching our audit conclusions. As required by section 16(3) of the *Audit Act 1994*, we gave a draft copy of this report, or relevant extracts, to those agencies and asked for their submissions and comments. We also provided a copy of the report to the Department of Premier and Cabinet.

Responsibility for the accuracy, fairness and balance of those comments rests solely with the agency head.

Responses were received as follows:

DHHS.....	84
Alfred Health	88
Austin Health	89

RESPONSE provided by the Secretary, DHHS



Secretary

Department of Health and Human Services

50 Lonsdale Street
Melbourne Victoria 3000
Telephone: 1300 650 172
GPO Box 4057
Melbourne Victoria 3001
www.dhhs.vic.gov.au
DX 210081

e4644664

Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31 / 35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves

Thank you for your letter of 26 September 2017, providing an opportunity to respond to the proposed performance audit report the Victorian Public Hospital Operating Theatre Efficiency.

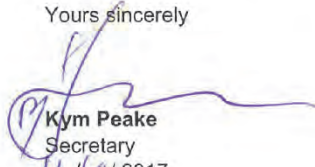
The Department of Health and Human Services has reviewed the report. Enclosed with this letter is the department's response to the recommendations of the proposed report and a plan outlining the actions the department commits to undertake to address the report's recommendations.

The department agrees with the findings of the report that highlight the need for benchmark data to drive improvement in hospitals. At the same time, the department needs to balance competing priorities. In light of this, the department will explore short term alternatives to efficiently address the recommendations. This may include work with third party providers already collecting some of the necessary information. The department will maintain constructive dialogue with your office and keep you updated on progress.

The department is committed to efficiency improvements and has already commenced a review of emergency surgery access measures and will update the Victorian Surgical Services Access Committee on progress at their next meeting in October 2017. The department will also build on the work previously undertaken with the *Surgical services measures guide* (2012) to update and create greater clarity around efficiency measures and data elements. Furthermore, the department will also use current forums with health services to share information and practices that improve the efficiency of operating theatres.

I would like to take this opportunity to thank your staff for their work and for the professional manner in which the audit was conducted.

Yours sincerely


Kym Peake
Secretary
11/10/2017
Encl.



e4644664 Attachment 3: Draft Action plan to the VAGO performance audit, Victorian Public Hospital Operating Theatre Efficiency

No	Recommendation	DHHS action	Proposed start date	Proposed end date
	We recommend that DHHS, in collaboration with health services:			
1	Implement an agreed suite of definitions, measures and targets for theatre efficiency that target the underlying causes of inefficiency	<p>The department accepts this recommendation.</p> <p>The department in collaboration with the Victorian Surgical Services Committee and key staff from health services will update its current <i>Surgical services measures guide</i> (2012) and republish for health services and the public.</p> <p>The department will develop further measures that will identify health services with best practice to enable the sharing of exemplar models across health services.</p>	Q3 2017-18	July 2019
2	Issue mandatory data quality standards for operating theatre data to ensure consistency in the data captured by health services	<p>The department accepts this recommendation.</p> <p>The department will seek consensus from the sector on key measures but ultimately will provide definitive guidance based on identified key measures (likely to accord with interjurisdictional measures).</p> <p>The department will consider targets for theatre efficiency based on feedback from health services on the likely flow on effects to other areas of the hospital and likely unintended consequences.</p>	Q3 2017-18	Dec 2019
3	Develop a centralised dataset for operating theatre data, to inform decision-making at DHHS	<p>This recommendation is agreed in principle.</p> <p>The department will explore short term alternatives to efficiently address the recommendations. This may include work with third party providers already collecting some of the necessary information. The department will review over time to assess whether and when to transfer work to department or Victorian Agency for Health Information. The department will maintain constructive dialogue with VAGO on progress.</p>	Q1 2018-19	July 2020
4	Disseminate operating theatre data to health services in a form that enables them to evaluate and benchmark their performance and identify sector best practice	<p>The department accepts this recommendation.</p>	Q1 2018-19	July 2020

e4644664 Attachment 3: Draft Action plan to the VAGO performance audit, Victorian Public Hospital Operating Theatre

Efficiency

No	Recommendation	DHHS action	Proposed start date	Proposed end date
5	Establish a regular, practitioner-led forum focused on sharing information and practices that improve the efficiency of operating theatres	<p>The department accepts this recommendation.</p> <p>The department will engage health services and encourage regular, clinician and manager forums focused on sharing information and practices that improve the efficiency of operating theatres.</p> <p>The forums will focus on sharing best practice of operating theatre efficiency and effectiveness including:</p> <ul style="list-style-type: none"> • Treat in turn • Categorisation • Matching capacity to demand • Emergency Surgery • Operating Theatre utilisation (time) • Operating theatre management. • Data analysis capability. • Pre and post-surgical systems and management • Surgical safety and quality. 	Q1 2018-19	July 2019
6	Work with the sector to improve productive efficiency at the theatre level (e.g. to reduce late starts and underruns)	<p>The department accepts this recommendation.</p> <p>The department will work with the sector to improve productive efficiency at the theatre level through identifying best performers and sharing key practice and models that contribute to improved productive efficiency.</p>	Q1 2018-19	July 2020
7	Develop and implement emergency surgery access measures	<p>The department accepts this recommendation.</p> <p>The department is currently working with the sector to improve access to emergency surgery. The key focus in 2017-18 is on access measures that indicate better quality and safety for emergency surgery. This will initially focus on time sensitive emergency surgery conditions such as fractured neck of femur and surgery conducted out of hours (known to increase risks to patients).</p> <p>Subsequently, the department will work with the sector to ensure that better and more efficient models of emergency surgery care (including dedicated emergency surgery resources and consultant led care) are rolled out across health services.</p>	Q1 2017-18 Q2 2018-19	Dec 2019 Dec 2019

