KPMG

Economic impact of the broader adoption of virtual hospitals in Australia

September 2024

Disclaimers

Inherent Limitations

This report has been prepared as outlined with Medibank Private Ltd (Medibank) in the Scope Section of the engagement letter dated 22 January 2024. The services provided in connection with this engagement comprise an advisory engagement, which is not subject to assurance or other standards issued by the Australian Auditing and Assurance Standards Board and, consequently, no opinions or conclusions intended to convey assurance have been expressed.

No warranty of completeness, accuracy or reliability is given in relation to the statements and representations made by, and the information and documentation provided by, the Medibank as part of the process. KPMG has indicated within this report the sources of the information provided. We have not sought to independently verify those sources unless otherwise noted within the report.

KPMG is under no obligation in any circumstance to update this report, in either oral or written form, for events occurring after the report has been issued in final form.

Disclaimer

KPMG does not make any statement in this report as to whether any forecasts or projections included in this report will be achieved, or whether the assumptions and data underlying any prospective economic forecasts or projections are accurate, complete or reasonable. KPMG does not warrant or guarantee the achievement of any such forecasts or projections.

Any economic projections or forecasts in this report rely on economic inputs that are subject to unavoidable statistical variation. They also rely on economic parameters that are subject to unavoidable statistical variation.

While all care has been taken to account for statistical variation, care should be taken whenever considering or using this information. There will usually be differences between forecast or projected and actual results, because events and circumstances frequently do not occur as expected or predicted, and those differences may be material.

Any estimates or projections will only take into account information available to KPMG up to the date of this report, therefore findings may be affected by new information. Events may have occurred since this report was prepared, which may impact on it and its findings. The information contained herein is of a general nature and is not intended to address the specific circumstances of any particular individual or entity.

KPMG is under no obligation in any circumstance to update this report, in either oral or written form, for events occurring after the report has been issued in final form. The findings in this report have been formed on the above basis.

Third Party Reliance

This report is solely for the purpose set out in the Scope Section of the engagement letter dated 22 January 2024 and for the Medibank's information, and is not to be used for any other purpose or distributed to any other party without KPMG's prior written consent.

This report has been prepared at the request of the Medibank in accordance with the terms of the Engagement Letter dated 22 January 2024. Other than our responsibility to Medibank, neither KPMG nor any member or employee of KPMG undertakes responsibility arising in any way from reliance placed by a third party on this report. Any reliance placed is that party's sole responsibility.

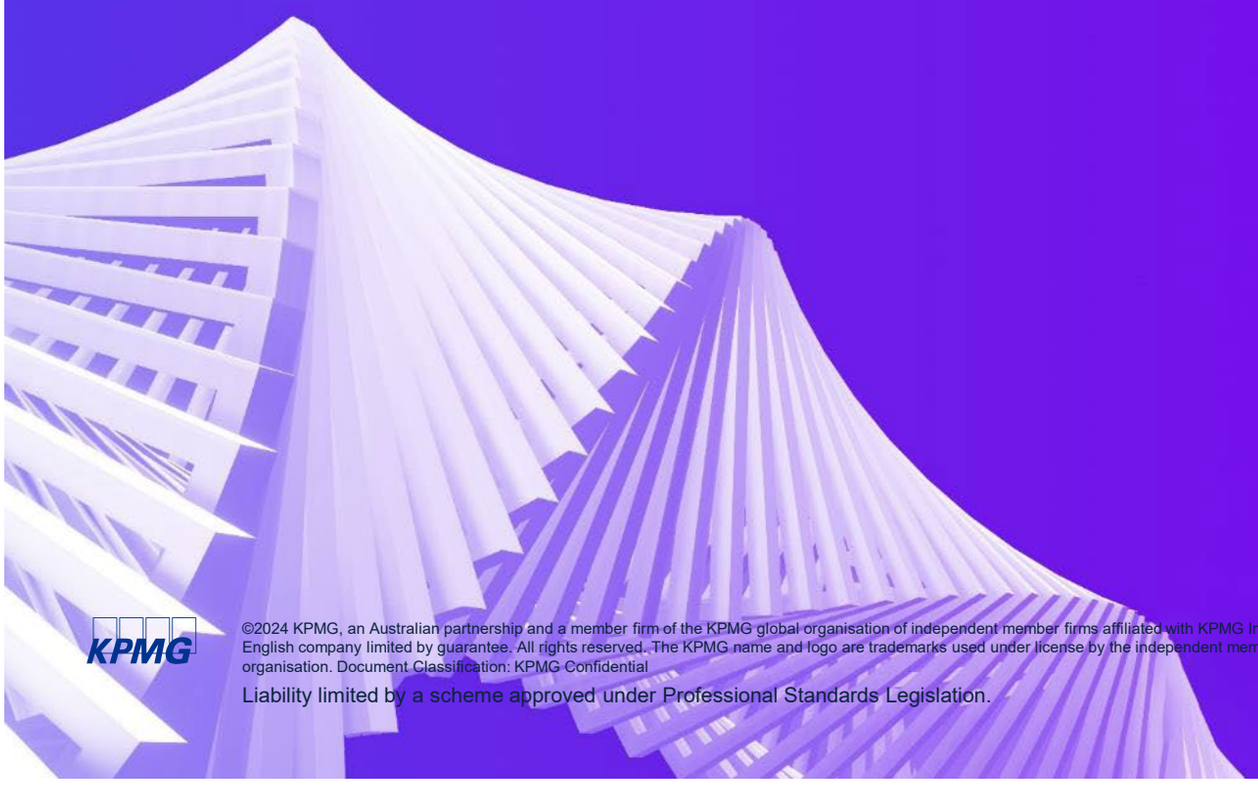
Electronic distribution of reports

This KPMG report was produced solely for the use and benefit of Medibank and cannot be relied on or distributed, in whole or in part, in any format by any other party. The report is dated June 2024 and KPMG accepts no liability for and has not undertaken work in respect of any event subsequent to that date which may affect the report.

Any redistribution of this report requires the prior written approval of KPMG and in any event is to be complete and unaltered version of the report and accompanied only by such other materials as KPMG may agree.

Responsibility for the security of any electronic distribution of this report remains the responsibility of Medibank and KPMG accepts no liability if the report is or has been altered in any way by any person.

Contents



Acronyms

ABS	Australian Bureau of Statistics
ACH	Advanced Care at Home
ACSQHC	Australian Commission on Safety and Quality in Health Care
ADHA	Australian Digital Health Agency
ADR	Adjacent Diagnosis Related Group
AH-HaH	Atrium Health's Hospital at Home
AHPEQS	Australian Hospital Patient Experience Question Set
AI	Artificial Intelligence
ALOS	Average length of stay
AMA	Australian Medical Association
AR-DRG	Australian Refined Diagnosis Related Group
CAGR	Compound annual growth rate
COPD	Chronic obstructive pulmonary disease
CPI	Consumer Price Index
DRGs	Diagnosis-related group
DVT	Deep vein thrombosis
ED	Emergency Department
HAC	Hospital-acquired complication
HaH	Hospital at Home
HITH	Hospital in the Home
ICT	Information and communication technology
ICU	Intensive Care Unit
IoT	Internet of Things
MyHH	My Home Hospital
NDIS	National Disability Insurance Scheme
NHCDC	National Hospital Cost Data Collection
NHRA	National Health Reform Agreement
NPS	Net Promoter Score
NWAU	National weighted activity unit
PE	Pulmonary embolism
RFT	Request for Tender
RLB	Rider Levett Bucknall
RACGP	Royal Australian College of General Practitioners
rpavirtual	Royal Prince Alfred Virtual Hospital
SAAS	SA Ambulance Service
SAVCS	SA Virtual Care Service
VACU	Virtual acute care unit

00 Executive Summary

What is a virtual hospital?

The virtual hospital model is an emerging and innovative approach to service delivery that is undergoing continuous evolution and refinement. There is no single definition of a virtual hospital that is recognised nationally or internationally.

For the purposes of this report, virtual hospitals have been defined based on the findings of a targeted literature review. A virtual hospital can be defined as a **medically-led** and **virtually-coordinated** alternative to in-patient hospital care which provides **continuous, comprehensive, multi-specialty, hospital-level acute care** to patients in their homes using combinations of technological interventions and direct face-to-face care.

Virtual hospitals cover a range of virtual care models, including Hospital in the Home (HITH), location-based responses such as in residential care settings, and increasingly higher acuity virtual care.

Virtual hospital care is suitable for patients with acute conditions who would otherwise require an acute hospital bed. Patients are treated in their home (or other non-hospital based location) by a multidisciplinary team comprised of doctors, nurses, and allied health practitioners.

Providers of virtual hospitals must meet hospital accreditation standards and do not necessarily need to be associated with a physical hospital.

Care is delivered to patients through a combination of remote and face-to-face modalities. Technology is central to the virtual hospital model as virtual hospitals employ advanced and emerging technologies to virtually deliver and coordinate care.

Case Study - My Home Hospital

Delivered on behalf of South Australia (SA) Health, My Home Hospital (MyHH) is a case study for understanding the benefits of virtual hospital models. Since beginning operations in SA in 2021, MyHH has serviced more than 15,000 patients, totalling to more than 66,000 bed days.

Health and quality
MyHH health and quality outcomes are in line with physical hospitals. Over the life of MyHH, 1.3% of patients had care escalated via an emergency department (ED) or inpatient admission. Average length of stay (ALOS) was longer in MyHH compared to physical hospitals (4.3 days vs 3.4 days), which may be indicative of the care model, the patient cohort or associated comorbidities. Patients in MyHH had lower rates of hospital acquired complications (HACs) compared to physical hospital models (0.4% vs 1.9%).

Patient experience
In FY23, patient experience at MyHH was ‘excellent’ with an average Net Promoter Score (NPS) of 88 and an average patient and carer satisfaction rate of 97.6%. This compares favourably to public sector outcomes.

Efficiency at scale
MyHH may be less resource intensive and more efficient at scale compared with physical hospitals. Adjusting for case mix, MyHH costs 23.6% less than the national average cost per episode of care and has a cost per national weighted activity unit (NWAU) that is 19.7% less than the national public hospital average.

Executive Summary (cont.)

Impact of virtual hospitals

A targeted literature review undertaken for this report found that virtual hospitals can improve patient and provider experience and promote more equitable access to healthcare without comprising on quality of care or patient safety. The literature also outlines a range of cost efficiencies which could be realised when the model is at scale.

To investigate this impact at scale, analysis of increased adoption of virtual hospitals in Australia in 2030 was undertaken. Three scenarios for the future adoption of virtual hospitals in Australia were considered:

1. Broader adoption with the current scope of virtual hospital care;
2. Broader adoption with a reduced scope of care; and
3. Broader adoption with an expanded scope of care.

This analysis found that the broader adoption of virtual hospitals has the potential to deliver a range of cost efficiencies to Australia's hospital system in 2030, outlined on the right.*

Consideration of the evidence, including from published literature, Australian and international case studies, and the modelled future impact of expanded adoption, indicates that virtual hospitals have potential to provide a critical alternative delivery channel for patients to respond to current and increasing healthcare system challenges in Australia.

360,000 – 1.2 million

Bed days substituted for virtual care in 2030

As a conservative estimate based on the current scope of virtual hospital care, it is estimated that the increased adoption of virtual hospitals could result in over **360,000 bed days** substituted for virtual care in Australia in 2030. It is estimated that a higher level of adoption of virtual hospitals with an expanded scope of care could substitute up to **1.2 million bed days** in 2030.

$290 million - $1.0 billion

Associated cost savings in 2030

The conservative estimate of the number of bed days substituted for virtual hospital care with the current scope of virtual care is associated with estimated cost savings of **$290 million** in Australia in 2030. The high-end estimate of number of bed days substituted based on an expanded scope of virtual care is associated with up to **$1.0 billion** in estimated cost savings in 2030.

$2.9 billion - $6.4 billion

Substituted capital expenditure

Analysis of substituted capital expenditure assumes that if care had not been delivered by virtual hospitals, the bed days substituted for virtual hospital care in 2030 would otherwise be provided by new physical hospital infrastructure.

As a conservative estimate that considers the broader adoption of virtual hospitals delivering their current scope of care, it is estimated that **$390 million** in capital expenditure could be substituted. If virtual hospitals were to expand their scope of care in the future beyond what is currently delivered, a high-end estimate of **$12.0 billion** in substituted capital expenditure could be realised.

*Low-end and high-end estimates are based on scenarios one (current scope of care) and three (expanded scope of care) respectively. For substituted capital expenditure, low-end and high-end of the range are the mid-points of results for scenarios one and three respectively. All monetary values are in FY24 prices.

01 Introduction

The Australian healthcare system is complex and facing a range of operational and demographic challenges that will impact the care Australians receive into the future if there is no transition to a more sustainable cost trajectory. Some of these challenges are not unique to Australia, including increased healthcare utilisation due to an ageing population, increased rates of chronic disease, the continued legacy of the COVID-19 pandemic, and a range of workforce constraints and shortages.

Beyond these well-known challenges, there are a range of other issues that affect the delivery of healthcare across all states and territories in Australia.

Bed block and delayed discharge

Bed block and delayed discharge can, among other things, lead to increasing wait times for elective surgery, longer wait times for patients in the ED, and increased rates of ambulance ramping.

Bed block and delayed discharge not only increase the cost of care, but also have knock-on effects across the health system.

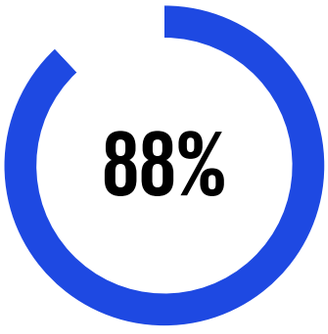
Bed block and delayed discharge have a variety of causes. In Australia, individuals may be medically fit for discharge but remain in hospital because of a lack of access to primary care, lack of community care for patients or delays to assessments including for residential aged care, and delays to disability processes or placement.[1]

For example, nationally around 1,400 National Disability Insurance Scheme (NDIS) clients wait an average of 160 days before they are discharged from hospital because of a lack of access to suitable accomodation.[1]

Patients who are medically fit for discharge may also remain in hospital due to operational reasons. In the UK, almost one-quarter of delayed discharges of patients in hospital for seven days or more were due to delays in the hospital discharge process.[2]

8.8 million

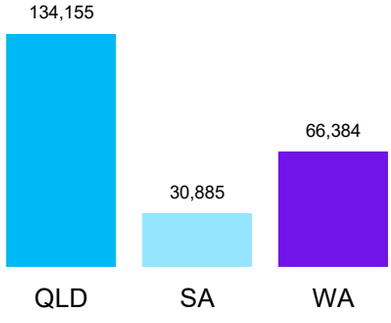
ED presentations in Australia in 2022/23.[3]



Increase in wait times for non-urgent elective surgery in Australia over 5 years.[5]

>230,000

Hours that ambulances were ramped in Queensland, SA and Western Australia (WA) combined in 2021/22.[4]



Total hours ramped in 2021/22.[4]

65%

Proportion of patients in Australia seen on time in EDs in 2022-23, down from 71% in 2018-19.[3]

New hospitals and hospital expansions are capital intensive and take many years.

$11.7 billion

National capital spending on health facilities and investments in 2021-22.[92]

$1-4 million

Estimated capital expenditure required per new hospital bed.

Introduction (cont.)

Ambulance ramping

Ambulance ramping occurs when ambulance officers and/or paramedics are unable to complete transfer of clinical care of their patient to the hospital ED within a clinically appropriate timeframe* due to physical capacity constraints.[112]

As demand for hospitals services continues to rise, ambulance ramping is a growing issue. Australian public hospitals are already operating at capacity and face numerous health system pressures, including bed block, staff shortages, the impact of COVID-19, and poor patient flow between different parts of the health system.[4, 112]

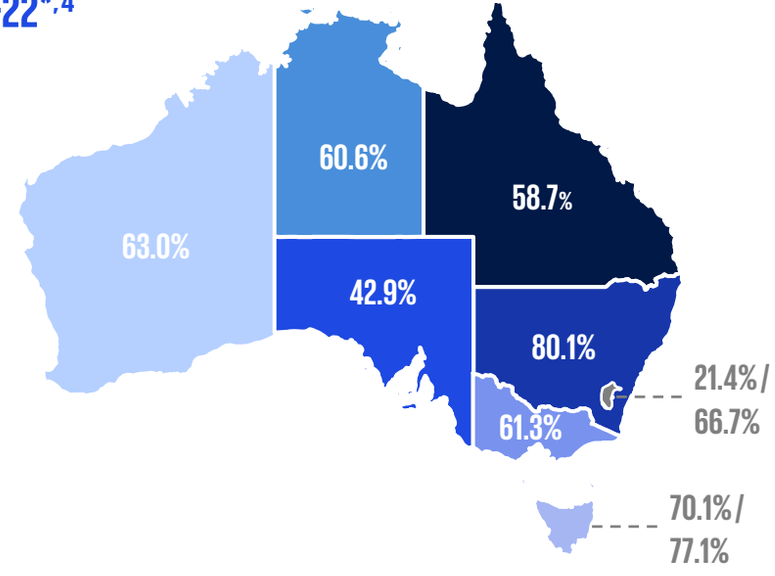
In 2021-22, no state or territory achieved their patient transfer targets (illustrated in the Figure below), and every state and territory except for the Australian Capital Territory (ACT) saw a deterioration in performance against at least one patient transfer target compared with previous years.[4]

Ambulance ramping has been shown to increase rates of adverse patient outcomes and reduce quality of patient experiences, including compromised quality of care, increased morbidity and in some cases mortality, and a loss of dignity and privacy.[112, 115]

Paramedics and staff are also adversely impacted through increased stress and interpersonal conflict between patients and staff, poor morale, burnout, increased workplace health and safety complications due to the use of inappropriate spaces to treat patients, and reduced staff wellbeing and job satisfaction leading to staff losses and work avoidance.[116, 117]

Governments are increasingly looking to new innovative models of care to offer sustainable alternative treatment pathways that can eliminate or reduce ambulance ramping.[118, 119]

Percentage of patients transferred from ambulance to ED within respective targets for each state and territory 2021-22*,[4]



*Patient transfer targets vary by state/territory. Target is 90% of patients within 30 minutes for Queensland, New South Wales (NSW), SA, and WA. Target for the ACT is 50% within 20 minutes / 90% within 40 minutes. Target for Tasmania is 85% within 15 minutes / 100% within 30 minutes. Target for Victoria is 90% within 40 minutes. Target for the Northern Territory (NT) is 90% within 25 minutes.

