NSW GOVERNMENT

Sydney
Local Health District

RPA Virtual Hospital Economic Evaluation Report

August 2024

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Acknowledgements

- Dr Teresa Anderson AM, (former) Chief Executive, Sydney Local Health District
- Dr Owen Hutchings, Clinical Director, RPA Virtual Hospital
- Danielle Levis, Director of Nursing, RPA Virtual Hospital
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- Professor Warwick Britton (Chair) and members of the RPA Virtual Hospital Research Steering Committee
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Contents

Acknowledgement of Country

Sydney Local Health District acknowledges that we are living and working on Aboriginal land. We recognise the strength, resilience and capacity of Aboriginal people on this land. We would like to acknowledge all of the traditional owners of the land and pay respect to Aboriginal Elders past and present.

Our District acknowledges ***Gadigal***, ***Wangal*** and ***Bediagal*** as the three clans within the boundaries of the Sydney Local Health District. There are about 29 clan groups within the Sydney metropolitan area, referred to collectively as the great ***Eora Nation***. *Always was and always will be Aboriginal Land*.

We want to build strong systems to have the healthiest Aboriginal community in Australia.

Together under the Sydney Metropolitan Partnership Agreement, including the Aboriginal Medical Service Redfern and in collaboration with the Metropolitan Local Aboriginal Land Council, Sydney Local Health District is committed to achieving equality to improve self-determination and lifestyle choices for our Aboriginal community.

Ngurang Dali Mana Burudi – A Place to Get Better

Ngurang Dali Mana Burudi — a place to get better, is a view of our whole community including health services, Aboriginal communities, families, individuals and organisations working in partnership.

Our story

Sydney Local Health District's Aboriginal Health story was created by the District's Aboriginal Health staff.

The map in the centre represents the boundaries of Sydney Local Health District. The blue lines on the map are the Parramatta River to the north and the Cooks River to the south which are two of the traditional boundaries.

The ***Gadigal***, ***Wangal*** and ***Bediagal*** are the three clans within the boundaries of Sydney Local Health District. They are three of the twenty-nine clans of the great ***Eora Nation***. The centre circle represents a pathway from the meeting place for Aboriginal people to gain better access to healthcare.

The Goanna or *Wirriga*
One of Australia's largest lizards, the goanna is found in the bush surrounding Sydney.

The Whale or *Gawura*
From June to October pods of humpback whales migrate along the eastern coastline of Australia to warmer northern waters, stopping off at Watsons Bay the traditional home of the Gadigal people.

The Eel or *Burra*
Short-finned freshwater eels and grey Moray eels were once plentiful in the Parramatta River inland fresh water lagoons.

Source: Sydney Language Dictionary

Artwork

***Ngurang Dali Mana Burudi* — a place to get better**
The map was created by our Aboriginal Health staff telling the story of a cultural pathway for our community to gain better access to healthcare.

Artwork by Aboriginal artist Lee Hampton utilising our story.

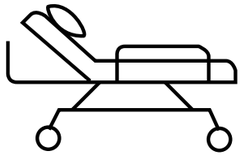
RPA Virtual Hospital Economic Evaluation: Highlights

Care from **rpa**virtual is highly valued by those who receive it

The vast majority (84%) of patients reported excellent care from rpavirtual. If given the choice, 97% of patients would definitely, probably or possibly use virtual care again.

Over nine in ten patients (95%) reported that they benefited from the care delivered by rpavirtual. Reduced travel time is the most frequently reported benefit – on average, patients saved two hours of time per attendance, valued at $69 per attendance.

Sustainability and resilience are improved as **rpa**virtual frees up resources



rpavirtual frees up resources in the health system-occupied bed days, emergency department occupancy and outpatient clinic occupancy. This benefit helps relieve pressure, contributing to systemic sustainability and resilience.

Virtual Trauma, Emergency Department to Community and Virtual Rehabilitation were estimated to free up 1,094 occupied bed days (acute and subacute) in 2023.

These estimates are uncertain. Improved data and further monitoring and evaluation would generate precise estimates and additional insights.

Following the pandemic volume, growth needs to occur to deliver efficiency

Most rpavirtual services delivered in 2023 were cost-saving. The volume of care for some services, however, was such that the cost per activity was potentially higher than alternative methods of delivering care.