e4644664 Attachment 3: Draft Action plan to the VAGO performance audit, Victorian Public Hospital Operating Theatre Efficiency

No	Recommendation	DHHS action	Proposed start date	Proposed end date
8	Analyse and forecast the impact of budget allocations on category 2 and 3 access indicators	The department accepts this recommendation. The department will work with health services in analysing and forecasting category 2 and 3 access indicators when setting health service priorities and annual budgets.	Q2 2018-19	July 2019
9	Review the current process for setting funding caps, to ensure caps are based on a comprehensive assessment of demand, capacity and performance measures	The department accepts this recommendation. The department will review its current process for setting health service budgets and priorities. The review will focus on identifying the key aspects of demand, capacity and performance that are relevant to improving efficiency and effectiveness of our surgical services.	Q3 2017-18	July 2019
10	Review current operating theatre management guidance provided to health services to incorporate better practice to drive theatre efficiency.	The department accepts this recommendation. The department will review current operating theatre management guidance provided to health services to incorporate better practice to drive theatre efficiency. The department intends to work with health services in developing a guide for health services (highlighting key service models and management practices as well as best practice examples from Victorian and interstate).	Q2 2018-19	Dec 2019
11	We recommend that the audited health services Formalise governance policies for decision makers allocating theatre resources between emergency and elective surgery and between surgical specialities.	For health services The department will support health services in meeting this recommendation by developing best practice examples and policies for the allocation of theatre resources between emergency and elective surgery and between surgical specialities.	Q1 2018-19	Dec 2019

RESPONSE provided by the Chair, Board of Directors, Alfred Health

55 Commercial Road
Melbourne VIC 3004
ABN 27 318 956 319

T +61 3 9076 2000
F +61 3 9076 2222
alfredhealth.org.au

Office of the Board Chair
Mr Michael W Gorton AM

T +61 3 9076 2449
E chair@alfred.org.au



4 October 2017

Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office (VAGO)
Level 31
35 Collins Street
Melbourne Victoria 3000

Dear Mr Greaves

Performance Audit Report Victorian Public Hospital Operating Theatre Efficiency

Thank you for your letter of 26 September 2017, addressed to Ms Helen Shardey. Ms Shardey retired as Alfred Health Board Chairperson on 30 June 2017 and I was appointed as Board Chair effective 1 July 2017.

Alfred Health is pleased to receive the provisional report of the above Performance Audit. I note the recommendations set out at page 12 of this provisional report and that recommendations 1 to 10 require the Department of Health and Human Services (DHHS) to take a lead. Alfred Health looks forward to working with the DHHS on these recommendations.

I note recommendation 11 is aimed at Audited Health Services. As one of those services, Alfred Health would make the following response:

Recommendation	Alfred Health response
<p>11. Formalise governance policies to guide decision-makers when allocating theatre resources between emergency and elective surgery and between surgical specialties.</p>	<p>Supported. The Alfred Centre model for elective surgery has dedicated theatres for elective surgery patients separate from the Main Ward Block operating theatres. This results in fewer hospital initiated postponements, reduces waiting list times, standardizes the patient journey and provides timely and efficient care for those having planned admissions and procedures.</p> <p>Governance is provided by the Theatre Reference Group (TRG) attended by the Surgical Heads of Units (HOU) and managed using the following guidelines:</p> <ul style="list-style-type: none"> • Elective Surgery Access Guideline • Admission Guidelines for Trauma Patients Guideline • Operating Suite Service – Alfred Main and Alfred Centre Guideline • Sandringham Operating Suite guideline <p>These guidelines will be reviewed by December 2017 to ensure that we are fully compliant with this recommendation.</p>

Yours sincerely

Michael W Gorton AM
Chair, Board of Directors
Alfred Health



RESPONSE provided by the Executive Director, Clinical Operations and Imaging Services, Austin Health



Austin Hospital

145 Studley Road
PO Box 5555 Heidelberg
Victoria Australia 3084
Telephone 03 9496 5000
Facsimile 03 9458 4779
www.austin.org.au

Andrew Greaves
Auditor-General
Victorian Auditor-Generals Office
Level 24, 35 Collins Street
MELBOURNE VIC 3000

12 October 2017

Dear Mr Greaves,

Thanks for the opportunity to participate in the Performance Audit of Victorian Public Hospital Operating Theatre Efficiency. Austin Health has reviewed the recommendations on page 12 of the proposed report and look forward to working with the Department of Health and Human Services (DHHS) on recommendations 1-10.