In South Australia

>40,000

Hours that ambulances were ramped in SA in 2023.[113]

20%

Compound annual growth rate (CAGR) in hours lost to ramping in SA in the five years to June 2024.[113]

$2.3 million

Cost of paramedic service for hours lost to ramping in SA in 2023.[**, 113, 114]**

**this cost is prior to the addition of on-costs, other allowances, overtime and ambulance operating costs, and does not account for cost of adverse impacts on outcomes.

Virtual care models

There are a range of emerging models of care that can provide hospital-level acute care outside the physical hospital setting. Virtual hospitals, virtual wards, HITH, and other virtual care models that provide hospital-level care in a person's home or place of residence are rapidly emerging, evolving and providing additional healthcare capacity.

Virtual hospital models have the potential to realise the following outcomes:

Provide effective, safe and timely care, with quality in line with physical hospitals.

Improve patient experience by providing high-quality care in a familiar home environment.

Improve work-life balance and job satisfaction for healthcare workers.

Promote more equitable access to healthcare and reduce health disparities across regions.

Provide care at a lower cost and improve affordability and sustainability of care.

Adoption of virtual care within acute care settings in Australia has been slow and faces a range of challenges.[7] These include alignment of funding mechanisms, a lack of digital infrastructure and interoperability, a lack of cohesive standards for electronic medical records, low public trust in data collection and sharing, and increasing costs of technology to enable virtual care.[69] Furthermore, the adoption of virtual care has been fragmented, with a diversity of goals and scope, and at limited scale.[111]

My Home Hospital

Despite the challenges in delivering virtual care, healthcare providers are increasingly adopting innovative models of care. Delivered on behalf of SA Health, MyHH is one Australian virtual hospital delivering hospital-level acute care to people in their home.[8] Established in 2021, MyHH is now at-scale and can service between 80 and 130 patients concurrently.[82]

MyHH is currently available as a public service to people in the greater Adelaide and peri-urban surrounds of SA and provides acute-level care for conditions where home care is safe and appropriate. These include:

- Infections requiring intravenous antibiotics, such as cellulitis, pneumonia and mastitis;
- Exacerbations of respiratory conditions, deep vein thrombosis, and pulmonary embolism; and
- Heart failure, postoperative care, and gastrointestinal issues.

Patients at MyHH receive individualised care plans developed and overseen by a care coordinator, who is an experienced registered nurse or medical officer, and are able to access mobile X-rays and ultrasounds when appropriate, oxygen for respiratory conditions, blood tests, medication, other support services such as meals and personal care, a personal alarm for patients who live alone or have a high risk of falls, and remote monitoring of pulse, temperature, and blood pressure.

Within MyHH, medical ward rounds are conducted daily, with more frequent medical review as required. Patients are supported by nursing and paramedic clinical reviews that occur at least once daily face-to-face and up to four times per day. Similarly to a physical hospital, patients have regular contact with their care team, including medical officers, nurses and allied health professionals who are available 24/7, and there is clear escalation and transfer pathways when emergency care is required.

Project scope

KPMG have been engaged by Medibank to assess the impact of an at-scale adoption of the virtual hospital model of care.

The scope of this project includes:

1. Providing an overview of the virtual hospital model in the context of similar models of care, such as HITH, that have been implemented locally and internationally.
2. Comparison of relevant and available MyHH metrics against physical hospitals.
3. Quantifying and modelling the economic impacts of wider adoption of virtual hospital care in Australia.

The Final Report (this document) has been developed to describe the results of the activities outlined above.

Limitations

There are a range of limitations inherent within the scope and analysis conducted, which include:

- Assumption that virtual hospital beds replace physical beds when modelling future impact of expanded adoption;
- Generalisation of MyHH costs and public hospital costs when modelling for future impact;
- Accuracy of comparisons between MyHH and public hospital outcomes; and
- Exclusion of change management and upfront costs from the modelled impact analysis.

Approach to targeted literature review

KPMG undertook an unstructured, non-exhaustive but focused literature review of peer-reviewed literature and grey literature published in Australia and internationally to understand the rationale for pursuing virtual hospital models.

The protocols of the search are outlined in the tables to the right. A total of 87 papers relating to virtual hospitals or similar models across 10 countries were included.

The findings of this review informed the development of a comprehensive definition of virtual hospitals, and led to the identification of a range of health and economic benefits that may arise from adoption of the virtual hospital model for patients, providers, and health systems more broadly.

It should be noted that whilst many forms and variations of virtual hospitals have been in existence for quite a period of time, the evidence and literature to define and assess feasibility of virtual hospitals is lagging. This review focuses on literature published from 2018 onward.

Targeted literature review search protocol

Element	Detail
Database	• Google Scholar + PubMed + Medline • Targeted searching of relevant government and non-government websites
Sources	• Peer-reviewed literature using all types of methodologies, including reviews and primary research • Grey literature, including organisational reports and evaluations, international case studies, frameworks, and policies
Publication date	2018 onward

Targeted literature review search terms

Concept	Search terms
Economic impact	Virtual / home hospital + patient + benefit + cost savings

Defining a virtual hospital

Virtual hospitals are a **medically-led** and **virtually-coordinated** alternative to in-patient hospital care which provides **comprehensive, multi-specialty, hospital-level acute care** to patients in their homes using combinations of technological interventions and direct face-to-face care. Patients who receive care in a virtual hospital would otherwise receive care in a physical hospital as an inpatient.

The virtual hospital model is an emerging and innovative model that is undergoing continuous evolution and development. There is no single definition of a virtual hospital that is recognised nationally or internationally. The following definition incorporates key elements of virtual hospital models identified through a targeted literature review.

The literature review was unable to find a consensus on a unique definition of a virtual hospital. The above definition and elements are based on the findings of the literature review and is considered the most representative for the purposes of this report.

It should be noted that there is considerable overlap between the definition of a virtual hospital and similar models, such as HITH and virtual wards. Key elements which distinguish virtual hospitals from these models are that virtual hospitals provide care that is acute, clinically-led and overseen, comprehensive, and multi-specialty, and virtual hospitals do not necessarily rely on an affiliation with a physical hospital.

Virtual hospital key characteristics

The patient

Virtual hospital care is suitable for patients with acute conditions who would otherwise require an acute hospital bed or care in another inpatient environment.

The provider

Providers of virtual hospitals must meet hospital accreditation standards and do not need to be associated with a physical hospital. Patients are treated by a multidisciplinary team comprised of doctors, nurses, and allied health practitioners.

Location

Care is provided to the patient in the patient's home or other non-hospital based location, which may include residential aged care and supported disability accommodation.

Level of care

Virtual hospitals provide continuous, comprehensive, multi-specialty, hospital-level care through a combination of remote and face-to-face modalities.

Technology

Virtual hospitals employ advanced and emerging technologies to virtually deliver and coordinate care.

While the clinical scope of HITH activity has remained relatively confined to a small number of diagnoses, there are a growing number of acute conditions suitable for treatment by virtual hospital. A 2019 study of 19 hospitals across Australia found that more than 80% of HITH activity was delivered within 50 DRGs.[9]

Conditions suitable for virtual hospitals include (but are not limited to) infections requiring IV antibiotics, coronary artery disease and heart failure, diabetes, stroke, chronic obstructive pulmonary disease (COPD), cancer treatment and care, exacerbation of respiratory conditions, gastrointestinal conditions, deep vein thrombosis (DVT) and pulmonary embolism (PE), postoperative care, and other conditions for which home based hospital care is safe and appropriate.

Elements of a virtual hospital

Virtual hospital service offerings

Virtual hospitals offer a range of medical services and supports to patients, and typically include:

- Direct treatment and continuous care;
- In-home diagnostic tests, including x-rays and blood tests;
- Medications and equipment delivered to the patient; and
- Remote patient education and support.

The model of care provided by virtual hospitals varies between hospitals, however some key common elements include:

- Individualised care plans;
- Care team available 24/7 offering acute active care;
- Ward rounds, with more frequent medical review as required for patient safety, appropriate escalation, and clinically appropriate and efficient discharge processes;
- Clinical reviews; and
- Clear escalation and transfer pathways for patients whose condition is deteriorating, or on request of the patient or family.

Virtual hospitals are a technology-enabled model of care

Virtual hospitals employ variable combinations of technological interventions and direct face-to-face care to monitor and treat patients, including:

- **Remote monitoring:** data is transmitted from the home to a provider using wearable and other devices, such as a glucometer, pulse oximeter, blood pressure measuring instruments, and wearable patches including ECG and thermometer. This allows nurses and doctors to review patient vital signs in real-time.
- **Telehealth:** direct treatment or care is provided remotely using technologies such as telephone, videoconferencing, electronic messages.
- **Face to face care:** virtual hospital patients receive in-home visits as often as their condition requires. These visits generally occur at least once a day.

The coordination of care in a virtual hospital occurs virtually from a centralised facility, also called a command centre or hub. This is where multidisciplinary teams virtually oversee the care of all patients within the virtual hospital and remotely monitor patients through the use of advanced technologies.

While the virtual delivery of care to patients in their homes is not new, the virtual hospital model has been strengthened by recent technological advancements and continues to be shaped by emerging technologies. Virtual hospital care is delivered and coordinated through the use of advanced and emerging technologies, which can include:

- **Internet of Things (IoT):** these tools interconnect physical and analogue devices with sensors to collect patient health data and transmit it to a network database in real-time.
- **Artificial Intelligence (AI):** there are various applications of AI in the virtual hospital setting, including medical imaging algorithms and analysis, and predictive modelling of data for early warning of deterioration. For example, SEHA Virtual Hospital in Saudi Arabia uses AI-powered medical imaging algorithms to automate image analysis, assist in the detection of abnormalities, and provide preliminary diagnoses.[10]
- **Sensors:** sensors embedded within devices can enable remote monitoring of patients' vital signs, track patients' movements, and automatically activate an alarm if medical intervention is required. For example, patients in NHS virtual wards wear sensors to continuously capture respiration rate, oxygen saturation, heart rate, body temperature, and movement data, and alert the care team of early signs of deteriorating health.[11]

02 The rationale for pursuing a virtual hospital model

With the sustainability of health systems under increasing pressure both in Australia and globally, virtual hospitals have the potential to be a contributor to a more sustainable health system.

Virtual hospitals provide the potential for delivery of an adaptable, flexible, and scalable model of acute care, with the expansion of the model showing potential to move 25-30% of core diagnoses into the home.[12]

By leveraging technology, virtual hospitals have the potential to reduce reliance on the built environment and support clinical workforce satisfaction whilst maintaining strong patient outcomes.

Health system challenge	Potential of virtual hospitals as a sustainable solution
Rising demand for hospitals and healthcare services Demographic changes, including an ageing population and the rising prevalence of chronic diseases, are resulting in increased demand for health services and mounting pressure on the sustainability of the system. The number of emergency presentations nationally has increased at an average annual rate of 1.3% over the last five years to 2022-23.[13] The number of Australians aged 65 and over is projected to more than double by 2066, when it will represent 23% of the total population.[14]	Virtual hospitals offer a sustainable solution to meet growing demand by expanding hospital bed capacity without the corresponding capital and time investment, alleviating pressures on hospital and ambulance services, and improving allocation of resources based on patient clinical needs. In the UK for example, one hospital saw a 40% reduction in bed days following implementation of a virtual ward,[15] and the NHS has a longer-term ambition of more than 50,000 virtual ward admissions a month.[16]
Rising costs of national health services In 2021-22, Governments funded $176 billion of Australia's total health spend of $241 billion.[17] A total of $77 billion was spent on public hospitals in Australia, with state and territory government expenditure on public hospitals rising 4.1% per year on average between 2011-12 and 2021-22.[18]	Virtual hospitals could safely deliver equal or better care while operating at a significantly lower cost compared to conventional services.[19] The National Institute for Health and Excellence found virtual wards and hospital at home (HaH) models of care were cost saving in 13 out of 15 included studies.[20] One study reports an adjusted mean cost of acute care episode was 38% lower for home patients than usual hospital care.[21]
Structural shortage of health professionals and burnout The shortfall of healthcare workers globally is projected to reach 10 million by 2030.[22] In 2020-21, almost 52% of physicians and 65% of nurses reported burnout.[23]	Virtual hospitals can enable health professionals to treat a larger volume of patients and can increase efficiency of care whilst reducing the risk of clinician burnout.[24, 25, 26]
Inequality in access to health services Close to 30% of the Australian population live in rural and remote areas and face unique challenges in accessing healthcare.[37]	The virtual delivery of care reduces time and cost burden associated with patient travel to hospitals and improves accessibility to hospital-level care across the population.[12, 28, 29, 19]
Patient flow and hospital waiting times Poor patient flow through the hospital system contributes to reduced access, increased wait times, missed treatment for patients that do not wait, and poor patient experiences.[30,31]	Virtual hospitals may reduce hospital wait times by expanding hospital capacity and mitigating pressures on healthcare services.[32] This includes reducing ALOS by discharging to other care settings and improved ED wait times.[33]
Ambulance ramping and access block Currently, Australian public hospitals and EDs are operating at capacity and all states and territories are not meeting their patient transfer targets.[34] In 2022-23, the proportion of emergency presentations 'seen on time' was just 65%, down from 71% in 2018-19.[13]	By improving triage and reducing ambulance calls and ED visits, virtual hospitals can reduce ambulance ramping and access block, unlocking significant cost savings. In 2022-23, there were in excess of 4 million ambulance transfers across Australia.[35] If patient transfer targets are missed in 30% of cases, this equates to more than 1 million people not receiving timely care.
Environmental sustainability Australia's healthcare sector accounts for 7% of the country's carbon emissions.[36]	As well as significantly reducing carbon emissions associated with patient travel, virtual visits emit less than 1% of greenhouse gases emitted by in-person visits.[37]

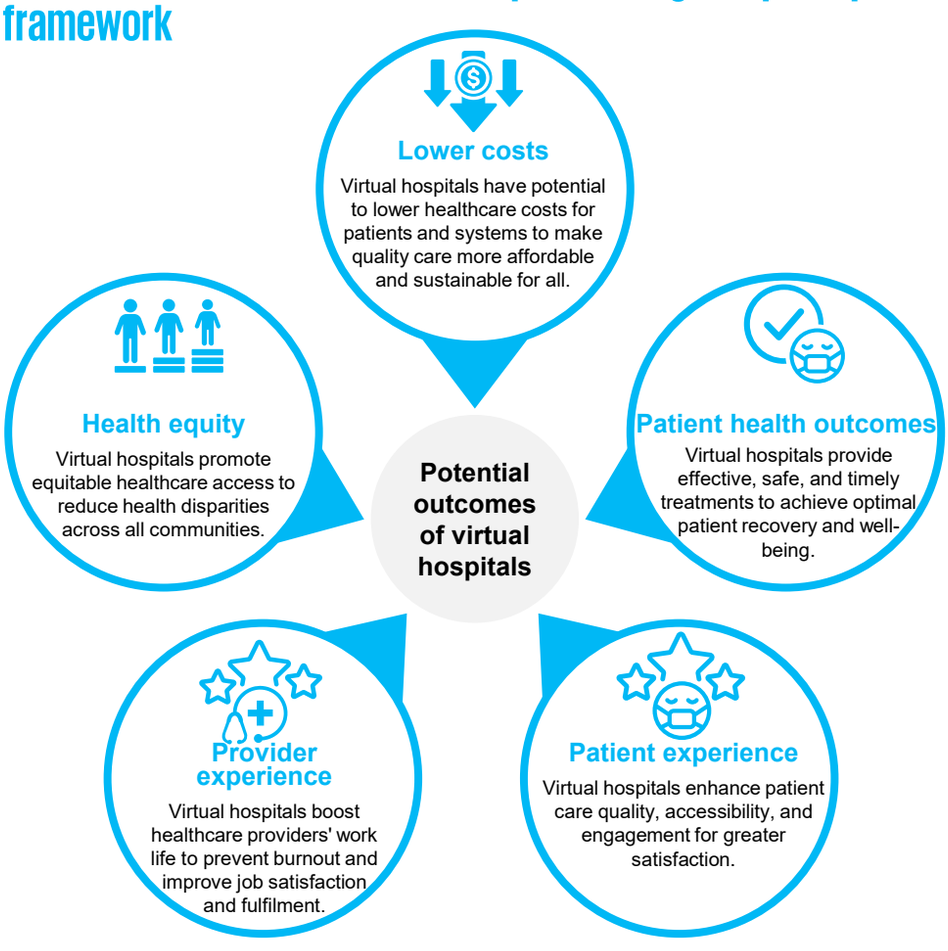
Overview of virtual hospital outcomes

Virtual hospitals are an innovative approach to healthcare delivery that offer significant potential benefits to patients, providers, and entire healthcare systems.

In this chapter, the benefits of virtual hospitals are explored in detail using the quintuple aim framework, which encompasses patient health outcomes, patient experience, provider experience, health equity, and lower costs.[38]

With the adoption of virtual hospitals growing throughout Australia and internationally, these benefits are increasingly being realised.[39, 19, 40] Virtual hospitals have potential to provide a critical alternative delivery channel for patients to respond to current and increasing healthcare system challenges.

Potential outcomes of virtual hospitals using the quintuple aim framework



It should be noted that the evidence presented in the following chapter is the output of a targeted literature review and is not an exhaustive review of literature. Whilst the targeted literature review identified a growing number of studies and evaluations demonstrating the benefit of virtual hospitals, the evidence for a complete virtual hospital is lagging. Evidence for similar models, including HaH and virtual wards, has been used to supplement this analysis (see Page 10 for additional detail on the approach to the targeted literature review).