As one of the audited Health Services please see the below response to recommendation 11 which is:

Health Services should formalise governance policies to guide decision-makers when allocating theatre resources between emergency and elective surgery and between surgical specialties.

Austin Health response:

The Austin Health surgical program operates across 2 sites – Austin Hospital and Heidelberg Repatriation Hospital. The Austin site supports emergency, complex elective surgery and transplant with the Repatriation site supporting a stand-alone elective surgery centre. The model at the Repatriation site has supported greater efficiency and certainty for Elective surgery with more patients being treated in clinically recommended times and fewer hospital initiated postponements. This separate site model is a strong contributor to organisational theatre efficiency.

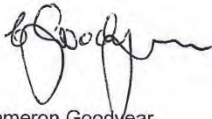
Governance and planning for the allocation of theatre resources is undertaken by the Theatre leadership group in collaboration with the relevant Surgical units and Anaesthesia. This is undertaken on weekly basis and supports the allocation of appropriate resources to support theatre activity. Austin Health is undertaking an improvement project focussing on theatre efficiency and utilisation, this will involve the review governance structures and relevant policies to support the efficient allocation of resources to support emergency and elective surgery activity. It is envisaged this project will be complete by June 2018.

Austin Health incorporates • Austin Hospital • Heidelberg Repatriation Hospital • Royal Talbot Rehabilitation Centre

RESPONSE provided by the Executive Director, Clinical Operations and Imaging Services, Austin Health—continued

Please contact me on 9496 5195 should you require any further information in regards to feedback on the report.

Yours Sincerely,

A handwritten signature in black ink, appearing to read 'C. Goodyear', with a stylized flourish at the end.

Cameron Goodyear
Executive Director
Clinical Operations and Imaging Services

Appendix B

Data quality

DHHS does not collate health services' operating theatre data into a statewide dataset, and therefore does not centrally govern, audit and assure health services' theatre data. The weaknesses in the data outlined in this appendix result from the lack of central governance.

There is significant variation in health services' data quality due to a lack of central governance. Introducing a statewide framework for governance of the theatre data, combined with consistent definitions and measures, would enable performance evaluation across the health system.

Inaccuracies in data

Data inaccuracy is the first major issue we identified in this audit. We applied logic rules and found that 5 per cent of records across the state had at least one error—such as recording that anaesthesia started after the operation commenced. However, this methodology cannot identify incorrect timestamps when they record sequential times.

Melbourne Health conducted an audit in 2016 to compare the recorded timestamps with the time the event actually occurred. They found 26 per cent of the records were accurate, 52 per cent had an error of less than 10 minutes and 22 per cent had an error of between 15 and 48 minutes. Since then, Melbourne Health has prioritised data improvement through its Theatres Transformation Project.

Although undetected data quality issues are present in the dataset we compiled, we expect the impact on our analysis to be low because we are reporting across a large number of records, and the Melbourne Health audit shows the degree of error is likely to be low.

Variation in data fields and terminology

Another major issue with data collection in the health services is the variability of the data fields collected. Health services collect different sets of timestamps and not all health services record the full set needed to assess theatre efficiency due to limitations in their IT systems or business rules. Only two health services were able to provide the full set of fields requested, and the lowest score of completeness was 77 per cent of the fields.

Health services also use data fields with the same name differently, such as the point in the surgery used to define 'surgery start'. This makes aligning data complicated and subject to error. In some cases, the combination of timestamps kept and definitions used do not enable the data to be accurately aligned across the 23 ESIS health services.

Common additional data errors we encountered included:

- terminology being defined in different ways
- different names being used for the same thing—for example, procedure names being abbreviated in different ways
- multiple rows of data being recorded for the same operation
- surgical session usage or length not being recorded accurately.

In the case of three health services, we determined that they recorded their data so differently from the other 20 health services that we could not include them in our reporting. For example, one health service's IT system records surgical sessions as running for 24 hours, which does not reflect reality and affected their reported efficiency rates in our dataset.

Appendix C

Assumptions and methodology

In this audit, we analysed efficiency in various ways, as described in Part 1. The health services currently use some of the measures in their internal reporting. We developed some measures to test issues identified by our engagement with health services, DHHS, stakeholders and subject-matter experts. This appendix outlines the assumptions and qualifications that apply to each measure.

Universal assumptions

We used a range of assumptions and measures, which apply throughout the report unless specified:

- We measured performance in ways that are most within the health services' control—we focused on business-day elective sessions, as this activity is a fairer measurement of management's performance.
- The available data has limited us to particular sorts of analysis, and we identify this in relevant parts of the report when it has affected the results.
- We excluded health services from certain measures when we were not satisfied with the quality of the data or how it reconciled with data provided by other health services.
- Theatre timestamps lack centralised governance, and health services do not necessarily collect all the possible timestamps. 'Procedure stop'—the time when the operation finishes—was provided to us by all of the health services and has been our default point for recording the end of a surgery. However, we acknowledge that this may reduce performance results for some measures such as utilisation rate and turnaround time.
- Health services collect data in their theatre data system in their operating theatres, procedure rooms and some ad hoc 'work around' locations. We have only reported on surgery that occurs in full operating theatres.

Utilisation rate

The utilisation rate discussed in Part 2 includes any elective and emergency procedures that occurred within business-day elective sessions. Session utilisation begins at 'anaesthetic start' and concludes at 'procedure stop' or 'anaesthetic stop'.

Some theatres have attached anaesthetic bays, which enable 'parallel processing'—the next patient can begin the anaesthetic process while the previous patient is still in the theatre. In this audit, we counted anaesthesia and the operation in the utilisation rate to mitigate the impact of different theatre infrastructure across the health services.

Late starts

To assess the frequency of late starts, we analysed morning elective sessions conducted on business days to mitigate the impact of emergency surgery and overrun morning sessions on our performance analysis. We had difficulties aligning each health service's timestamps as definitions vary across the sector. For this reason, our results may vary from those that health services report internally.

Health services also did not consistently record reasons for delays—either not recording delays or using different terms and definitions for their recorded reasons.

Underruns and overruns

Underruns and overruns assess the time difference between the conclusion of the session's last procedure and the session's scheduled finish. We have measured the end of the last elective or emergency surgery that occurred relative to the end of the elective session.

Unused capacity

This measure records whether health services scheduled a surgical session in a theatre on a business day. We have not limited the type or length of the surgical session. We define an unstaffed theatre as being 'unused', though the available data does not tell us the reason why it was unused.

Cost efficiency and specialisation

Health services provided us with procedure-based data that enables us to view data at the theatre, procedure and speciality levels. However, as this data comes from the theatre systems, much of the terminology is inconsistent. For example, the names used to describe procedures differ significantly between health services. We attempted to standardise the data to create a common dataset, but we could not link all procedures because of data limitations.

Consultants and registrars

We attempted to identify whether a consultant or a registrar performed each procedure to evaluate the impact of teaching on efficiency. Unfortunately, not all health services' data enabled us to identify the surgeon's status. The reported results comparing surgical length only include operations when we could clearly identify the surgeon's status.

Appendix D

Specialisation

We identified that the length of an operation falls as the surgeon performs more of that particular operation.

To demonstrate this, we examined six common surgeries that are performed by consultants in Victoria. In five of the surgeries we examined, the duration of the operation was shorter when it was performed by the top 10 highest-volume surgeons compared to surgeons who had performed the procedure 10 or fewer times, as shown in Figure D1. In three cases the difference was over 20 per cent.

The data did not enable us to identify the methodology used to deliver the operation or if there were complicating factors. Incorporating this information into the data captured would enable health services to better benchmark the average duration of particular operations.

Figure D1
High- and low-volume surgeon efficiency (average minutes per procedure)

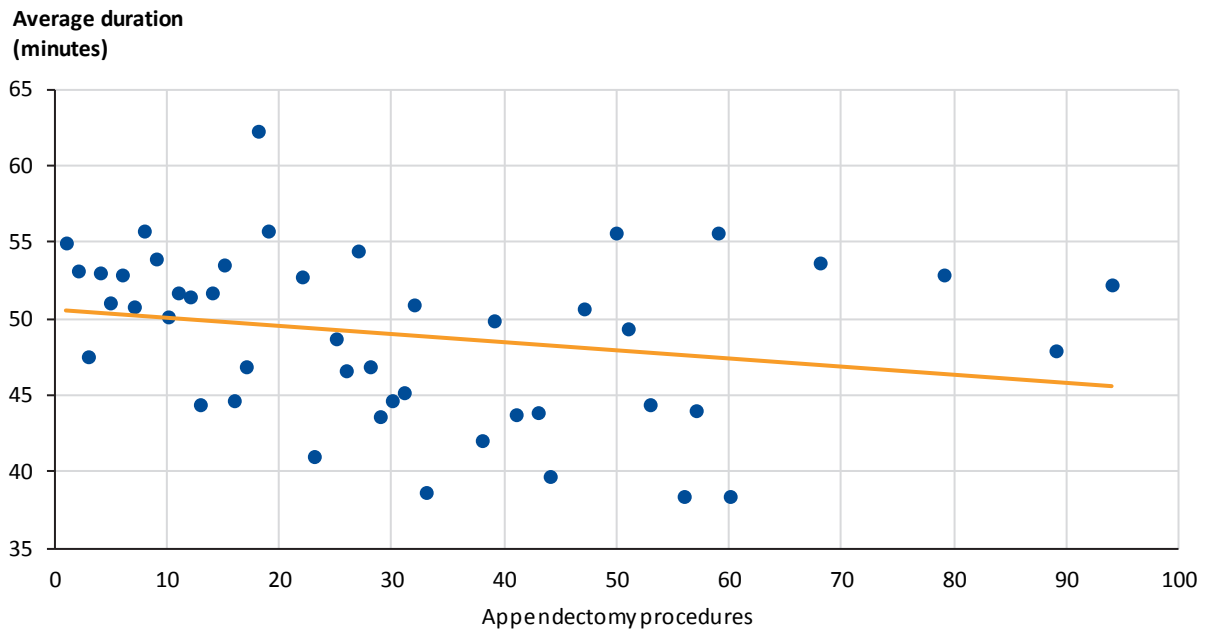
Surgeon	Appendectomy	Fractured neck of femur	Hip replacement	Knee replacement	Cataract surgery	Coronary artery bypass
Top 10 by volume	47.7	59.8	99.0	92.3	20.6	223.4
≤ 10 operations	53.1	62.7	119.5	118.6	25.9	220.6
Difference	11%	5%	21%	28%	26%	-1%