The strongest evidence identified by the targeted literature review was two Cochrane reviews published in 2024 on HaH models.[39, 32] The evidence presented in these reviews ranged between low, moderate and high quality, however overall the reviews provided strong evidence of HaH as an alternative to conventional hospitalisation for select groups of patients. This evidence is supplemented by peer-reviewed studies and evaluations of specific virtual hospital or similar programs, however the majority of these programs remain small; one of the Cochrane meta-analyses had an average of 155 patients across included randomised controlled trials.[39] There is room for additional large, high-quality randomised trials with a focus on complete virtual hospital models to improve the certainty of evidence and generalisability of these findings.

Patient health outcomes

Virtual hospitals have been shown to deliver non-inferior or superior clinical outcomes when compared with physical hospitals, with potential for improved patient health outcomes over the long-term.

A recent Cochrane meta-analysis found HaH is comparable to physical hospital care in terms of clinical outcomes and self-reported health status and was likely to make little or no difference to risk of death and readmission to hospital after discharge.[39]

There is some evidence to suggest that the use of virtual hospital and HaH models are capable of improving readmission rates and reducing the risk of adverse events when compared with physical hospitals for patients with specific conditions, such as heart failure and COPD.[39, 41, 42]

Delirium is the most common HAC in Australia, with 35.7 cases per 10,000 hospitalisations in 2019-20.[43] It is possible that the more familiar, less disruptive and comforting environment of home can help mitigate delirium, falls, and other HACs.[44, 45]

Virtual hospital models deliver high-quality and safe clinical care, and offer several advantages over physical hospitals which benefit clinical outcomes, including:

- **The provision of continuous monitoring and care by a multidisciplinary team using advanced technologies:** this model of care enables prompt assessments for time-sensitive conditions, early identification of diseases, timely diagnoses, and accurate interventions. [24, 46, 40, 26] For example, a rapid evaluation of a virtual ward in the UK reported that telehealth monitoring found significant pathology that was detected earlier or would otherwise not have been detected in a physical hospital setting, with possible fatal outcomes if not treated.[46]
- **Timely access to care:** The virtual connection of hospitals and physicians through the virtual hospital model eliminates or materially reduces the need for patient travel and can therefore reduce delays to patient care. Virtual coordination and collaboration also enables virtual transfers between providers of different levels of specialisation, providing timely access to advanced care. This can be particularly beneficial for patients with rare diseases or unusual clinical presentations.[24, 12, 47, 48]
- **Reduced risk of deconditioning:** Patients treated at home are more physically active and maintain their independence, spending less time sedentary or lying down compared with usual hospitalisation care. This is particularly important for older or frail patients, as virtual hospital models have the potential to lower the risk of functional decline from limited mobility during admission in a physical hospital.[39, 42, 21]
- **Reduction in hospital-acquired infections:** Patients benefit from a reduced risk of being exposed to pathogens in a physical hospital setting.[42, 24]

Case Study Snapshot: Atrium Health

In the US, Atrium Health's Hospital at Home (AH-HaH) program reported equivalent or superior clinical outcomes compared with patients in physical hospitals.[28] The program has a readmissions rate of 0.8, better than Atrium Health's physical facilities.[49]
The full case study can be found on Page 31.

Patient and provider experience

Patient experience

There is growing evidence demonstrating that virtual hospital and similar models deliver enhanced patient experience and quality of life outcomes, and in some instances offer a superior experience to physical hospitals.

The Cochrane meta-analysis of HaH models found that HaH patients reported higher levels of satisfaction on average, albeit with low-certainty evidence. The review also found with moderate-certainty evidence higher patient self-reported quality of life in HaH.[39]

Virtual hospital patients value being able to receive hospital-level care in the comfort of their homes, and commonly cite convenience, ease of access, avoidance of in-person care settings, and flexibility as key drivers of their positive experiences.[46, 19]

Virtual hospitals also reduce patient wait times and alleviate the cost and time burden for patients and families of travelling to and from health institutions.[21, 19, 48]

Virtual hospitals have the potential to enable improved cooperation and collaboration between healthcare professionals, including primary, community, hospital, and ambulance care, which can result in more holistic care for patients and greater continuity of care.[50, 51, 52]

Virtual hospital patients benefit from a patient-centric model of care, including individualised care plans, care that is responsive to patient preferences and needs, and continuous assistance and care from a multidisciplinary team.[24, 19, 53, 54]

Along with enabling more personalised and tailored patient experiences, it is possible that virtual care creates greater opportunities for increased supported patient self-management and engagement. By allowing patients access to and ownership of their own data, and in some cases educational resources, patients can more actively engage in their recovery and improve their health literacy, fostering a greater sense of empowerment and autonomy over their health.[42, 24, 48]

Case Study Snapshot: Mayo Clinic

Providers at the Mayo Clinic's Advanced Care at Home (ACH) model in the US found the model very rewarding and reported being able to deliver high-quality and safe care to patients.[55]

Patients at ACH highly recommend the service, and scored the program high on responsiveness, staff engagement and communication, ease of equipment use, and readiness for discharge.[55]

The full case study can be found on Page 29.

Provider experience

Virtual hospital clinicians value the collaborative and technologically-enabled model, which allows for improved communication, coordination, and flow of patient care among a team of multidisciplinary clinicians.[28, 50]

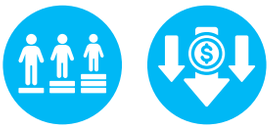
A recent journal article investigating the perspectives of a multidisciplinary panel of academics and healthcare managers on virtual hospitals found that these models have the potential to offer significant benefits for hospital providers, including larger patient volumes, reduced waiting lists, increased efficacy and efficiency of care, and improved relationships and trust with patients.[24]

Additionally, virtual solutions and robotics can reduce administrative workload and repetitive activities for providers, reducing the risk of burnout, improving productivity, and enabling more opportunities for providers to focus on delivering quality care.[24, 25, 26]

For example, the digital platform Huma used in NHS' virtual wards reduces time spent reviewing patients by 40%, reduces time calling patients by 60%, and results in two times the clinical capacity potential.[26]

As clinician referral is required for admission to a virtual hospital, the model can increase the efficiency of resource allocation by ensuring the right patient is referred for the right reasons and resources match patient clinical needs.[80]

Health equity and lower costs



Health equity

Virtual hospitals leverage remote monitoring and telehealth technologies to provide more accessible hospital-level care to all patients, regardless of location or physical limitations.

The virtual hospital model is capable of reaching diverse populations from any location. By offering high-quality hospital-level care in a highly accessible and timely way, virtual hospitals can significantly benefit patients in rural areas or underserved populations who normally lack access to healthcare.[28, 29, 56, 57]

Virtual hospitals can offer greater access to advanced care for isolated patients and patients with rare or unusual clinical presentations. This is because these patients can be virtually transferred between providers of different levels of specialisation, without needing to leave the home.[12, 47, 52]

Lower costs

Virtual hospitals and similar models can deliver equal or better clinical care and/or system outcomes in a way that is substantially more efficient than conventional approaches, without compromising on patient safety.

A recent Cochrane meta-analysis found with moderate-certainty evidence that HaH models probably decrease healthcare costs, with evidence of decreased overall societal costs at six months' follow-up.[39]

The virtual hospital model has significantly less fixed costs of operation compared to traditional inpatient care for select groups of patients,[12] and is capable of operating at potentially half the cost or less of conventional services.[19] One study has indicated substantial savings per episode than comparable in-patient care, with cost savings driven by reductions in medical and clinical labour costs and larger patient volumes per provider.[58]

There is evidence demonstrating the cost-effectiveness of specific virtual hospital models across a growing number of controlled trials and evaluations both nationally and internationally (see Pages 29 to 32 for select case studies).

Virtual hospital patients also benefit from cost savings from reduced transportation costs and the minimisation of unnecessary healthcare service utilisation. A randomised controlled trial of a home hospital delivering care to acutely ill patients in the UK found the adjusted mean cost of the acute care episode was 38% lower for home patients compared with usual care patients, and home patients had fewer laboratory orders, imaging studies, and consultations.[21]

A focus on value-based and personalised healthcare in virtual hospital models means care is specific and targeted, driving efficiencies in healthcare resource use.[19, 59]

Case Study Snapshot: rpavirtual

Royal Prince Alfred Virtual Hospital (**rpa**virtual) played a pivotal role in providing accessible care to diverse communities throughout Sydney during the COVID-19 pandemic. **Rpa**virtual incorporates an equity lens through:[60]

- Assessment of patient risk, with consideration of health and non-health determinants and protective factors for health and wellbeing. Additional care was offered to Aboriginal and Torres Strait Islander people and elderly people without social support, and patients were connected to supports as needed.
- Provision of direct welfare support, such as food and income support.
- Provision of accessible information material in plain English and community languages, including Aboriginal specific information.
- Provision of cultural support by Aboriginal care navigators.

See Page 32 for further detail on this case study.

Lower costs (cont.)

At a systems-level, virtual hospitals have the potential to deliver benefits over the long-term, including:

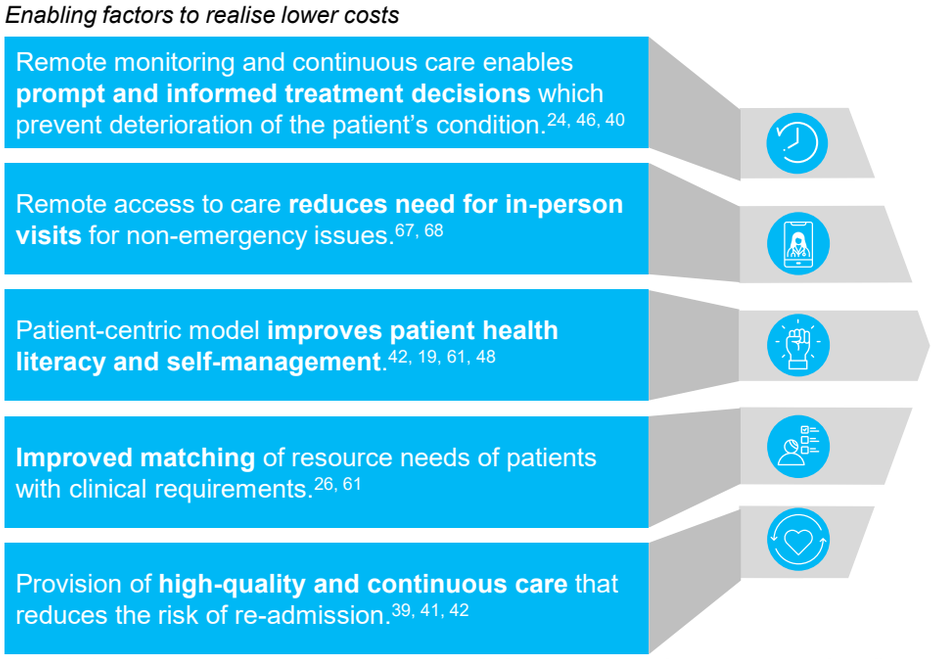
Avoided costs from reduced healthcare utilisation; the Figure below provides an overview of some of the ways virtual hospitals can reduce demands on health systems. This includes reducing unnecessary or avoidable ambulance calls, ED visits, intensive care unit (ICU) admissions, and hospitalisations.[32, 19, 56] This impact can be observed in the case of a Swedish virtual hospital delivering safe and high-quality care with a geriatric focus,[51] where total care consumption for residents aged over 75 years decreased 4% in the city serviced by the virtual hospital, compared with a 10% increase for the rest of the region between 2014 and 2018.[57]

Improved hospital flow and earlier hospital discharge; A recent Cochrane meta-analysis found HaH reduced the ALOS in hospital, which ranged from 4.1 to 18.5 days in the hospital group compared with 1.2 to 5.1 days in the HaH group.[39] Similarly, a hospital in the UK observed a 40% reduction in bed days following the implementation of a virtual COVID-19 ward.[15] By improving patient flow and reducing demands on healthcare services, virtual hospitals also have potential to help to minimise issues of ED ramping and access block.

Increased hospital capacity due to physical bed days saved; The virtual delivery of care and improved efficiency of resource allocation expands the bed capacity of physical hospitals.[26, 61, 62, 102, 20] For example, HaH provider Atrium Health estimates that their AH-HaH program has saved more than 33,000 physical bed days since the program's inception in March 2020 (see Page 31 for the full case study).[49] Virtual hospitals also reduce the need for new physical hospital ward infrastructure.

Reduced carbon footprint; Virtual resources can optimise value with minimum resources, reducing demand for resource-intensive clinical facilities.[63, 64] Additionally, virtual hospitals can significantly reduce carbon emissions by reducing patient travel.[19, 65, 66] Based in Sydney, **rpa**virtual have estimated that their virtual hospital has saved nearly nine million kilometres of travel in the period February 2021 to January 2022, equating to nearly 1,600 tonnes of avoided carbon emissions and over $36,000 in avoided carbon costs (see Page 32 for the full case study).[19]

Enabling factors to realise lower costs



Virtual hospitals reduce unnecessary or avoidable:[19, 20, 32, 56]

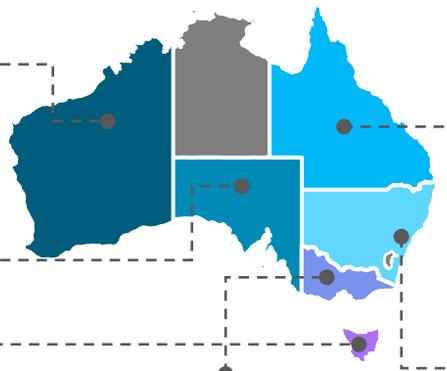
- **Ambulance calls and ED ramping**
- **ED visits**
- **ICU admissions**
- **Hospitalisations**

Current state of virtual care in Australia

- WA Country Health Service (WACHS) Command Centre
- WA Virtual ED (WAVED)

- My Home Hospital
- South Australian Child and Adolescent Virtual Urgent Care service
- South Australia Virtual Care Services (SAVCS): Virtual ED
- South Australia Virtual Emergency Service program (SAVES)

- Tasmania Hospital@Home
- COVID-19@homeplus



- Victorian Virtual ED (VVED)
- Austin Health's Hospital in the Home and Virtual Care (HITH-VC)

- Queensland Health HITH
- Mackay Hospital and Health Service's COVID-19 Virtual Ward
- Gold Coast Health's COVID-19 Virtual Ward
- Metro North Health's Virtual ED & COVID Virtual Ward

- Rpavirtual
- Virtual Care – Remote Patient Monitoring Program (VC – RPM)
- Virtually enhanced Community Care (VeCC)'s Virtual Hospital Ward
- virtualKIDS Urgent Care Service
- Virtual Rural Generalist Service

Virtual care activity in Australia

Innovation and uptake of virtual care in Australia was accelerated by the COVID-19 pandemic, and there has since been an expansion of many of these initiatives as well as the establishment of new and innovative virtual care solutions.[69]

Despite a small number of pioneering examples of successful virtual care delivery, the Australian health system more broadly has been slow to adopt virtual models of care within acute care settings.[7] The Alfred Hospital in Victoria, Royal Prince Alfred Hospital in NSW and MyHH in SA are some of the few virtual services provided by accredited hospitals or virtual hospitals that exist. The above Figure provides some examples in the virtual care space across Australia.

The expansion of virtual hospitals in Australia will require significant investment and change management. Virtual hospital implementation expertise is limited within Australia, and the Australian health system faces a number of challenges to expanding adoption.[111]

Challenges to expanding adoption in Australia

A wide-ranging consultation process undertaken as part of the Mid-Term Review of the National Health Reform Agreement (NHRA) Addendum 2020-2025 identified a number of issues with the Australian health system's ability to support growth in digital health.[69] These issues include:

- The NHRA lacks adequate funding mechanisms to incentivise digitally-enabled care services. The operation of a 6.5% national growth cap that covers both price and activity growth leaves insufficient room for new activity.
- Healthcare data remains siloed, largely driven by the lack of connected digital infrastructure and interoperability.
- An absence of cohesive standards for electronic health records.
- Low public trust in data collection and sharing.
- Increasing costs of evolving requirements for healthcare to be digitally enabled.
- Clinician resistance to diverting from existing/current traditional roles/models.

Virtual care is an important future priority in Australia

Continued investment in virtual care is increasingly a national priority. The Australian Government is investing $951.2 million over four years to modernise the healthcare system, including a renewal of the Intergovernmental Agreement on National Digital Health and continued funding of the Australian Digital Health Agency (ADHA) to make it an ongoing entity.[70]

The improvement and expansion of virtual care in Australia is a priority area of the ADHA's National Digital Health Strategy 2023-2028 Delivery Roadmap. To facilitate achievement of this, the ADHA has outlined three initiatives aimed at expanding the delivery of home-based care, evaluating virtual care models, and improving and scaling virtual care in Australia.[118] However, there is currently no national target for virtual hospital growth.

Deep dive | Australian virtual hospital

My Home Hospital

The impact of virtual hospitals will be illustrated through a deep dive into one virtual hospital in Australia, MyHH. The outcomes of MyHH will be analysed relative to those of physical hospitals in Australia.

As part of this engagement, KPMG have been contracted to explore the impact of MyHH relative to physical hospitals.

This deep dive will be followed by a series of case studies to demonstrate the broader impact of virtual hospitals nationally and internationally. KPMG have worked with Medibank to select the case studies included in this report.

About MyHH

MyHH is a South Australian Health Service delivered in Adelaide and peri-urban surrounds on behalf of SA Health.[77] MyHH was implemented between September and December 2020, and became an accredited hospital in March 2023.