Source: VAGO.

Health services can improve efficiency by scheduling surgery in a way that concentrates types of operations with surgeons so that their clinicians undertake higher volumes of particular operations.

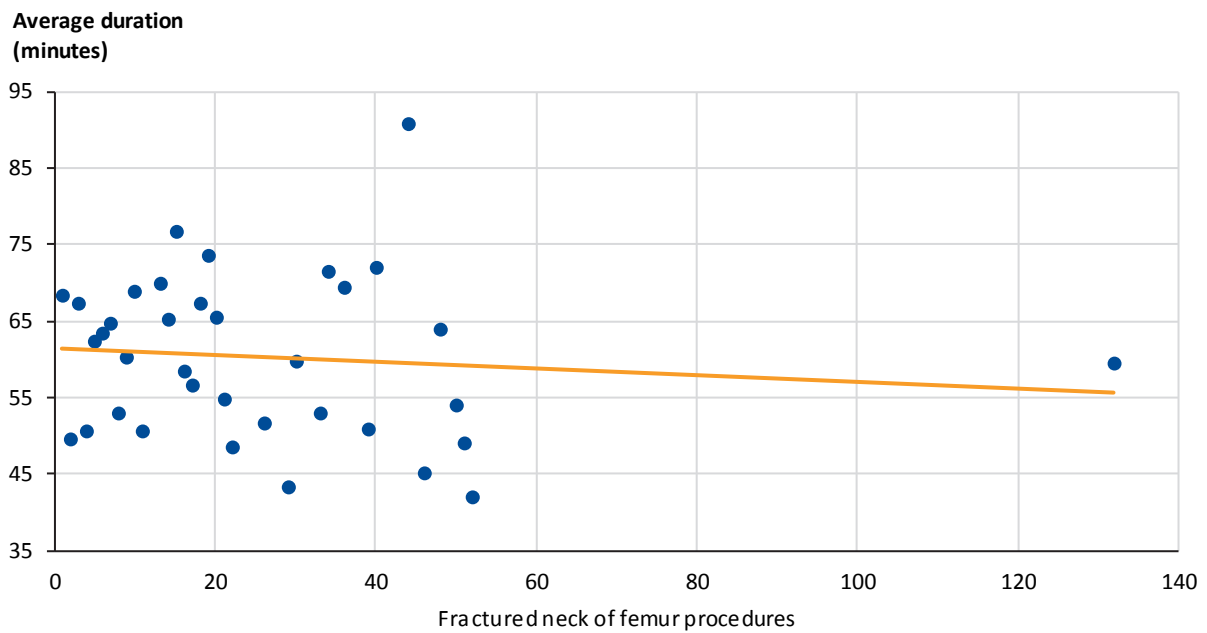
Each operation tested is shown in Figures D2 to D7.

Figure D2
Appendectomy performed by a consultant at the ESIS health services,
1 July 2014 to 31 December 2016



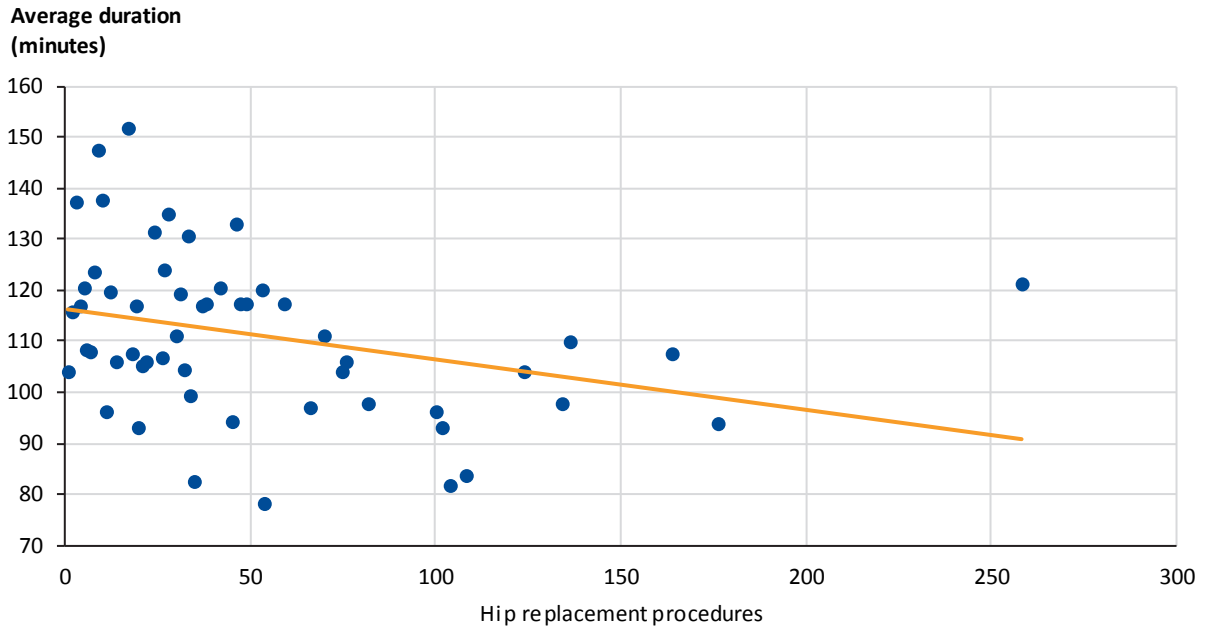
Source: VAGO.

Figure D3
Fractured neck of femur performed by a consultant at the ESIS health services,
1 July 2014 to 31 December 2016



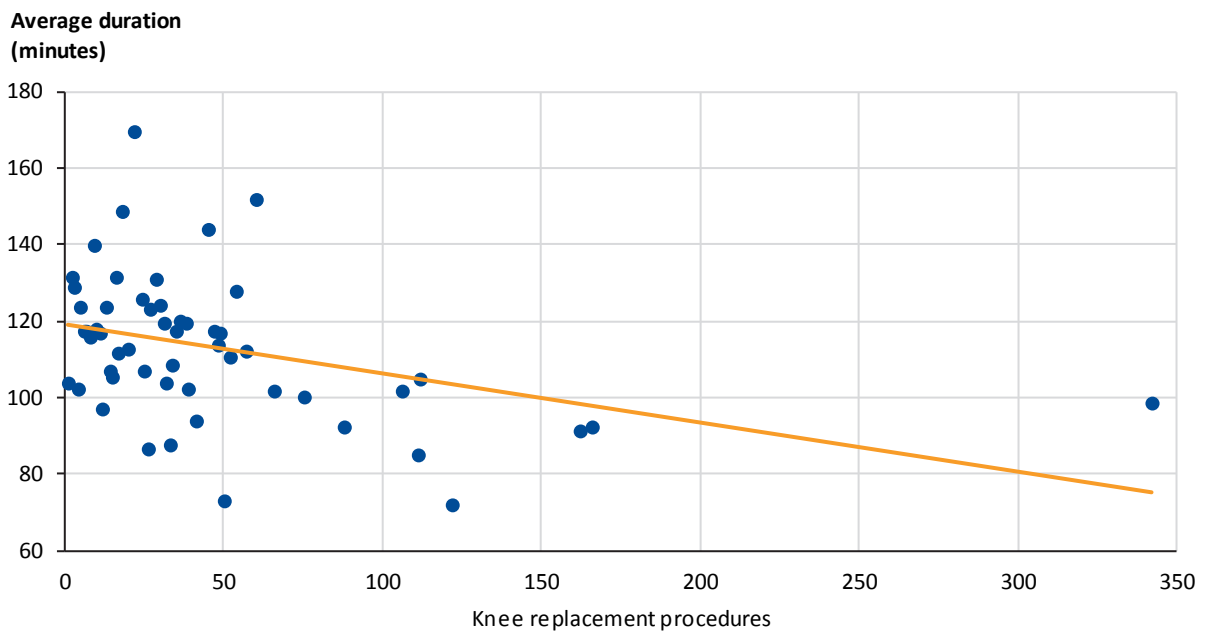
Source: VAGO.

Figure D4
Hip replacement performed by a consultant at the ESIS health services,
1 July 2014 to 31 December 2016