As at 31 May 2024, MyHH has serviced over 14,000 patients since its commencement in January 2021.[79]

Whilst MyHH provides HITH services, several key factors differentiate the service from existing HITH models in Australia. These include:

- Independence from a physical hospital or hospital network;
- Dedicated medical governance;
- Dedicated medical leadership;
- Use of virtual technology to enable the program; and
- Regular monitoring of clinical indicators seven days per week.

Target Patients

MyHH provides care for patients in the greater metropolitan Adelaide region with a variety of acute conditions for which home based hospital care is safe and appropriate. This includes infections requiring intravenous antibiotics (e.g. cellulitis, pneumonia, mastitis), exacerbation of respiratory conditions, DVT and PE, heart failure, postoperative care, and gastrointestinal conditions.[77]

MyHH is currently working to expand its scope of service to a wider range of patients, including increasing the breadth of surgical procedures that are appropriate for post-surgical care at home and that address bed challenges for elective and non-elective surgery.[96]

Model of Care

The MyHH service offers:[80]

- Individualised care plans, developed and overseen by a care coordinator , who is an experienced registered nurse or medical officer;
- Mobile X-rays and ultrasounds when appropriate, oxygen for respiratory conditions, blood tests, medication, other support services such as meals and personal care, and a personal alarm for patients who live alone or have a high risk of falls;
- Remote monitoring of pulse, temperature, and blood pressure using wearable devices;
- Daily ward rounds, with more frequent medical review as required;
- Daily nursing clinical review as often as required, or at least once daily, and up to four in-person nursing visits per day;
- Paramedic clinical reviews for deterioration or escalation;
- Regular contact with the care team, who are available 24/7, with virtual access after 10:30pm; and
- Clear escalation and transfer pathways.

Deep dive | Australian virtual hospital

My Home Hospital implementation capabilities

Stakeholders report that the successful implementation of MyHH is underpinned by strong experience in rapid implementation to stand up clinical services, deep knowledge of clinical governance processes, procurement of appropriate technology platforms, and extensive stakeholder engagement.

The Figure to the right outlines the six capabilities that have been identified by MyHH delivery partners as crucial to the success of its implementation.

Along with stakeholder engagement, co-design, and technological implementation, the development of workforce and partnerships were critical to MyHH's successful implementation.

This involved the recruitment and training of virtual care centre staff and dedicated medical and nursing staff, as well as the establishment of partnerships to deliver ancillary services such as radiography and pathology in the home.

Capabilities in MyHH implementation

Stakeholder engagement

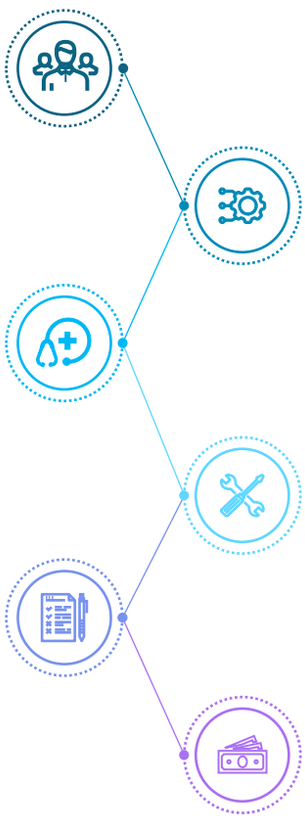
Engagement with stakeholders including government, industry organisations, customer representatives, clinicians, and public hospitals.

Clinical

- Clinical protocols / model of care / governance
- Medical professional engagement
- Clinician training to deliver virtual care plans
- Workforce planning
- Remote diagnostic tools.

Logistics management

For example, ensuring pharmacy supplies arrive ahead of nurse arrival (rostering/scheduling), coordination of x-ray, pathology and patient transport.



Technology

- Procurement of tech platform
- Design and implementation of the solution with consideration given to data security and interoperability.

Operational

- Project management
- Support services
- Delivery of monitoring and medications
- Patient management systems
- Regulatory compliance (hospital accreditation).

Financial & administrative

- Budget and funding
- Performance monitoring.

Stakeholder engagement

In the design and implementation process, MyHH engaged with more than 120 stakeholders, including government, customer representatives, public hospitals, and industry organisations such as the Royal Australian College of General Practitioners (RACGP) and Australian Medical Association (AMA).

The holistic patient journey was co-designed with stakeholders and considered connection to primary care and referral and discharge pathways.

Stakeholder engagement was led and funded by SA Health and gave the project good standing.

Deep dive | Australian virtual hospital

My Home Hospital implementation considerations

While growth was initially slower in the early stages of operation, MyHH has continued to grow and expand to care for more complex patients. Key enablers for this growth include the support and confidence of referrers, stakeholder engagement, workforce growth, and logistics management.

Over 90% of DRGs claimed in the first financial year were one of the following DRGs:

- Cellulitis, Minor Complexity
- Kidney and Urinary Tract Infections, Minor Complexity
- Respiratory Infections and Inflammations, Minor Complexity
- Cellulitis, Major Complexity
- Chronic Obstructive Airways Disease, Minor Complexity
- Heart Failure and Shock, Minor Complexity
- Kidney and Urinary Tract Infections, Major Complexity
- Respiratory Infections and Inflammations, Major Complexity.

At the time of launch, there was a single referral pathway from EDs to MyHH, and MyHH commenced with DRGs known to be delivered safely within a HITH service. This approach was important for managing workforce capacity, stress testing the systems, governance and models of care, and building confidence in stakeholders and their willingness to refer.

The program was designed to incrementally broaden referral channels as appropriate and grow to peri-urban areas. MyHH began to accept referrals directly from GPs, ambulances, the critical care service, and residential aged care facilities.

MyHH also started to admit a broader range of patients, with higher risk and complexity. This shift required extensive stakeholder engagement, workforce growth and expansion of the logistics management capabilities.

It takes time to develop the confidence of referrers, as they need to see the delivery of quality care with equal or better outcomes for patients in the virtual hospital before referring more complex patients.

Noting, when there is no track record in safely looking after sick patients then adoption will be slower. This lower occupancy will drive higher costs per patient.

The hospital has continued to grow and expand, managing complex patients with a broader range of medical conditions and surgical planned pathways.

Hospital accreditation was awarded in March 2023. This is a crucial element to increasing referrer confidence in the virtual hospital's ability to manage complex patients.

MyHH implementation success factors

Success factors in the implementation of MyHH include:

- ✓ Broad and intensive stakeholder engagement, including engagement initiatives in collaboration with the SA Health
- ✓ Consultative clinical models developed with key clinicians across numerous specialties
- ✓ Ease of referral into the VH, including medical contact and acceptance 24/7
- ✓ Accredited to National Safety and Quality Health Service Standards
- ✓ Robust clinical governance, specifically clarity around medical governance
- ✓ Procurement and tailoring of technology solutions
- ✓ Extensive experience in operational management processes
- ✓ Clinical workforce management, including onboarding and appropriate knowledge and education processes.

Deep dive | MyHH

Demand for My Home Hospital

Since its inception in January 2021, MyHH has rapidly expanded its patient intake. As at 31 May 2024, MyHH has serviced over 14,000 patients, equating to over 66,000 bed days over the lifespan of the virtual hospital.[78]

The number of admissions into the program is growing at a CAGR of 130%, and compound quarterly growth rate of 26%.[82] While strong growth is anticipated given the program's recent implementation, the rapid pace of expansion is in line with broader trends for virtual care in Australia; the amount of hospital care delivered as HITH in Australia is increasing at a rate that is almost twice that of traditional care.[81]

A dip in the number of MyHH admissions can be observed in FY23 Q3 on the graph to the right. This dip is attributed to a decline in admissions for COVID-19 and other respiratory conditions.

Approximately two-thirds (66%) of patients admitted over the life of the program were aged 65 years and older. There is a roughly 50/50 split between male and female patients (49.7% male and 50.1% female).[82]

Services Provided by My Home Hospital

15,000+

Patients serviced as of 30 June 2024

69,000+

Total bed days as of 30 June 2024

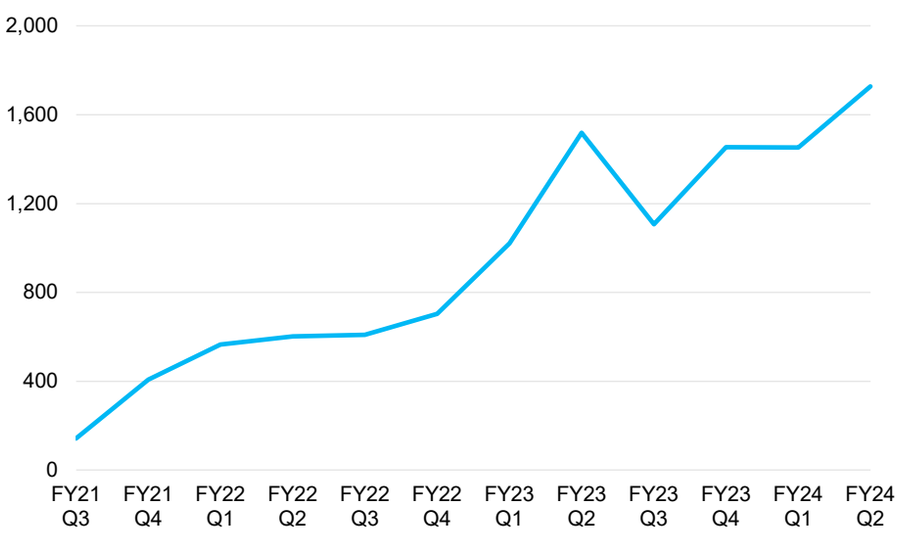
130%

Compound annual growth rate of number of admissions, FY21 to FY24

66%

Proportion of patients aged 65 years and older

Number of My Home Hospital admissions from beginning of program



Deep dive | MyHH

My Home Hospital services

The conditions treated at MyHH are currently concentrated in a small number of DRGs, with the top three Adjacent Diagnosis Related Groups (ADRGs) representing over half of total activity since the inception of the program.

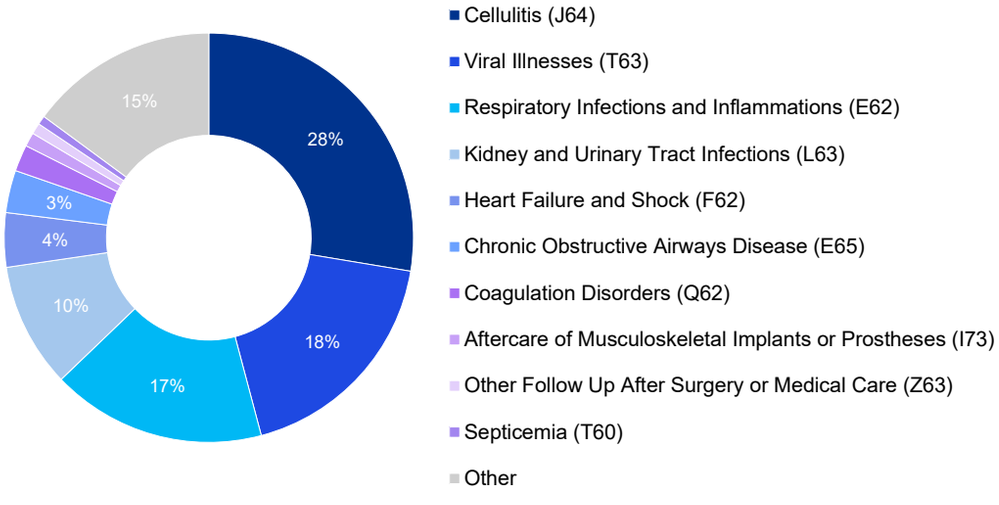
MyHH was initially contracted by SA Health to provide a narrow set of DRGs, and the scope of care has since expanded. The proportion of total activity attributed to the top five ADRGs is declining (76% in 2023, down from 88% in 2021), and reflects a shift toward more normal operating conditions following COVID-19 related admissions and the continuous expansion of MyHH's scope of service.

The most common diagnoses at MyHH over the life of the program are cellulitis (28%), viral illnesses (18%), and respiratory infections and inflammations (17%).[82] ADRGs of potential additional target populations for MyHH include septic arthritis, digestive malignancy, infective endocarditis, select musculoskeletal procedures, sleep apnoea, and septicaemia.

In 2023, the mean number of face-to-face visits per episode of care per day varied by ADRG and ranged between 1.3 visits and 1.8 visits for the top 10 ADRGs. Of the top 10 ADRGs, the ADRG with the highest number of face-to-face visits per day was cellulitis, followed by septicemia, and heart failure and shock.[82]

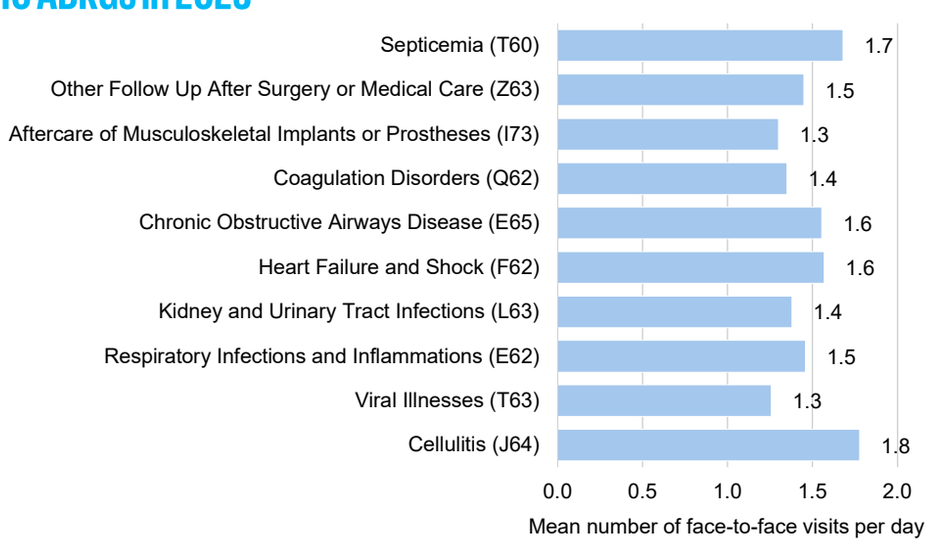
Within a given ADRG, the mean face-to-face visits per episode of care increases with higher levels of complexity and with comorbidities. The highest number of face-to-face visits occur for patients on oxygen.

Volume of patients from beginning of program by ADRG*,[82]



*An ADRG is a code consisting of alpha and two numeric characters used to group procedures and conditions.

Mean face-to-face visits per episode of care per day for top 10 ADRGs in 2023[82]



Deep dive | MyHH

My Home Hospital performance

Comparison of MyHH outcomes with those of physical public hospitals nationally indicates that MyHH outcomes are comparable with physical hospitals, with no significant shortcomings.

MyHH data has been compared with publicly available data on outcomes of public hospitals where possible. The results show that patients at MyHH had a longer average length of stay (ALOS) than in physical hospital settings, and the hospital-acquired complication (HAC) rate at MyHH was significantly lower than in public hospitals.

Health and quality

Comparison of MyHH health and quality outcomes, including readmission rates and HAC rates, with public hospital data indicates MyHH outcomes are at least in line with those of physical hospitals.

Over the life of the MyHH program, 1.3% of MyHH patients had their care escalated from virtual hospital to a physical hospital, either through escalation to ED or inpatient admission.[82]

ALOS at MyHH in FY24 was 4.3 days.[75] Based on the most recent publicly available data, weighted ALOS across public hospitals nationally in FY21 was 3.4 days for the top 20 MyHH Australian Refined Diagnosis Related Groups (AR-DRGs).[108] The ALOS for SA admitted acute hospital care in FY21 was 2.5 days, or 4.3 days excluding same-day admissions.[84]

Across the top 20 MyHH AR-DRGs, ALOS at MyHH in 2023 was on average 75% longer than public hospitals in 2021.[82, 108] The longer ALOS is to be expected given virtual settings do not experience the same pressure to release physical beds and ease bed block as is experienced in physical hospitals.

A HAC refers to a complication experienced by a patient during their stay at hospital and for which clinical risk mitigation strategies may reduce, but not necessarily eliminate, the risk of that complication occurring.[85]

MyHH's average FY23 HAC rate[79] of 0.6% represents less than one-third of the average public hospital rate for acute patients of 1.9% in 2021-22.[83]

ALOS

3.4 days
National weighted ALOS in public hospitals for the top 20 MyHH AR-DRGs in FY21.*, [108]

4.3 days
ALOS at MyHH in FY24.[79]

HAC rate

1.9%
National HAC rate for acute patients in public hospitals in FY22.[83]

0.4%
HAC rate at MyHH in FY24.[79]

*ALOS for public hospitals has been weighted across the top 20 MyHH AR-DRGs to improve alignment of case mix with MyHH and accuracy of comparison.

Deep dive | MyHH

My Home Hospital performance

Patient experience

In FY24, patient experience at MyHH was 'excellent' with an average NPS of 88* and an average patient and carer satisfaction rate of 97.6%.**, [79]**

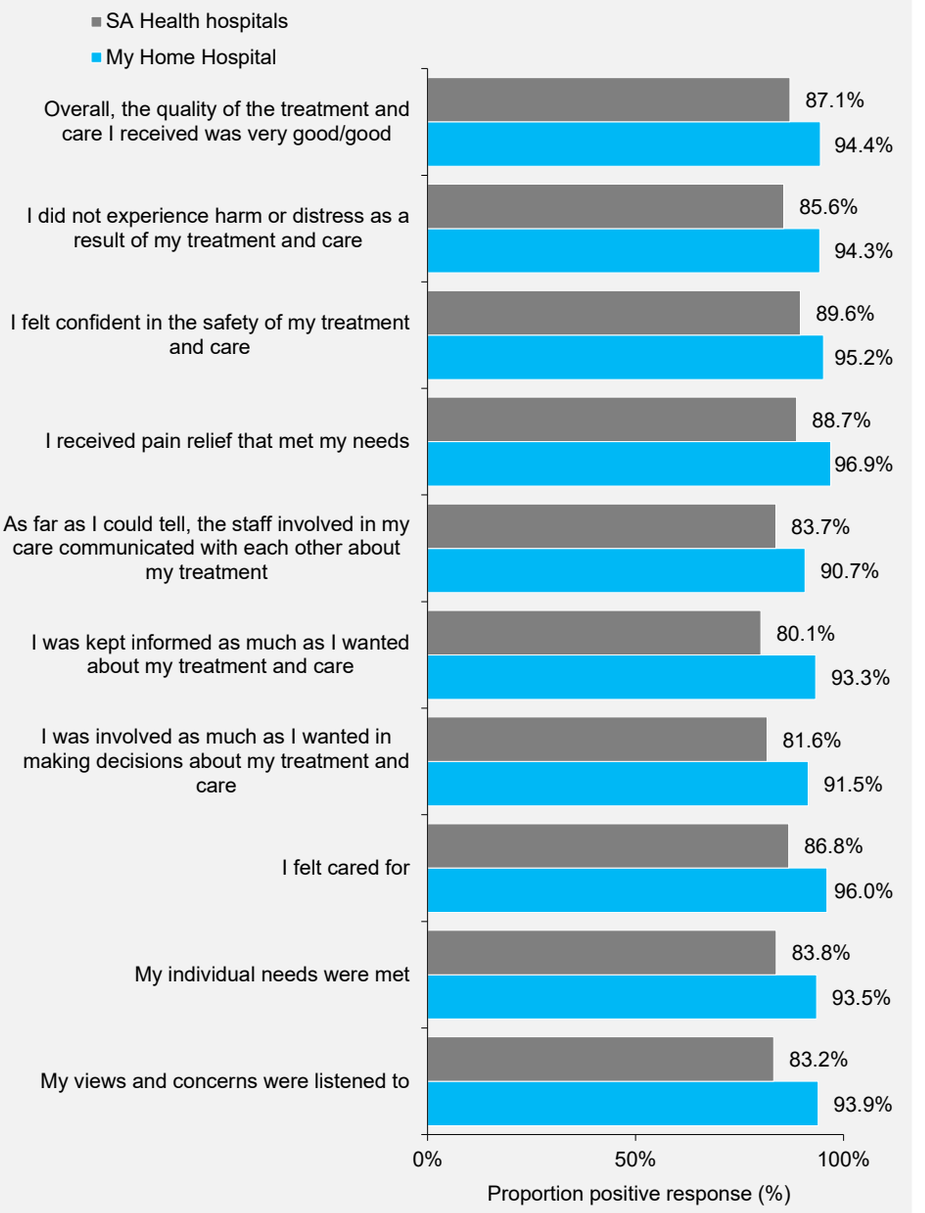
NPS is a patient experience metric that is widely used in many countries to support benchmarking and comparison of healthcare performance. In Australia and New Zealand, the benchmark is for an NPS of 30 or higher, and a score above 70 is considered excellent.[109]

MyHH actively monitors patient experience through the My Home Hospital Consumer Experience Survey. A sample of 125 MyHH patients completed the survey in July to September 2023.[82]

This data has been compared with outcomes of the Australian Hospital Patient Experience Question Set (AHPEQS) in relation to SA Health hospitals (see Figure to the right). The AHPEQS is designed by the Australian Commission on Safety and Quality in Health Care (ACSQHC) with the purpose of monitoring quality of hospital services and providing a nationally consistent assessment of patients' experiences.[110]

A higher proportion of MyHH respondents reported a positive response compared to SA Health hospitals for all questions, and the MyHH proportion was significantly higher in seven of ten questions.

Proportion of positive responses to Australian Hospital Patient Experience Question Set (July to September 2023)[82]



*NPS results have not been case mix adjusted.
**Average patient and carer satisfaction from 1 January 2024 to 30 June 2024.

Deep dive | MyHH

My Home Hospital performance

Efficiency at scale

The implementation of a virtual hospital involves upfront costs (such as supporting information technology systems, equipment, and operational resources), as well as hidden costs not articulated due to the complexity of the establishment arrangement. Implementation also takes time and involves a dedicated effort for change management, such as staff training and patient education.

Once a virtual hospital is fully operational and reaches an appropriate scale, it is likely to demonstrate efficiencies compared to physical hospitals for equivalent DRGs, even where LOS is longer. Ongoing cost efficiency is underpinned by technology and enhanced workforce efficiency due to reduced manual day-to-day tasks.

The following analysis of MyHH demonstrates the cost efficiencies of an at-scale virtual hospital. This analysis assesses the current service* excluding some of the earlier-stage costs to establish and scale the model of care to current service delivery levels.**

*As MyHH expands to serve a broader cohort, this level of cost efficiency might not necessarily be retained as new DRGs or regions are added.

**Some of the costs associated with implementation and change management steps are not comparable to the traditional delivery model which operates at maturity. Hence, investment to achieve scale has been excluded.

***MyHH costs include variable costs, fixed costs, and in-kind costs.

The complexity and resource intensity of care at MyHH, measured by inlier NWAU per episode of care, has increased over the life of MyHH. Inlier NWAU per episode of care at MyHH increased from 0.78 in FY21 to 0.86 in FY24, reflecting the increasing complexity of patients as the program matures.[82]

These NWAU results include COVID-19 admissions which are generally less complex. Excluding COVID-19 admissions to MyHH, the average inlier NWAU was higher at 0.96 between July and December 2023.[82]

When considering the top 10 MyHH AR-DRGs treated in a public hospital setting, the national average NWAU per episode of care in FY21 was 0.85.[87] This suggests that patients treated at MyHH in FY24 are of similar complexity to those in physical public hospitals.

When comparing average MyHH costs***, with national average costs of admitted acute care across the top 10 MyHH AR-DRGs treated in a public physical hospital setting, the following cost savings are observed:

- The average cost per episode of care at MyHH is 23.6% less than the national average cost per episode of care in public hospitals in FY21 (indexed to FY24 prices).[82, 86, 87]
- The average cost per NWAU at MyHH is 19.7% less than the national average cost per NWAU in public hospitals in FY21 (indexed to FY24 prices).[82, 86, 87]

NWAU per episode of care

0.85

National average NWAU per episode of care for the top 10 MyHH AR-DRGs in public hospitals in FY21.[87]

0.86

Inlier NWAU per episode of care at MyHH in FY24 (July-Dec).[82]

#FTE does not capture service provider's FTE required to deliver the in-home care.
##FTE calculated as the average FTE in public hospital services nationally in 2021-22, divided by the average available beds in public hospitals nationally 2021-22, and multiplied by 80 beds.

Case Study | USA

Mayo Clinic

The ACH hospital-at-home model provides high-acuity inpatient-level care and post-acute care to patients in their homes. As at August 2023, more than 2,600 patients had been treated under the ACH program since its inception in 2020.[71]

Conditions treated

Patients with acute-level conditions requiring inpatient-quality care, in both urban and rural settings, are eligible for treatment under the ACH program. Commonly treated conditions include COVID-19 infection, heart failure, septicemia, pneumonia, bloodstream infections, and bronchitis.[72]

Model of Care

A central Command Centre staffed with clinicians provides oversight of the care of all patients. The program offers 24/7 virtual care, including:

- Telehealth and remote vital signs monitoring;
- In-person care by doctors, nurses and community paramedics;
- A care plan;
- Pharmacy and medication management; and
- Targeted individualised patient education.

Under the program, hospital-quality tests and examinations, including lab tests, mobile ultrasounds, X-rays and IV therapies, can be done in the home.[72]

Daily rounds are conducted by video with physicians, and patients are seen twice daily by either a registered nurse or a community paramedic overseen by the command centre virtual registered nurse. If a patient's condition deteriorates, the patient is immediately connected with the Command Centre and a virtual evaluation is performed. Patients are discharged once they are clinically stable and have the option to enter the ACH restorative phase, involving up to 30 days of post-acute virtual outpatient observation.[12]

Demonstrated Benefit

Provider experience

- The ACH model allows the highest-cost providers to manage a larger volume of patients compared to other hospital-at-home models.[12]
- An eight-month study of provider experience with the ACH model concluded providers found the model very rewarding and were able to deliver high-quality and safe care to patients. Over 80% of providers gave positive scores to all three areas of investigation; providers perception of quality and safety, providers perception of decision-making and teamwork, and whether providers found working in ACH rewarding.[55]

Patient experience

- ACH is highly recommended by patients, with patients scoring the program highly on responsiveness, staff engagement and communication, ease of equipment use, and readiness for discharge.[53]

Health equity

- Patients could be easily transferred between virtual providers with varying degrees of specialisation, enabling the provision of advanced care to isolated patients and improving patient convenience.[12]

Case Study | England

Croydon Health Service

Virtual wards in England are expanding rapidly, with the NHS reporting a 60% rise in virtual beds available between May 2022 (4,485 virtual beds) and January 2023 (7,653 virtual beds). At the start of 2023, the NHS had rolled out over 7,600 virtual ward beds and more than 340 virtual ward programs across England, treating over 100,000 patients using virtual wards in 2022.[40]

The NHS recently committed to the greater use of virtual wards, aiming to scale up capacity with a long-term ambition of reaching 40 to 50 virtual wards per 100,000 people, which would mean more than 50,000 admissions a month.[16]

Initially set up as a rapid response to the first wave of COVID-19, Croydon's Virtual Ward now provides 24/7 hospital-level care in the homes of residents of Croydon borough.[73]

Target Patients

The NHS is investing in virtual wards for conditions including frailty, acute respiratory conditions and heart failure.[16] Croydon's Virtual Ward cares for patients with acute and acute long-term conditions, including hypertension, COPD, asthma and Long Covid.[73]

Model of Care

Patients are trained to use remote monitoring devices, providing continuous measurements to the Rapid Response team, a clinical team of doctors, nurses and healthcare assistants.[46]

Patients are actively monitored between 8am – 8pm every day, with immediate alerts if there are signs of patient health deterioration. The team assesses the patient by phone or video call to determine an appropriate response, which may include a home visit or hospitalisation. Care is delivered in line with individualised treatment plans.[46]

Demonstrated Benefit

Lower cost

- The virtual ward delivered cost savings, with the total cost saving per virtual ward patient estimated at £742.44 (approximately 1,400 AUD) compared to the rapid responses control group.[46]
- The digital platform Huma used in NHS virtual wards can reduce readmission rates by over 30%, alleviating workload of healthcare providers and resulting in two times the clinical capacity potential.[26]

Patient experience

- There were significant improvements to patients' quality of life since being cared for under the virtual ward team.[46]
- Patient experience was 'excellent' with an NPS of 55. Patients reported that the service gave them peace of mind, was easy and simple to use, that they felt they were receiving the same standard of care as they would in a physical hospital, and in some instances their experience exceeded their experience of being treated in hospital in terms of feeling safe.[46]

Patient health outcomes

- The virtual ward had relatively low rates of readmissions and hospital admissions post-discharge from the virtual ward, at 12% and 9% respectively.[46]
- Telehealth monitoring identified significant pathology that was detected earlier or would otherwise not have been detected.[46]

Case Study | USA

Atrium Health

Atrium Health rapidly designed and implemented the AH-HaH early in the COVID-19 pandemic to offset the expected influx of patients at the hospital.[74]

Patients with higher-acuity COVID-19 who would otherwise be hospitalised are cared for in a virtual acute care unit (VACU). The program cares for approximately 60 patients per day and has supported over 9,400 patients as at February 2024.[75, 49]

The program aims to expand capacity to 200 daily patients by 2025.[75]

Target Patients

A variety of acute conditions are treated at AH-HaH, including COVID-19, tier 2 subacute chronic conditions (such as congestive heart failure and diabetes), and acute or episodic conditions (such as cellulitis and deep vein thrombosis).[28]

Model of Care

AH-HaH is a hybrid of virtual and in-person services. Core components of the AH-HaH VACU model include:[74]

- Discussion of AH-HaH risks and benefits amongst clinicians, patient and caregiver;
- Admission and home admission visit to set up home monitoring and acute interventions;
- Multidisciplinary team care with daily proactive 24/7 symptom monitoring, daily virtual physician rounds, twice-daily nursing assessments, twice-daily in-person home visits from paramedics and nurses; and
- Discharge to a virtual observation unit or transfer to traditinal hospital as needed.

Demonstrated Benefit

Health equity

- AH-HaH incorporates a health equity lens in the program's design, leveraging telemedicine to reach a diverse population, with particular benefits for Black and Hispanic populations in the COVID-19 pandemic.[28]
- Atrium health staff are trained to assess patients' medical and nonmedical needs, such as food insecurity and unsafe housing, and connect patients with appropriate resources or community partners.[28]

Lower cost

- According to the American Medical Association, the program costs 20% less than delivering the same care in physical hospitals.[28]
- Atrium Health reported in February 2024 that more than 33,000 bed days have been saved since the program's inception in March 2020.[49]

Patient health outcomes

- Equivalent or superior clinical outcomes compared with patients in physical hospitals.[39]
- According to Atrium Health, the program has a readmissions rate of 0.8, which is better than Atrium Health's traditional facilities.[49]

Patient experience

- An NRC Health survey reported high patient satisfaction with AH-HaH, approximately 13% higher than patients in physical hospitals.

Case Study | Australia

RPA Virtual Hospital

Established in February 2020, **rpa**virtual delivers a suite of virtual care services, including HITH.[76] The key objectives of **rpa**virtual are to support patient flow in Sydney Local Health District's acute hospitals by delivering hospital care in the community, reduce unnecessary demand on healthcare services, and enhance the patient experience.[19]

Target Patients

rpavirtual treats patients with a variety of acute, subacute, post-acute, and chronic conditions. Conditions treated through **rpa**virtual's HITH model of care can include for example cellulitis, bacteraemia, endocarditis, pneumonia, septic arthritis, urinary tract infections, and wound infections.

Model of Care

The Virtual Care Centre at **rpa**virtual provides 24/7 support to patients through technology-enabled care pods with access to electronic medical records, clinical protocols, remote monitoring tools, and telehealth facilities. Patients are monitored through clinical assessment via video conferencing, remote monitoring of vital signs using wearable devices, and patient self-reported symptoms and wellbeing using technology with daily review by a clinician.[19]

rpavirtual integrates person-centred features to support the patient experience, including regular communication regarding the patient journey, input from a consumer network, and comprehensive clinical care protocols.[19]

The model incorporates a health equity lens in its design, including assessment of patient risk and protective factors for health and wellbeing, connection to appropriate community supports and services, and provision of direct welfare support, cultural support, and accessible information.[60]

Demonstrated Benefit

Lower costs

- Cost efficiencies were encountered across the range of virtual services under **rpa**virtual. For example, **rpa**virtual's COVID-19 antenatal clinics have an average cost saving per service event of $116.85 compared to a RPA Hospital service event, resulting in total avoided costs of over $129,000 between February 2021 and January 2022.[19]
- In the period 9 August to 16 September 2021, the ED avoidance rate following **rpa**virtual medical review was estimated between 60% and 70%, with a total cost saving of avoided ED presentations of over $17.5 million during this period.[19]
- **rpa**virtual is estimated to have saved nearly nine million kilometres of travel in the period February 2021 to January 2022, equating to nearly 1,600 tonnes of avoided carbon emissions and over $36,000 in avoided carbon costs.[19]

Patient experience

- Of 3,198 **rpa**virtual patients surveyed in 2021-2022, over 80% of respondents agreed that the virtual care had helped them, had improved access to treatment, had an easy-to-use video conferencing system, that they felt confident at home, and that communication with clinicians was clear.[19]

Provider experience

- Results from a survey of **rpa**virtual clinicians in 2022 were very positive on four out of five domains, including quality of care, confidence, psychological safety, and inter-professional working.[19]

03 Economic analysis

This section explores the potential economic impact of the expansion of the virtual hospital model in Australia. This analysis builds on a deep dive into the impact of MyHH relative to physical hospitals in Australia.

In Chapter 2, the benefits of virtual hospitals described by literature and case studies both within Australia and internationally were detailed.

In this section, the impact of increased adoption of virtual hospitals in Australia in 2030 will be investigated, including:

- Physical bed days substituted for virtual hospital care in 2030 by redirecting patients through virtual hospitals;
- Cost savings associated with these bed days substituted in 2030; and
- Substituted capital expenditure based on based days saved in 2030.

A summary of the results of this analysis is outlined on the right, with low-end and high-end estimates based on scenarios one (current scope of care) and three (expanded scope of care) respectively.*

The results of this analysis suggest virtual hospitals have the potential to play a key role in the health transition to more efficient and sustainable models of healthcare in Australia and more broadly.

360,000 – 1.2 million

Bed days substituted for virtual hospital care in 2030.

$286 million - $1.0 billion

Avoided costs associated with bed days substituted in 2030.

$2.9 billion- $6.4 billion

Substituted capital expenditure based on bed days substituted in 2030.

*Low-end and high-end estimates are based on scenarios one (current scope of care) and three (expanded scope of care) respectively. For substituted capital expenditure, low-end and high-end of the range are the mid-points of results for scenarios one and three respectively. All monetary values are in FY24 prices.

Modelling future benefits of virtual hospitals

This analysis considers the expansion of virtual hospital care for specific DRGs that have been selected based on the current scope of service and anticipated future growth of the virtual hospital model.

Three scenarios, each with a defined set of DRGs, are included in the analysis:

1. **Current scope of care:** as a base case, the top 20 AR-DRGs treated by MyHH have been selected. These AR-DRGs represent 87% of admissions to MyHH.
2. **Reduced scope of care:** as a more conservative estimate, the top 10 AR-DRGs treated by MyHH, which represent 80% of admissions, will be considered.
3. **Expanded scope of care:** in addition to the top 20 AR-DRGs currently serviced by MyHH, this scenario will consider additional AR-DRGs suitable for treatment by virtual hospitals based on virtual hospital activity observed within Australia, as well as AR-DRGs with potential for treatment by virtual hospitals in the future based on trialled models and population-specific studies. This scenario assumes the virtual hospital model will continue to mature in Australia.