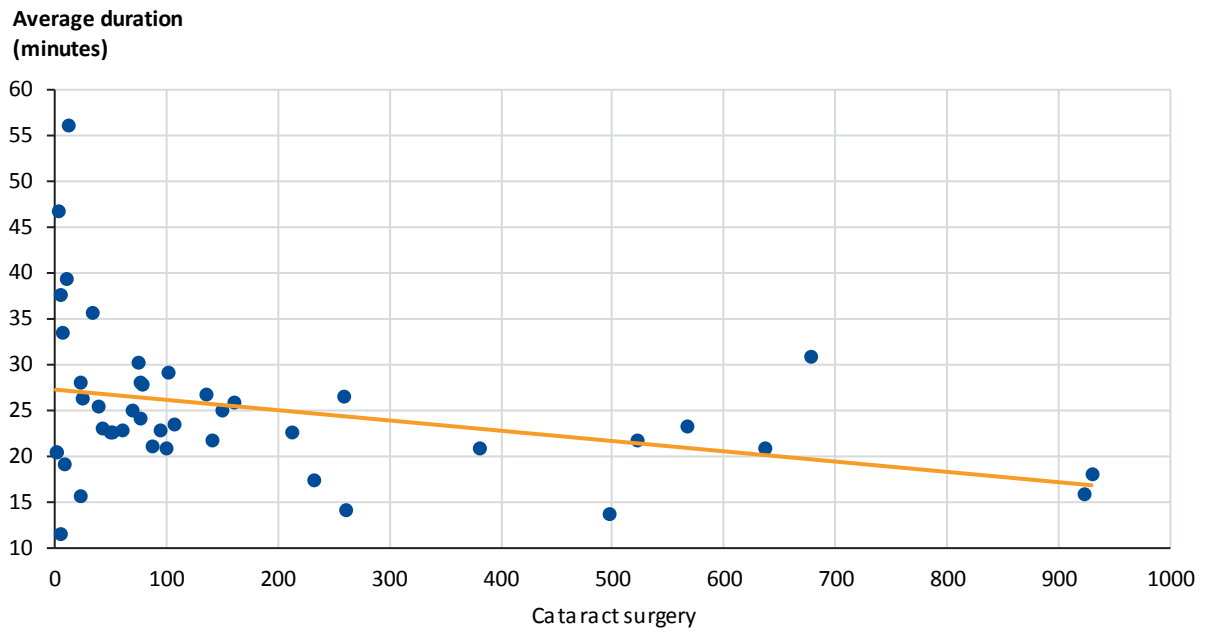
Source: VAGO.

Figure D5
Knee replacement performed by a consultant at the ESIS health services,
1 July 2014 to 31 December 2016



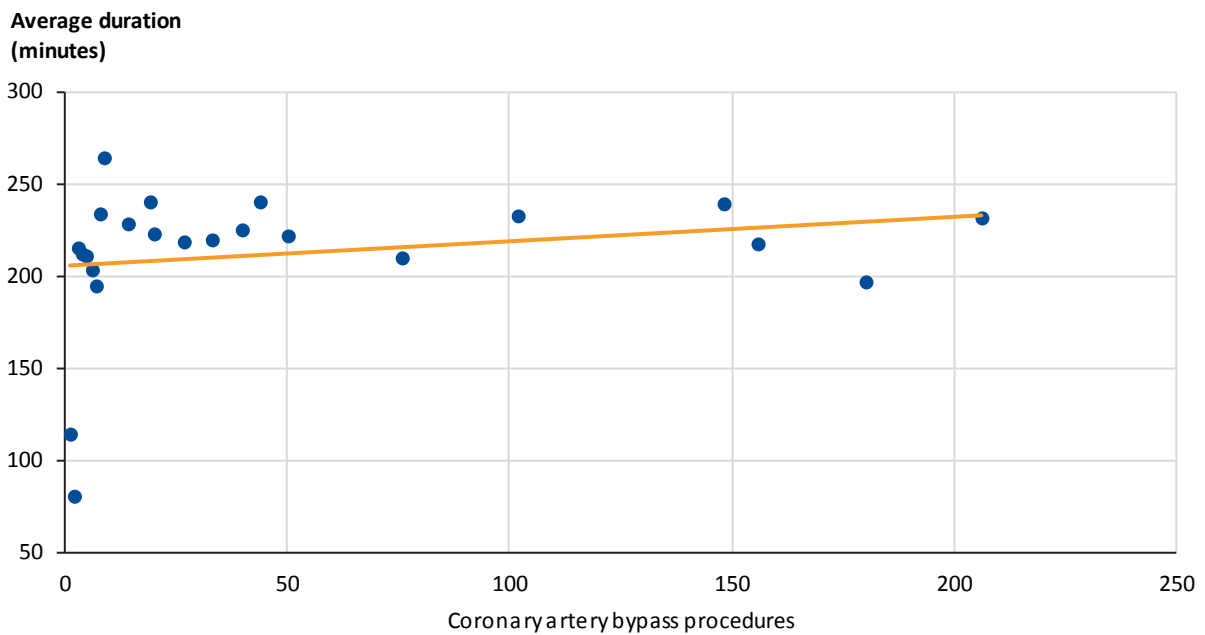
Source: VAGO.

Figure D6
Cataract surgery performed by a consultant at the ESIS health services,
1 July 2014 to 31 December 2016



Source: VAGO.

Figure D7
Coronary artery bypass performed by a consultant at the ESIS health services,
1 July 2014 to 31 December 2016



Source: VAGO.

Appendix E

Financial accounting consistency

DHHS mandates a common chart of accounts for health services to drive standardisation in recording financial information. However, we found significant inconsistency in how health services use the accounts.