To estimate the projected number of admissions treated by virtual hospitals in 2030, the model considers both patient eligibility and the level of substitution of traditional care.

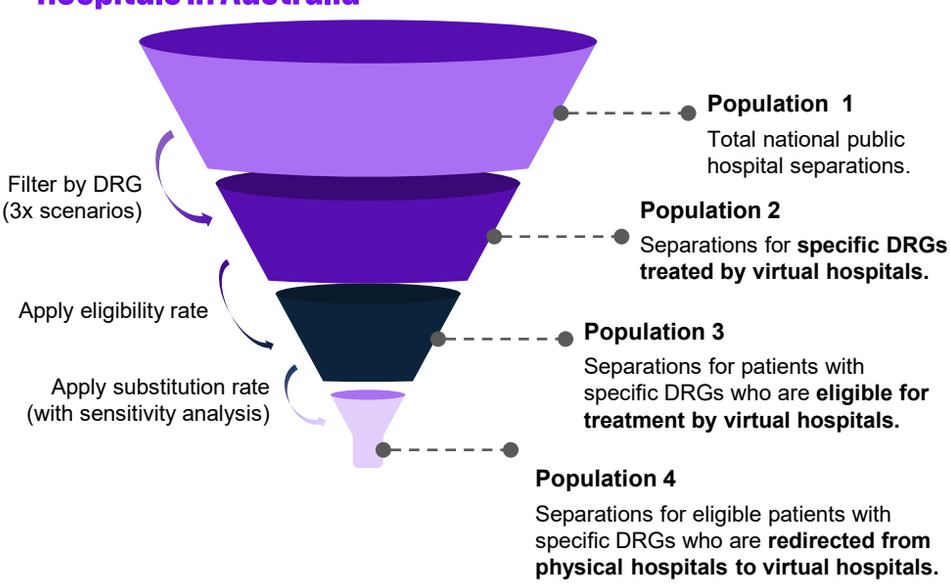
Eligibility for treatment by a virtual hospital differs between services. Some common factors that determine eligibility include assessment of clinical appropriateness by a clinician, stability of the patient's condition, safety and stability of the patient's living situation, patient age, access to technology, and patient consent. Therefore, only a proportion of patients with specified DRGs are eligible for treatment.

The projected number of separations treated by virtual hospitals is further narrowed by the capacity of the system to substitute traditional care with virtual hospital care. Future adoption of the model will depend upon various factors, such as:

- The level of investment;
- The funding and policy environment;
- Acceptability and satisfaction of patients and workers, including clinicians and operating staff; and
- The ability to recruit, onboard and train the required staff.

As this substitution rate is uncertain, sensitivity analysis has been conducted. Additional detail on the model method can be found in Appendix B.

Estimating the number of separations treated by virtual hospitals in Australia



Bed days substituted for virtual hospital care

As physical hospitals come under mounting pressure to meet future demand, it is estimated that virtual hospitals have potential to substitute between 105,000 and 381,000 separations in 2030. This could substitute between 360,000 and 1.2 million physical bed days in 2030, which represents between 1.6% and 5.3% of currently available public hospital bed capacity.

Redirecting patients through virtual hospitals can free bed days that patients would have occupied in a physical hospital and can also expand capacity of the hospital system.

With the current scope of care, it is estimated that virtual hospitals could substitute between 360,221 and 540,332 bed days in 2030, equivalent to between 986 and 1,480 beds.

With reduced scope of care, a more conservative estimate of between 239,571 and 359,357 bed days could be substituted, the equivalent of between 656 and 985 beds.

If virtual hospitals were to expand their current scope of care, it is estimated that between 810,878 and 1.2 million bed days could be substituted, equating to between 2,222 and 3,332 beds.

Bed days substituted

Current scope of care

360,000 – 540,000

Bed days substituted in 2030 with current virtual hospital DRGs.

Reduced scope of care

240,000 – 359,000

Bed days substituted in 2030 with a reduced number of DRGs.

Expanded scope of care

810,000 – 1.2 million

Bed days substituted in 2030 with expanded set of DRGs.

Deep dive: postoperative care

Postoperative care is one area that is increasingly becoming serviced by virtual hospitals internationally.[39, 79, 91] This area has strong potential to benefit from virtual hospital care; in 2022-23, 50% of patients waited at least 49 days for admission from elective surgery waiting lists in Australia, up from 40 days in 2021-22.[5]

It is estimated that virtual hospital care for postoperative patients with select DRGs* in Australia could substitute between 106,383 and 159,575 bed days in 2030, the equivalent of between 291 and 437 beds.**

**surgical DRGs for which there is evidence of current or potential future virtual postoperative care activity, including knee replacement, hip replacement, coronary bypass without invasive cardiac investigation, vascular surgery, and other follow up after surgery or medical care.*
***These substituted beds are for postoperative care. Improved patient flow through surgery would also require an increase in the number of surgeries or expanded surgical theatre capacity.*

Associated avoided costs

Substituting physical hospital separations with virtual hospital care could avoid between $286 million and $1.0 billion in 2030 (in FY24 prices).* This is because virtual hospitals can deliver safe and effective care at a lower cost per episode of care than physical hospitals.

It was previously estimated that the average cost per episode of care at MyHH is 24% less than the national average cost per episode of care in public hospitals (see Page 28). Applying this lower cost at scale, the potential cost savings of redirecting care from physical hospitals to virtual hospitals is projected to reach between $198 million to $1.0 billion in 2030.

With the current scope of care demonstrated in MyHH, it is estimated that virtual hospitals can save between $286 million and $430 million relative to delivering the same care in physical hospitals in the year 2030.

As a conservative comparison, it is estimated that if the virtual hospital model was to expand with a reduced scope of care, between $198 million and $296 million could be saved by diverting care away from physical hospitals in 2030.

Expanding the scope of virtual hospital care increases cost savings to between $679 million and $1.0 billion in 2030.

A number of important considerations when interpreting these results are outlined on Page 38.

Cost savings

Current scope of care

$286 million – $430 million

Cost savings in 2030 with current virtual hospital DRGs.

Reduced scope of care

$198 million – $296 million

Cost savings in 2030 with a reduced number of DRGs.

Expanded scope of care

$679 million – $1.0 billion

Cost savings in 2030 with expanded set of DRGs.

*The range of estimated associated avoided costs is large and accounts for the uncertainty and variability in both scope of future care and the level of future adoption. The low-end estimate of $286 million is based on the current scope of care and conservative level of adoption, while the high-end estimate of $1.0 billion is based on an expanded scope of care and high level of adoption.

Substituted capital expenditure

Delivering care through virtual hospitals could substitute between $2.9 billion and $6.4 billion in capital expenditure on new public hospital infrastructure (in FY24 prices) based on bed days substituted for virtual hospital care in 2030.*

This analysis considers a scenario where if care had not been delivered by virtual hospitals, the bed days substituted in 2030 (estimated on Page 35) would instead be provided by new physical hospital infrastructure.

With the current scope of care, it is estimated that virtual hospitals can substitute between $393 million and $5.3 billion in construction costs on new hospital infrastructure.

With reduced scope of care, substituted capital costs in 2030 are estimated between $261 million and $3.5 billion.

With expanded scope of care, these substituted capital costs increase to between $884 million and $12.0 billion.

*Low-end and high-end of the range are the mid-points of results for scenarios one and three respectively. The large range can be attributed to the variability in capital expenditure on hospital construction in Australia (see Appendix B for detail). All monetary values are in FY24 prices.

Substituted capital expenditure

Current scope of care

$393 million – $5.3 billion

Substituted capital expenditure with current virtual hospital DRGs.

Reduced scope of care

$261 million – $3.5 billion

Substituted capital expenditure with a reduced number of DRGs.

Expanded scope of care

$884 million – $12.0 billion

Substituted capital expenditure with expanded set of DRGs.

Deep dive: hospital construction activity in Australia

Construction of new hospital infrastructure is a significant expense in Australia; capital spending on health facilities and investments, including government and non-government expenditure, totalled to **$11.7 billion** in 2021-22.**, [92] Examples of current hospital infrastructure projects underway nationally include:

- Princess Alexandra Hospital in Brisbane is undergoing a major **$350 million** expansion which will deliver 219 new acute inpatient and 30 new ICU beds, 13 new cancer treatment bays, and reconfigured specialist treatment spaces.[93]
- A **$47 million** project at Lyell McEwin hospital in Adelaide will deliver 48 single occupancy rooms with ensuites, including rooms with specialty care features for people who require a higher level of support and a range of other utility and support spaces. [94,95]
- The expansion of Canberra Hospital is receiving over **$600 million** in funding to develop a new ED with 147 spaces, new and improved intensive care facilities, 22 operating theatres, and 156 inpatient beds.[96]

***excludes spending by individuals or private health insurance providers.*

Interpretation of future benefits

While virtual hospitals have strong potential to generate cost savings for Australia's hospital system in 2030, the modelled benefits should be interpreted with caution.

The cost savings of future virtual hospital expansion is based on MyHH delivering care at a lower cost per episode of care compared to the national average public hospital cost per episode of care for similar DRGs (see Appendix B for additional detail on the method). The interpretation of cost savings (see Page 36) should consider:

- **Virtual hospital beds assumed to replace physical beds;** The realisation of these cost savings assumes that virtual hospital beds will replace physical beds, which would require either the closure of physical beds or avoided builds of new physical beds.
- **Generalisability of MyHH costs;** The cost per episode of care in a virtual hospital is informed by MyHH costing data, however virtual hospital costs vary across different services, locations, and scale. The cost per episode of care at MyHH may not translate to broader adoption across the system. Additionally, MyHH costs exclude some of the earlier-stage costs to establish and scale the model, and new virtual hospitals are anticipated to incur higher costs early on. These factors may impact the generalisability of results.
- **Generalisability of public hospital costs;** The national average public hospital cost per episode of care used in this model includes hospitals of varying size and service offerings, which may impact the accuracy of comparison with MyHH.
- **Accuracy of cost comparisons;** Total hospital system costs are incorporated into national average public hospital costs per episode of care, which may impact comparisons between virtual hospital and national public hospital data.
- **Change management costs;** the analysis does not consider the costs associated with change management for scaling virtual hospitals in Australia.

Benefits of adoption at the national scale are more likely to be realised if there is a vibrant market with strong investment and incentives for innovation.

However, there are a number of market and political factors which impact the scope of the future role of virtual hospitals in Australia's healthcare system, including funding and tax mechanisms, buy-in from healthcare workers and the public, connected and interoperable digital infrastructure, and investment in the model. These factors will be pivotal in determining the extent to which benefits can be realised.

Implications for the broader healthcare system

Ambulance ramping and surge management

Virtual hospitals and virtual care models have the potential to relieve stress on EDs nationally, with potential flow-on effects of reduced ambulance ramping and increased capacity to manage surges in ED presentations, such as during the flu season.[123, 128]

It has been estimated that virtual hospitals can substitute between 360,000 and 540,000 physical bed days in 2030 (see Page 35). It is expected that a proportion of these freed physical bed days will be filled by patients from ED, which can reduce access block of patients from ED to hospital admission.

While the drivers of ambulance ramping and surge are complex and link to variables such as an ageing population and seasonality, it is likely that improved patient flow through the ED as a result of virtual hospitals can free ED capacity, with potential flow-on effects for reduced wait times of ED presentations, reduced ambulance ramping, and improved capacity to manage surge.[120]

Additionally, virtual models can reduce demand on EDs by offering alternative pathways for triage and assessment, such as virtual EDs.

The potential benefit can be illustrated in the context of residential aged care, which represents a source of growing demand for ambulances with 37% of aged care residents presenting to an ED at least once in 2018-19.[121]

The AMA estimated that there were 49,300 non-admitted ED presentations from residential aged care homes in 2020-21 at a cost of $112 million in this year.[122] Characteristics of these presentations include minor condition diagnoses, a discharge without admission, and ED transportation via ambulance. The total estimated cost of these presentations over four years is almost $500 million (2020-21 to 2024-25).[122]

Virtual EDs represent a suitable alternative for many in this cohort by allowing these residents to access ED clinicians without leaving their facility. This can alleviate the time and costs associated with transfers between residential aged care homes and hospitals.

For example, the SA Virtual Care Service (SAVCS) enables ED trained clinicians to work directly with SA Ambulance Service (SAAS) paramedics via video link to assess patients onsite. Uptake by residential aged care facilities has been high, with 80% of South Australian residential aged care providers now registered to use the SAVCS, and more than half having used the service.[123]

Since its launch in December 2021, SAVCS has coordinated more than 1,400 virtual consults with residential aged care residents across SA, and more than 80% of these calls have resulted in residents receiving care in their residential home and avoiding ED transfer.[123]

Patient experience

In Chapter 2, evidence of the benefit of virtual hospitals and similar models of care for the patient experience was detailed (see Page 16). Along with the benefit experienced directly by patients, there are a number of economic impacts associated with positive patient experiences.

There is evidence to suggest that more positive patient experience is associated with lower hospital costs and greater hospital profitability.[124, 125] One explanation for this is the direct impact of more positive patient experiences, and less negative patient experiences, resulting in fewer complaints and liability cases.[124, 125]

Positive patient experience is closely linked to a hospital's reputation, as better patient experience can increase patient loyalty and patients recommending the hospital to others. In turn, this can increase the number of elective patients and future hospital revenue.[124]

Virtual hospital and other patient-centred approaches can foster higher levels of trust in the patient-clinician relationship. Studies have shown that increased trust can be associated with more beneficial patient health behaviours, increased patient quality of life, and improved clinical outcomes and patient safety, all of which can have an indirect impact in lowering hospital costs.[126, 127]

05 Appendices

A: Reference list

1. Parliament of NSW. (2022). *Impact of ambulance ramping and access block on the operation of hospital emergency departments in New South Wales*. https://www.parliament.nsw.gov.au/lcdocs/inquiries/2892/Report%20No.60%20-%20Portfolio%20Committee%20No.%202%20-%20Health%20-%20Ambulance.pdf
2. Nuffield Trust. (2023). Delayed discharges from hospital. https://www.nuffieldtrust.org.uk/resource/delayed-discharges-from-hospital
3. Australian Institute of Health and Welfare. (2023). Emergency department care. https://www.aihw.gov.au/reports-data/myhospitals/sectors/emergency-department-care
4. Australian Medical Association. (2023). 2023 Ambulance Ramping Report Card. https://www.ama.com.au/articles/2023-ambulance-ramping-report-card
5. Australian Institute of Health and Welfare. (2023). Elective surgery. https://www.aihw.gov.au/reports-data/myhospitals/sectors/elective-surgery
6. Northern Adelaide Local Health Network. (2023). 48 Bed Expansion at Lyell McEwin Hospital. https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/about+us/our+local+health+networks/northern+adelaide+local+health+network/about+us/latest+news+from+nalhn/48+bed+expansion+at+lyell+mcewin+hospital
7. Australian Government Productivity Commission. (2024). Leveraging digital technology in healthcare. https://www.pc.gov.au/research/completed/digital-healthcare/digital-healthcare.pdf
8. Calvary Amplar Health Joint Venture. (2024). My Home Hospital. https://calvaryamplarhealth.com.au/my-home-hospital/
9. Montalto, M., McElduff, P., & Hardy, K. (2020). Home ward bound: features of hospital in the home use by major Australian hospitals, 2011–2017. Medical Journal of Australia, 213(1), 22-27.
10. ICT&health. (2023). Saudi arabia brings world's first virtual hospital to life. https://ictandhealth.com/news/saudi-arabia-brings-worlds-first-virtual-hospital-to-life/
11. NHS England. (n.d.). Preoperative virtual ward reducing bed occupancy through monitoring of hot gallbladder. https://transform.england.nhs.uk/key-tools-and-info/digital-playbooks/perioperative-digital-playbook/preoperative-virtual-ward-reducing-bed-occupancy-through-monitoring-of-hot-gallbladder/
12. Paulson, M. R., Shulman, E. P., Dunn, A. N., Fazio, J. R., Habermann, E. B., Matcha, G. V., ... & Maniaci, M. J. (2023). Implementation of a virtual and in-person hybrid hospital-at-home model in two geographically separate regions utilizing a single command center: a descriptive cohort study. BMC health services research, 23(1), 139.
13. Australian Institute of Health and Welfare. (2023). Emergency department care activity. AIHW. https://www.aihw.gov.au/reports-data/myhospitals/intersection/activity/ed
14. Australian Institute for Health and Welfare. (2023). Older Australians. AIHW. https://www.aihw.gov.au/reports/older-people/older-australians/contents/demographic-profile
15. Swift, J., Harris, Z., Woodward, A., O'Kelly, N., Barker, C., & Ghosh, S. (2021). An evaluation of a virtual COVID-19 ward to accelerate the supported discharge of patients from an acute hospital setting. British Journal of Healthcare Management. https://doi.org/10.12968/bjhc.2021.0073.
16. NHS. (2023). Delivery plan for recovering urgent and emergency care services – January 2023. https://www.england.nhs.uk/long-read/delivery-plan-for-recovering-urgent-and-emergency-care-services-january-2023/
17. Australian Institute of Health and Welfare. (2023). Health expenditure. AIHW. https://www.aihw.gov.au/reports/health-welfare-expenditure/health-expenditure#Health_spending

A: Reference list (cont.)

18. Australian Institute of Health and Welfare. (2023). Australia's hospitals at a glance. AIHW. https://www.aihw.gov.au/reports/hospitals/australias-hospitals-at-a-glance/contents/spending-on-hospitals
19. Wilson, A., & Shaw, M. (2022). RPA Virtual Hospital Year 2 Evaluation Report February 2021 to January 2022. Available from https://ses.library.usyd.edu.au/bitstream/handle/2123/31423/RPA%20Virtual%20Hospital%20Year%202%20Evaluation%20Report%20FINAL.pdf?sequence=1&isAllowed=y
20. National Institute for Health and Care Excellence. (2023). Virtual Wards as Alternatives to Hospital Care Economic Evidence Review HTA Innovation Laboratory Report.
21. Levine, D. M., Ouchi, K., Blanchfield, B., Saenz, A., Burke, K., Paz, M., ... & Schnipper, J. L. (2020). Hospital-level care at home for acutely ill adults: a randomized controlled trial. Annals of internal medicine, 172(2), 77-85.
22. World Health Organisation. (n.d.). Health workforce. WHO. https://www.who.int/health-topics/health-workforce#tab=tab_1
23. Beamtree and Health Roundtable. (2021). Addressing Burnout: Bringing data-driven solutions, care and hope to the health workforce. https://www.rah.sa.gov.au/assets/general-images/Inaugural-White-Paper-Addressing-Burnout_-Bringing-data-driven-solutions-care-and-hope-to-the-health-workforce_1.pdf
24. Bidoli, C., Pegoraro, V., Dal Mas, F., Bagnoli, C., Bert, F., Bonin, M., ... & Campostrini, S. (2023). Virtual hospitals: The future of the healthcare system? An expert consensus. Journal of Telemedicine and Telecare, 1357633X231173006.
25. Fera, B., Korba, C., & Shukla, M. (2020). The future of virtual health: Executives see industrywide investments on the horizon. Deloitte Center for Health Solutions. https://www2.deloitte.com/content/dam/Deloitte/pl/Documents/Reports/pl_the_future-of-virtual-health.pdf
26. World Economic Forum. (2024). Transforming Healthcare: Navigating Digital Health with a Value-Driven Approach. WEF. https://www3.weforum.org/docs/WEF_Transforming_Healthcare_2024.pdf
27. Australian Institute of Health and Welfare. (2023). AIHW. Rural and remote health. https://www.aihw.gov.au/reports/rural-remote-australians/rural-and-remote-health
28. American Medical Association. (n.d.). Future of Health Case Study: Atrium Health. https://www.ama-assn.org/system/files/future-health-case-study-atrium-health.pdf
29. Nicholson, B., Sloss, E. A., Fausett, A., Davis, C., Dumas, K., Littledike, M., & Mooney, K. (2024). Rural Access to the Cancer Hospital at Home Care Model. NEJM Catalyst Innovations in Care Delivery, 5(3), CAT-23.
30. Leviner, S. (2020). Patient flow within hospitals: A conceptual model. Nursing science quarterly, 33(1), 29-34.
31. Manning, L., & Islam, M. S. (2023). A systematic review to identify the challenges to achieving effective patient flow in public hospitals. The International Journal of Health Planning and Management, 38(3), 805-828.
32. Wallis, J. A., Shepperd, S., Makela, P., Han, J. X., Tripp, E. M., Gearon, E., ... & O'Connor, D. (2024). Factors influencing the implementation of early discharge hospital at home and admission avoidance hospital at home: a qualitative evidence synthesis. Cochrane Database of Systematic Reviews, (3).
33. Tlapa, D., Zepeda-Lugo, C., Tortorella, G., Baez-Lopez, Y., Limon-Romero, J., Alvarado-Iniesta, A., & Rodriguez-Borbon, M. (2020). Effects of lean healthcare on patient flow: A Systematic Review. Value in Health, 23(2), 260-273.

A: Reference list (cont.)

34. Australian Medical Association. (2023). Ambulance Ramping Report Card. AMA. https://www.ama.com.au/articles/2023-ambulance-ramping-report-card
35. Australian Government Productivity Commission. (2024). Report on Government Services 2024, Ambulance services. https://www.pc.gov.au/ongoing/report-on-government-services/2024/health/ambulance-services
36. Barratt, A. L., Bell, K. J., Charlesworth, K., & McGain, F. (2022). High value health care is low carbon health care. The Medical Journal of Australia, 216(2), 67.
37. Thiel, C. L., Mehta, N., Sejo, C. S., Qureshi, L., Moyer, M., Valentino, V., & Saleh, J. (2023). Telemedicine and the environment: life cycle environmental emissions from in-person and virtual clinic visits. NPJ Digital Medicine, 6(1), 87.
38. Nundy, S., Cooper, L. A., & Mate, K. S. (2022). The quintuple aim for health care improvement: a new imperative to advance health equity. Jama, 327(6), 521-522.
39. Edgar, K., Iliffe, S., Doll, H. A., Clarke, M. J., Gonçalves-Bradley, D. C., Wong, E., & Shepperd, S. (2024). Admission avoidance hospital at home. Cochrane Database of Systematic Reviews, (3).
40. Hakim, R. (2023). Realising the potential of virtual wards. NHS Confederation. https://www.nhsconfed.org/system/files/2023-05/Realising-the-potential-of-virtual-wards.pdf
41. Moore, G., Du Toit, A., Jameson, B., Liu, A., & Harris, M. (2020). The effectiveness of 'virtual hospital' models of care: a rapid evidence scan brokered by the Sax Institute for Sydney Local Health District, 2020. Sax Institute, Sydney Local Health District: Sydney, NSW, Australia) Available at https://www.saxinstitute.org.au/news/virtual-hospitals-a-new-way-to-ease-healthcare-burdens/
42. NHS England. (2023). Guidance note: virtual ward care for people with heart failure. https://www.england.nhs.uk/wp-content/uploads/2023/10/PRN00299_Guidance-note-Virtual-ward-care-for-people-with-heart-failure_October-2023.pdf
43. Australian Commission on Safety and Quality in Health Care. (2023). Delirium Clinical Care Standard. https://www.safetyandquality.gov.au/our-work/clinical-care-standards/delirium-clinical-care-standard#:~:text=The%20standard%20builds%20on%20other,was%2035.7%20per%2010%2C000%20admissions.
44. Morano, B., Jimenez-Mejia, J., Sanon, M., Morano, C., & DeCherrie, L. V. (2020). Acute care in the home setting: Hospital at home. Geriatric practice: a competency based approach to caring for older adults, 393-401.
45. Shepperd, S., Butler, C., Cradduck-Bamford, A., Ellis, G., Gray, A., Hemsley, A., ... & Young, J. (2021). Is comprehensive geriatric assessment admission avoidance hospital at home an alternative to hospital admission for older persons? A randomized trial. Annals of internal medicine, 174(7), 889-898
46. Health Innovation Network. (2021). Rapid Evaluation of Croydon Virtual Ward. https://healthinnovationnetwork.com/wp-content/uploads/2022/01/Croydon-VW-Evaluation-Report-to-NHSX-v10.pdf
47. Rifino, N., Bersano, A., Padovani, A., Conti, G. M., Cavallini, A., Colombo, L., ... & Scelzo, E. (2023). Virtual hospital and artificial intelligence: a first step towards the application of an innovative health system for the care of rare cerebrovascular diseases. Neurological Sciences, 1-9.
48. New South Wales Agency for Clinical Innovation. (n.d.). Benefits of virtual care. https://aci.health.nsw.gov.au/virtual-care-in-practice/about/benefits
49. Raths, D. (2024). How Atrium Health Scaled Up Hospital at Home. Healthcare Innovation. https://www.hcinnovationgroup.com/population-health-management/home-based-care/article/53096226/how-atrium-health-scaled-up-hospital-at-home

A: Reference list (cont.)

50. Babaei, N., Zamanzadeh, V., Valizadeh, L., Lotfi, M., Samad-Soltani, T., Kousha, A., & Avazeh, M. (2023). A scoping review of virtual care in the health system: infrastructures, barriers, and facilitators. Home Health Care Services Quarterly, 42(2), 69-97.

51. Healthcare and Care At Distance. (n.d.). The virtual Home Hospital in Borgholm. https://www.healthcareatdistance.com/distance-spanning-solutions/distance-treatment/the-virtual-home-hospital-in-borgholm/

52. New South Wales Agency for Clinical Innovation. (n.d.). About virtual care. https://aci.health.nsw.gov.au/statewide-programs/virtual-care/about

53. Maniaci, M. J., Torres-Guzman, R. A., Garcia, J. P., Avila, F. R., Maita, K. C., Forte, A. J., & Paulson, M. R. (2022). Overall patient experience with a virtual hybrid hospital at home program. SAGE open medicine, 10, 20503121221092589.

54. Vaartio-Rajalin, H., Fagerström, L., & Santamäki-Fischer, R. (2021). They Know Me and My Situation—Patients' and Spouses' Perceptions of Person-Centered Care in Hospital-at-Home Care. Holistic Nursing Practice, 35(6), 332-343.

55. Maniaci, M. J., Maita, K., Torres-Guzman, R. A., Avila, F. R., Garcia, J. P., Eldaly, A., ... & Paulson, M. R. (2022). Provider evaluation of a novel virtual hybrid hospital at home model. International Journal of General Medicine, 1909-1918.

56. Gorbenko, K., Baim-Lance, A., Franzosa, E., Wurtz, H., Schiller, G., Masse, S., ... & Siu, A. (2023). A national qualitative study of Hospital-at-Home implementation under the CMS Acute Hospital Care at Home waiver. Journal of the American Geriatrics Society, 71(1), 245-258.

57. MacFarlane, Anne, A. Teixeira, K. Taylor, C. Martins, and B. Guimar. (2020). General practice and the community: research on health service, quality improvements and training. Selected abstracts from the EGPRN Meeting in Vigo, Spain, 17-20 October 2019 Abstracts. European Journal of General Practice 26(1): 42-50

58. Boldt-Christmas, O., Kannourakis, R., Maud, M., & Ungerman, D. (2023). Virtual hospitals could offer respite to overwhelmed health systems. Accessed from https://www.mckinsey.com/industries/healthcare/our-insights/virtual-hospitals-could-offer-respite-to-overwhelmed-health-systems

59. Deloitte Public Health Transformation Offering and United States of Care. (2023). Leveraging Virtual Health within a Value-Based Care Framework: Advancing Health Equity in the Medicaid Population. https://www2.deloitte.com/content/dam/Deloitte/us/Documents/life-sciences-health-care/us-lshc-leveraging-virtual-health-within-a-value-based-care-framework.pdf

60. Health Equity Research and Development Unit. (2023). Equity-focused health impact assessment of the COVID-19 pandemic in Sydney Local Health District Technical report. Available at https://www.unsw.edu.au/content/dam/images/medicine-health/cphce/websites/2323-02-cphce-website/10_2023%20HERDU_EFHIA_COVID_Technical_Final%202023.pdf

61. Queensland Health. (2023). Hospital in the Home. https://www.health.qld.gov.au/system-governance/policies-standards/guidelines/hospital-in-the-home

62. Jalilian, A., Sedda, L., Unsworth, A., & Farrier, M. (2024). Length of stay and economic sustainability of virtual ward care in a medium-sized hospital of the UK: a retrospective longitudinal study. BMJ open, 14(1), e081378.

63. World Economic Forum. (2022). Here's how healthcare can reduce its carbon footprint. https://www.weforum.org/agenda/2022/10/cop27-how-healthcare-can-reduce-carbon-footprint/

64. Robeznieks, A. (2024). Telehealth virtual visits can be a tool to fight climate change. https://www.ama-assn.org/delivering-care/public-health/telehealth-virtual-visits-can-be-tool-fight-climate-change

A: Reference list (cont.)

65. Welk, B., McArthur, E., & Zorzi, A. P. (2022). Association of virtual care expansion with environmental sustainability and reduced patient costs during the COVID-19 pandemic in Ontario, Canada. JAMA Network Open, 5(10), e2237545-e2237545.
66. Purohit, A., Smith, J., & Hibble, A. (2021). Does telemedicine reduce the carbon footprint of healthcare? A systematic review. Future Healthcare Journal, 8(1), e85.
67. Haleem, A., Javaid, M., Singh, R. P., & Suman, R. (2021). Telemedicine for healthcare: Capabilities, features, barriers, and applications. Sensors international, 2, 100117.
68. Gajarawala, S. N., & Pelkowski, J. N. (2021). Telehealth benefits and barriers. The Journal for Nurse Practitioners, 17(2), 218-221.
69. Huxtable, R. (2023). Mid-Term Review of the National Health Reform Agreement Addendum 2020-2025 Final Report. Available from https://www.health.gov.au/sites/default/files/2023-12/nhra-mid-term-review-final-report-october-2023.pdf
70. Department of Health and Aged Care. (2023). Budget 2023-24 Budget Overview. https://www.health.gov.au/sites/default/files/2023-05/stakeholder-pack-budget-2023-24.pdf
71. Famakinwa, J. (2023). Mayo Clinic's At-Home Care Optimism Goes Far Beyond Hospital at Home. Home Health Care News. https://homehealthcarenews.com/2023/08/mayo-clinics-at-home-care-optimism-goes-far-beyond-just-hospital-at-home
72. Mayo Clinic. (2023). Advanced Care at Home. https://www.mayoclinic.org/departments-centers/hospital-at-home/sections/overview/ovc-20551797
73. NHS South West London. (2022). Croydon's virtual ward: Healthcare in the comfort of your home. https://www.southwestlondonics.org.uk/local-stories/croydons-virtual-ward-healthcare-in-the-comfort-of-your-home/
74. Sitammagari, K., Murphy, S., Kowalkowski, M., Chou, S. H., Sullivan, M., Taylor, S., ... & McWilliams, A. (2021). Insights from rapid deployment of a "virtual hospital" as standard care during the COVID-19 pandemic. Annals of internal medicine, 174(2), 192-199.
75. Atrium Health. (2024). Atrium Health Leading Way in Virtual Care. https://atriumhealth.org/about-us/newsroom/news/atrium-health-leading-way-in-virtual-care
76. Sydney Local Health District. (n.d.). About. https://slhd.health.nsw.gov.au/rpa virtual/about
77. SA Health. (2023). About My Home Hospital. https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/services/hospitals/my+home+hospital/about+us/about+my+home+hospital
78. Medibank. (2024). Half year results 2024 Investor presentation. Available from https://www.medibank.com.au/livebetter/newsroom/post/2024-half-year-results#:~:text=Group%20operating%20profit%20increased%204.2,increased%2016.3%25%20to%20%24262.5%20million.&text=For%20a%20complete%20list%20of,please%20visit%20our%20Investor%20Centre.
79. Calvary Amplar Health Joint Venture. (2023). My Home Hospital. https://calvaryamplarhealth.com.au/my-home-hospital/
80. SA Health. (2024). My Home Hospital for health professionals. https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/services/hospitals/my+home+hospital/health+professionals/my+home+hospital+for+health+professionals
81. Montalto, M., McElduff, P., & Hardy, K. (2020). Home ward bound: features of hospital in the home use by major Australian hospitals, 2011–2017. Medical Journal of Australia, 213(1), 22-27.
82. MyHH data supplied by Medibank.
83. Independent Health and Aged Care Pricing Authority. (2023). Hospital Acquired Complications. https://benchmarking.ihacpa.gov.au/extensions/ihpanbp/index.html?_gl=1*sy90bc*_ga*MTEzNDk5MzM2OS4xNzEzMTM4NTU0*_ga_RT9SCTSN40*MTcxMzEzODU1My4xLjAuMTcxMzEzODU1My4wLjAuMA..#/periodic-insights/hac-trends

A: Reference list (cont.)

84. IHACPA. (2023). *NHCDC Financial Year 2020-21*. https://www.ihacpa.gov.au/sites/default/files/2023-06/nhcdc_infographic_2020-21.pdf

85. Independent Health and Aged Care Pricing Authority. (2023). National Benchmarking Portal User Guide. IHACPA. https://www.ihacpa.gov.au/sites/default/files/2023-05/National%20Benchmarking%20Portal%20-%20User%20Guide_2.PDF

86. Australian Bureau of Statistics. (March Quarter 2024). Consumer Price Index, Australia. ABS. https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/consumer-price-index-australia/latest-release.

87. Independent Health and Aged Care Pricing Authority. (2023). Cost per NWAU. https://benchmarking.ihacpa.gov.au/extensions/ihpanbp/index.html?_gl=1*sy90bc*_ga*MTEzNDk5MzM2OS4xNzEzMTM4NTU0*_ga_RT9SCTSN40*MTcxMzEzODU1My4xLjAuMTcxMzEzODU1My4wLjAuMA..#/periodic-insights/overview

88. Leong, M. Q., Lim, C. W., & Lai, Y. F. (2021). Comparison of Hospital-at-Home models: a systematic review of reviews. BMJ open, 11(1), e043285.

89. Australian Bureau of Statistics. (2023). Patient Experience: Tables 16-18 Experience of Hospital Services. https://www.abs.gov.au/statistics/health/health-services/patient-experiences/latest-release

90. Australian Institute of Health and Welfare. (2023). Hospital resources 2021-22 data tables. https://www.aihw.gov.au/reports-data/myhospitals/themes/hospital-workforce#:~:text=In%202021%E2%80%9322%3A,staff%20employed%20in%20public%20hospitals

91. Peters, G. M., Doggen, C. J., & Van Harten, W. H. (2022). Budget impact analysis of providing hospital inpatient care at home virtually, starting with two specific surgical patient groups. BMJ open, 12(8), e051833.

92. Australian Institute of Health and Welfare. (2023). Health expenditure Australia 2021-22. https://www.aihw.gov.au/reports/health-welfare-expenditure/health-expenditure-australia-2021-22/contents/spending-trends-by-area-of-spending/capital-spending

93. Queensland Government. (2024). Princess Alexandra Hospital expansion takes shape. https://statements.qld.gov.au/statements/99760

94. Northern Adelaide Local Health Network. (2023). 48 Bed Expansion at Lyell McEwin Hospital. https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/about+us/our+local+health+networks/northern+adelaide+local+health+network/about+us/latest+news+from+nalhn/48+bed+expansion+at+lyell+mcewin+hospital

95. Government of South Australia. (2024). New 48 beds at Lyell McEwin to meet growing northern demand. https://www.premier.sa.gov.au/media-releases/news-items/new-48-beds-at-lyell-mcewin-to-meet-growing-northern-demand

96. ACT Government. (n.d.). Canberra Hospital Expansion. https://www.builtforcbr.act.gov.au/projects/health/canberra-hospital-expansion

97. Jobs and Skills Australia. (n.d.). Skills Priority List. Australian Government. https://www.jobsandskills.gov.au/data/skills-shortages-analysis/skills-priority-list

98. Chandrasiri, S. (2023). How to solve Australia's health workforce shortage. InSight+. https://insightplus.mja.com.au/2023/18/how-to-solve-australias-health-workforce-shortage/

99. Department of Health and Aged Care. (2024). Unleashing the Potential of our Health Workforce – Scope of Practice Review. https://www.health.gov.au/our-work/scope-of-practice-review

100. Partington, A. Schultz, T. Gray, J. Snoswell, C. Karnon, J. (2022). Identifying Potential Populations for Home Hospitalisation: A scoping review of the literature to support the review of the South Australian My Home Hospital service. Flinders Health and Medical Research Institute, Adelaide, Australia.