Compiling a shared financial dataset required significant data manipulation to overcome the variation. Even then, attributing some costs was challenging, and undertaking analysis to the level we wanted was impossible. For example, we could not distinguish between costs used to deliver emergency and elective surgery or for surgery that occurs within or outside business hours. Due to the lack of comparable data, health services are unable to benchmark their costs and efficiency.

Figure E1 shows the variation in how the four audited health services capture anaesthetic salaries. The use of different cost centres, evidenced by the different numbers used, is a significant barrier to the easy comparison of costs between health services. This is one example and indicative of the inconsistencies in how the health services use the chart of accounts.

Figure E1
Anaesthetic cost centres used at audited health services

Cost centre	Alfred Health	Austin Health	Melbourne Health	SVHM
A4152 Anaesthetics			✓	
A4155 Anaesthetics HMO			✓	
A8252 Anaesthesia	✓			
Anaesthesia salaries		✓		
Anaesthetics				✓
A8254 Anaesthesia external medical staff CLOSED USE A4190		✓		
HMO Anaesthesia	✓			
A8257 Anaesthetics				✓

Source: VAGO.

Appendix F

Health services' operating theatre performance

We collected operating theatre data from the 23 health services that report to ESIS, and collated it into a dataset. Figure F1 outlines the 23 health services' results against common performance indicators. Health services use their own efficiency measures with different underlying assumptions. Our data, therefore, may differ from the health services' internal reports, as we have applied our own definitions.

Figure F1
Health services' theatre performance against key utilisation measures

Health service	Utilisation rate		Overruns		Underruns		Turnaround time		
	Anaesthetic start to surgery stop	Anaesthetic start to anaesthetic stop	Percentage of occurrence	Average minutes	Percentage of occurrence	Average minutes	Anaesthetic stop to anaesthetic start	Surgery stop to anaesthetic start	Unused capacity
Health Service A	79.75%	-	9.28	3.80	59.89	38.26	-	16.43	37.50%
Alfred Health	71.46%	75.82%	14.32	16.58	59.62	33.19	22.62	27.21	5.22%
Austin Health	74.70%	-	11.76	7.66	67.07	42.28	-	22.96	15.54%
Health Service D	65.25%	-	13.15	5.10	64.41	36.82	-	25.56	4.46%
Health Service E	77.88%	83.97%	10.96	6.72	56.56	29.33	13.42	16.46	4.88%
Health Service F	78.42%	83.78%	17.66	7.94	51.68	21.03	13.13	17.22	3.44%
Health Service G	72.06%	77.27%	14.89	10.40	60.75	35.56	17.88	20.62	8.22%
Health Service I	75.14%	79.69%	27.40	17.56	23.55	10.05	12.61	13.85	1.17%
Melbourne Health	82.31%	82.31%	39.06	43.97	26.90	12.80	17.71	17.71	3.00%
Health Service K	61.47%	70.72%	10.97	4.23	65.28	33.62	20.55	26.59	13.09%
Health Service L	74.30%	80.42%	14.13	7.31	57.91	29.33	17.26	21.90	7.81%
Health Service M	71.93%	-	20.95	14.26	47.03	27.40	-	15.57	11.13%
Health Service N	72.16%	76.69%	19.60	15.72	51.95	25.56	19.05	21.74	4.17%
Health Service Q	73.88%	80.08%	26.32	29.59	38.92	18.47	13.55	16.02	24.80%
SVHM	72.91%	93.86%	23.57	29.62	50.72	70.45	21.82	23.41	7.88%
Health Service T	75.31%	79.48%	15.81	9.43	50.21	26.12	15.74	19.16	10.83%
Health Service U	85.25%	88.99%	14.97	6.67	53.78	22.50	13.13	15.10	1.09%
Health Service V	69.84%	77.39%	9.98	3.23	68.25	35.04	18.09	24.07	20.16%
Health Service W	78.13%	83.77%	15.80	8.21	51.76	24.93	14.22	16.32	6.64%
Health Service X	71.55%	76.73%	15.08	8.49	62.99	35.23	19.12	22.64	11.02%
Average	74.27%	80.29%	16.36	12.04	55.27	31.82	17.50	21.00	9.52%

Note: The table excludes Health Services H, O and P due to underlying data issues.

Note: Cells are blank if health services do not collect the relevant data point (generally 'anaesthetic stop').

Note: All data is for the period 1 July 2014 – 31 December 2016 except for 'unused capacity', which covers 1 July 2016 – 31 December 2016. The shorter period is used for 'unused capacity' to account for new theatres being opened over the full date range, which affects the results.

Source: VAGO.

Auditor-General's reports tabled during 2017–18

Report title	Date tabled
V/Line Passenger Services (2017–18:1)	August 2017
Internal Audit Performance (2017–18:2)	August 2017
Effectively Planning for Population Growth (2017–18:3)	August 2017

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Victorian Auditor-General's Office
Level 31, 35 Collins Street
Melbourne Vic 3000
AUSTRALIA

Phone +61 3 8601 7000
Email enquiries@audit.vic.gov.au