A: Reference list (cont.)

101. IHACPA. (2023). NHCDC Public Sector Report 2020-21: Appendix Table 4. https://www.ihacpa.gov.au/resources/national-hospital-cost-data-collection-nhcdc-public-sector-report-2020-21

102. van Goor, H. M., de Hond, T. A., van Loon, K., Breteler, M. J., Kalkman, C. J., & Kaasjager, K. A. (2024). Designing a Virtual Hospital-at-Home Intervention for Patients with Infectious Diseases: A Data-Driven Approach. Journal of Clinical Medicine, 13(4), 977.

103. SA Health. (2023). My Home Hospital for patients. https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/services/hospitals/my+home+hospital/patients/my+home+hospital+for+patients

104. Independent Health and Aged Care Pricing Authority. (2023). National Hospital Cost Data Collection. IHACPA. https://www.ihacpa.gov.au/sites/default/files/2023-06/national_hospital_cost_data_collection_report_public_sector_2020-21_0.pdf

105. NHCDC Public Sector Report 2020-21 Appendix Table 3. Available from https://www.ihacpa.gov.au/resources/national-hospital-cost-data-collection-nhcdc-public-sector-report-2020-21

106. Rider Levett Bucknall. (2024). Construction Cost Calculator. RLB. https://www.rlb.com/ccc/#construction-cost-indicator

107. Spence, A. (2017). *'Most advanced hospital in modern world' opens*. The Lead. https://theleadsouthaustralia.com.au/industries/health-and-medical/advanced-hospital-modern-world-opens/

108. IHACPA. (2023). NHCDC Public Sector Report 2020-21: Appendix Table 3. https://www.ihacpa.gov.au/resources/national-hospital-cost-data-collection-nhcdc-public-sector-report-2020-21

109. Australian Patients Association and Healthengine. (2022). *Australian Healthcare Index*. https://australianhealthcareindex.com.au/wp-content/uploads/2022/11/Australian-Healthcare-Index-Report-Nov-22.pdf

110. Australian Commission on Safety and Quality in Health Care. (n.d.). *Australian Hospital Patient Experience Question Set*. https://www.safetyandquality.gov.au/our-work/indicators-measurement-and-reporting/australian-hospital-patient-experience-question-set

111. Harrison, R., Clay-Williams, R., & Cardenas, A. (2022). Integrating virtual models of care through infrastructure innovation in healthcare facility design. *Australian Health Review*, *46*(2), 185-187.

112. Parliament of NSW. (2022). *Impact of ambulance ramping and access block on the operation of hospital emergency departments in New South Wales*. https://www.parliament.nsw.gov.au/lcdocs/inquiries/2892/Report%20No.60%20-%20Portfolio%20Committee%20No.%202%20-%20Health%20-%20Ambulance.pdf

113. SA Health. (2024). *Ambulance waiting times*. Government of South Australia. https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/about+us/our+performance/ambulance+waiting+times

114. South Australian Employment Tribunal. (2018). *SA Ambulance Service Award*. https://www.aeasa.com.au/wp-content/uploads/2019/04/SAAS-AWARD-2018.pdf

115. Jones, P. G & van der Werf, B. (2020). Emergency department crowding and mortality for patients presenting to emergency departments in New Zealand. Emergency Medicine Australasia. 10. doi: 10.1111/1742-6723.13699

116. Australiasian College for Emergency Medicine. (n.d.). *NSW Inquiry into the Impact of Ambulance Ramping and Access Block*.

A: Reference list (cont.)

117. Kingswell, C., Shaban, R. Z., & Crilly, J. (2017). Concepts, antecedents and consequences of ambulance ramping in the emergency department: a scoping review. *Australasian Emergency Nursing Journal, 20*(4), 153-160.

118. Australian Digital Health Agency. (2023). *National Digital Health Strategy 2023-2028 Delivery Roadmap*. https://www.digitalhealth.gov.au/national-digital-health-strategy/strategy-delivery-roadmap

119. NSW Government. (n.d.). *NSW Government Response. Inquiry into the impact of ambulance ramping and access block on the operation of hospital emergency departments in New South Wales*. https://www.parliament.nsw.gov.au/lcdocs/inquiries/2892/Government%20response%20-%20PC%202%20-%20Ambulance%20ramping.pdf

120. Woodward, T., Hocking, J., James, L., & Johnson, D. (2019). Impact of an emergency department-run clinical decision unit on access block, ambulance ramping and National Emergency Access Target. *Emergency Medicine Australasia, 31*(2), 200-204.

121. Royal Commission into Aged Care Quality and Safety. (2021). *Hospitalisations in Australian Aged Care: 2014/15-2018/19 Research Paper 18.* https://agedcare.royalcommission.gov.au/publications/research-paper-18-hospitalisations-australian-aged-care-201415-201819

122. AMA. (2022). *Putting health care back into aged care*. https://www.ama.com.au/articles/report-putting-health-care-back-aged-care-0

123. Aged Care Research & Industry Innovation Australia. (2023). *Virtual service reduces hospital transfers for older Australians*. https://www.ariia.org.au/node/1520

124. Giese, A., Khanam, R., Nghiem, S., Rosemann, T., & Havranek, M. M. (2023). Patient-reported experience is associated with higher future revenue and lower costs of hospitals. *The European Journal of Health Economics*, 1-9.

125. Richter, J. P., & Muhlestein, D. B. (2017). Patient experience and hospital profitability: is there a link?. *Health care management review, 42*(3), 247-257.

126. Birkhäuer, J., Gaab, J., Kossowsky, J., Hasler, S., Krummenacher, P., Werner, C., & Gerger, H. (2017). Trust in the health care professional and health outcome: A meta-analysis. *PloS one, 12*(2), e0170988.

127. Ward, P. (2018). Trust and communication in a doctor-patient relationship: a literature review. *Arch Med, 3*(3), 36.

128. NSW Government. (2024). *Virtual care relieving pressure on emergency departments.* *https://www.nsw.gov.au/media-releases/virtual-care-relieving-pressure-on-emergency-departments*

B: Method for estimating the economic contribution of virtual hospitals in 2030

0. Developing three DRG scenarios for analysis

The analysis in Chapter 3 considers the expansion of virtual hospital care for specific DRGs that have been selected based on the current scope of service and anticipated future growth of the model.

Three scenarios, each with a defined set of DRGs, are included in the analysis:

1. *DRGs currently treated by virtual hospitals:* as a base case, the top 20 DRGs treated by MyHH have been selected. These DRGs represent 87% of admissions to MyHH.
2. *Reduced number of DRGs:* as a more conservative estimate, the top 10 DRGs treated by MyHH which represent 80% of admissions.
3. *Expanded scope of care:* in addition to the top 20 DRGs currently serviced by MyHH, this scenario will consider additional DRGs suitable for treatment by virtual hospitals based on home hospital activity observed within Australia, as well as DRGs with potential for treatment by virtual hospitals in the future based on trialled models and population-specific studies. Additional DRGs for inclusion are sourced from a literature review by Parlington et al. (2022) which identifies potential additional target populations for MyHH-type services.[100]

DRGs included in each scenario are outlined in the Table below.

Scenario	Included AR-DRGs	Description of included AR-DRGs
1	J64B, T63B, E62B, L63B, J64A, E62A, F62B, L63A, E65B, Q62B, I73B, T63A, Z63B, T60C, E65A, T64C, L67B, F62A, G70B, E75B	DRGs include cellulitis, viral illnesses, respiratory infections, kidney and urinary tract infections, heart failure and shock, chronic obstructive airways disease, coagulation disorders, aftercare of musculoskeletal implants or prostheses, other follow up after surgery, septicimea, other infectious and parasitic diseases, and other digestive system disorders
2	J64B, T63B, E62B, L63B, J64A, E62A, F62B, L63A, E65B, Q62B	DRGs include cellulitis, viral illnesses, respiratory infections, kidney and urinary tract infections, heart failure and shock, chronic obstructive airways disease, and coagulation disorders
3	J64B, T63B, E62B, L63B, J64A, E62A, F62B, L63A, E65B, Q62B, I73B, T63A, Z63B, T60C, E65A, T64C, L67B, F62A, G70B, E75B, I67A, I67B, G60A, G60B, F61A, F61B, I12A, I12B, I12C, E63A, E63B, T60A, T60B, G70A, G70C, K62A, K62B, K62C, K40A, K40B, F73A, F73B, X64A, X64B, X64C, X60A, X60B, J65A, J65B, D61A, D61B, B80A, B80B, B64A, B64B, B63A, B63B, E69A, E69B, I04A, I04B, F06A, F06B, F06C, Z63A, I03A, I03B, I33A, I33B, vascular surgery*	As scenario one, with the addition of septic arthritis, digestive malignancy, infective endocarditis, musculoskeletal interventions for infection/inflammation of bone/joint, sleep apnoea, metabolic disorders, endoscopic and investigative interventions for metabolic disorders, syncope and collapse, injuries, poisonings and toxic effects, trauma to skin, subcutaneous tissue and breast, disequilibrium, other head injuries, delirium, dementia and other chronic disturbances of cerebral function, bronchitis and asthma, knee replacement, coronary bypass without invasive cardiac investigation, hip replacement for trauma, hip replacement for non-trauma, and vascular surgery

*postoperative care for vascular surgery was identified as an area of virtual hospital activity by Peters et al. (2022).[91] Specific DRGs relating to vascular surgery have not been identified, and the number of national separations is based on AIHW data on admissions from waiting lists for elective surgery.[5]

B: Method for estimating the economic contribution of virtual hospitals

1. Estimating bed days substituted for virtual hospital care in 2030

By redirecting patients through virtual hospitals, the bed days that patients would have occupied for the duration of their stay in a physical hospital are freed.

Bed days substituted by virtual hospitals in 2030 under the three scenarios is estimated as the number of separations treated by virtual hospitals in 2030 (step 1.1) multiplied by the ALOS in physical hospitals (step 1.2).

1.1. Estimating the number of separations treated by virtual hospitals in 2030

For each scenario identified in step 0, the number of national public hospital separations for included DRGs was sourced from the National Hospital Cost Data Collection (NHCDC) 2020-21.*, [87] The number of separations was projected to 2030 by applying the average annual growth rate of national separations prior to the COVID-19 pandemic in 2016-2019.[87, 101]

The number of separations treated by virtual hospitals in 2030 for each DRG scenario is calculated as the projected number of admissions in 2030 for select DRGs, multiplied by an eligibility rate (see 1.1.1) and a substitution rate (see 1.1.2).

1.1.1. Eligibility rate

As not all of these separations will be eligible for treatment by virtual hospitals, an eligibility rate was applied to the number of separations in 2030.

Eligibility criteria differs between specific virtual hospital services, however some common factors include:[28, 15, 103]

Assessment of clinical appropriateness by a clinician, which may include clinical factors such as respiration, systolic blood pressure, oxygen saturation, oxygen requirements, vital signs requirements, and anticipated need for advanced diagnostics or procedure;

- Patient condition stable enough for virtual hospital treatment;
- Patient has a safe/stable living environment;
- Patient is within a specified age range;
- Patient has the ability to comply with monitoring devices and care team interactions, or has support in home to do so;
- Patient understands the plan of care and consents to receive care at home; and
- Patient has access to certain technology, such as a working telephone, tablet or laptop.

An eligibility rate of 48% has been used in this analysis. This estimate is sourced from a recent study of a virtual hospital in the Netherlands which closely aligned with the service offerings and patient diagnoses of MyHH.[102]

1.1.2. Substitution rate

The application of a substitution rate recognises that only a proportion of eligible separations will be redirected through virtual hospitals. This is due to capacity restraints as the model continues to grow in Australia.

As the substitution rate in 2030 is uncertain and depends upon factors such as investment and traction among patients, healthcare workers and policymakers, the analysis applies both a conservative estimate of 40% and a higher estimate of 60%. These estimates were validated with experts and referenced against estimates of populations serviced by existing virtual hospitals.[100]

1.2. Estimating ALOS

The ALOS in physical hospitals is taken as the weighted national ALOS in public hospitals across DRGs included within each scenario in 2020-21.[105] It is assumed that virtual hospitals are an admission avoidance model, and the full ALOS is used in calculations (see Assumption 1 in Appendix C).

B: Method for estimating the economic contribution of virtual hospitals

2. Estimating cost savings

2.1 Estimating average cost savings per episode of care in 2030

The cost saving per episode of care (in FY24 prices) is the difference between the average cost of an episode of care in a physical hospital in 2030 (see 2.1.1) and the average cost of a virtual hospital episode of care in 2030 (see 2.1.2).

2.1.1. Cost per physical hospital episode of care in 2030

The average cost per episode of care in a physical hospital is taken as the national average admitted acute cost per episode of care across the top 10 MyHH DRGs in 2020-21, sourced from IHACPA.[87] The cost was adjusted to 2024 dollars according to Australian Bureau of Statistics (ABS) Consumer Price Index (CPI) data prices.[86]

After adjusting for inflation, public hospital costs grew at a CAGR of 1.1% between FY19 and FY21.[86, 104] This CAGR was applied to physical hospital costs through to 2030.

2.1.2. Cost per virtual hospital episode of care in 2030

The average cost per virtual hospital episode of care is taken as the average cost per MyHH episode of care across the program's three-year history (indexed to FY24 prices) (see Assumption 3 in Appendix C).

As the cost of virtual hospital separations is declining over time,[104, 82] a CAGR of -3.5% was applied to virtual hospital costs through to 2030. This CAGR is based on the CAGR of HITH episodes from FY19 – FY21, [104] with the effect of inflation accounted for by adjusting costs to FY21 dollars according to ABS CPI data prices (Assumption 4 in Appendix C).[86]

2.2. Estimating total cost savings

Total cost savings in 2030 (in FY24 prices) is estimated as the number of separations treated by virtual hospitals in 2030 (estimated in step 1.1) multiplied by the average cost saving per episode of care (estimated in step 2.1).

With sensitivity analysis, a range of cost savings is generated. The minimum cost saving is obtained by applying the conservative substitution estimate (40%), and the maximum cost saving by applying the higher substitution rate (60%).

3. Estimating substituted capital expenditure on new hospital infrastructure

3.1. Estimate the physical beds saved by virtual hospitals in 2030

For each scenario, the number of physical beds saved by virtual hospitals in 2030 is calculated as the number of bed days substituted (estimated in step 1) divided by 365.

3.2. Estimate capital cost per physical bed

The model uses a low and high estimate of capital expenditure per bed.

The low estimate is sourced from the Rider Levett Bucknall (RLB) construction cost calculator.[106] The estimate is based on the national average construction cost of a low-rise private hospital with a 45-60m^2 floor area per bed (see Assumption 8 in Appendix C).

The construction cost calculator provides a range of estimated capital expenditure costs in FY24 prices specific to Adelaide, Canberra, Gold Coast, Perth, Townsville, Brisbane, Darwin, Melbourne and Sydney. Averaging the upper estimate across all cities gives a capital cost estimate per bed of $397,897. The RLB estimate does not include information and communication technology (ICT) costs.

A high-cost estimate of $3.6 million per bed (in FY24 prices) is based on the Royal Adelaide Hospital in SA which has capacity for 800 beds at a cost of $2.9 billion (indexed to FY24 prices).[86, 107]

3.3. Estimate the substituted capital costs based on physical beds saved in 2030

The conservative and higher estimates of bed days substituted in each scenario are multiplied by the high and low construction cost per bed respectively, resulting in a range of estimated substituted capital expenditure (in FY24 prices). Presenting a range of possible substituted costs accounts for variability due to factors such as geography and construction features.

C: Assumptions

Assumptions and limitations of the model for future benefits

1. Modelled future benefits are for admission avoidance virtual hospital models. It is therefore assumed that patients are not admitted to a physical hospital at all and instead spends the full duration of their hospital episode of care at home.
2. The realisation of cost savings assumes that virtual hospital beds will replace physical beds, which would require either the closure of physical beds or avoided builds of physical beds.
3. The cost per episode of care in a virtual hospital is informed by MyHH costing data, however virtual hospital costs vary across different services, locations, and scale. Additionally, new virtual hospitals are anticipated to incur higher costs early on due to upfront capital costs, and the cost per episode of care in MyHH may not translate to broader adoption across the system. These factors may impact the generalisability of results.
4. In the absence of national data on changes to virtual hospital costs at scale over time, it is assumed that the cost per episode of care in a virtual hospital will decline at the same CAGR as HITH episodes from FY19 – FY21.
5. The national average public hospital costs per episode of care used in this model includes hospitals of varying size and service offerings, which may impact the accuracy of comparison with MyHH.
6. Total hospital system costs are incorporated into national average public hospital costs per episode of care, which may impact comparisons between virtual hospital and national public hospital data.
7. The extent to which estimated future benefits can be realised depend on a number of market and political factors in Australia's hospital system, including funding and tax mechanisms, buy-in from clinicians and the public, connected and interoperable digital infrastructure, and investment in the model
8. The cost of new hospital construction varies according to geography and construction features. It is assumed that costs of hospital construction that are substituted due to the delivery of care through virtual hospitals are equivalent to national average construction costs of a low-rise private hospital with a 45-60m^2 floor area per bed.

KPMG

KPMG.com.au