The COVID-19 pandemic resulted in a massive use of **rpa**virtual services, but the volume of activity has since fallen. Economies of scale associated with **rpa**virtual were exploited during 2020-2021-during this time **the return on investment was more than two to one**. In 2023, these economies of scale at **rpa**virtual have not been seen to the same extent.

An expanded role in virtual urgent care in NSW will generate increased activity. Continued championing of virtual care by senior leadership, evidence development, service delivery beyond Royal Prince Alfred and incentivisation are required to deliver greater efficiency.

Executive Summary

Virtual care is the use of any interaction between consumers and clinicians (or between clinicians) that occurs remotely using technology (NSW Agency for Clinical Innovation).

It is part of an ongoing transformation in the health system involving the increasing use of digital technologies. These technologies have the potential to benefit consumers, the health system and wider society (Productivity Commission, 2024).

At the same time, health systems are under stress. In recent years, the pandemic placed great demands on health systems. Additional systemic strains are evident due to demographic and other trends: older populations, more people with chronic diseases, and more people with multiple chronic diseases. Virtual care has great potential to provide beneficial patient-centred health services, with improved access and at lower cost.

The RPA Virtual Hospital – **rpa**virtual - is a purpose designed service embedded within the Sydney Local Health District in New South Wales (NSW), Australia. The vision of **rpa**virtual is to be a world leader in virtual care. Since it began in 2020, it has evolved into a complex virtual healthcare service and played a pivotal role in the NSW Health response to the COVID-19 pandemic.

This report evaluates the value of **rpa**virtual from an economic perspective. Five non-pandemic related virtual care services provided by **rpa**virtual were assessed:

- acute hospital care substitution (Virtual Trauma);
- subacute care substitution (Virtual Rehabilitation);
- improving integration (Emergency Department to Community).
- emergency department substitution (Virtual Urgent Care and Emergency Department); and
- outpatient specialist care substitution (Virtual Fracture).

These services were selected in particular as they correspond to five types of services typically provided by "bricks and mortar" hospitals (acute care, subacute care, emergency care, non-admitted care and other services).

What has this evaluation found?

The seven findings of this report are as follows:

1. The care that **rpa**virtual delivers is safe and valued by users.
2. Virtual hospitals, like **rpa**virtual, solve difficult problems.
3. The relative value of **rpa**virtual for the health system depends on its volume of activity and its contribution to reducing health system pressures.
4. **rpa**virtual may not save expenditure in the shorter term.
5. **rpa**virtual increases the sustainability and resilience of the health system in the longer term.
6. Current funding structures are unlikely to support public virtual hospitals financially.
7. Confidence in **rpa**virtual would be increased by further research and continuous evaluation.

These findings are further detailed below.

Finding 1: The care that **rpa**virtual delivers is safe and valued by users

rpavirtual delivers healthcare that is safe and valued by its patients. In 2023, 84% of patients reported excellent care from **rpa**virtual. If given the choice, 97% of patients would definitely (78%), probably (13%) or possibly (6%) use virtual care again. Only 3% reported that they would definitely / probably not use virtual care again, if given the choice.

rpavirtual also produces benefits beyond healthcare for patients. Over 90% of patients reported that they benefitted from using **rpa**virtual services in other ways, with a reduction in travel the most frequently cited benefit. A conservative estimate was that patients saved two hours of time per attendance, valued (with travel costs) at $69 per attendance. For those residing in the Sydney Local Health District, there was a one-hour reduction in time spent accessing care.

Finding 2: Virtual hospitals, like **rpa**virtual, solve difficult problems

The diverse set of services delivered by **rpa**virtual has strong potential to solve many different challenges experienced by patients and the NSW health system. Some models, such as Virtual Rehabilitation and Virtual Trauma, have reduced or avoided hospital stays for people. Others have provided care that would traditionally be given in an outpatient clinic or face to face for example, Virtual Fracture and Virtual Tuberculosis medication management. The Urgent Care and Emergency Department has delivered care that would usually have been delivered in an emergency department setting. Furthermore, multi-disciplinary care has been shown to be easier to organise and implement in a virtual hospital setting.

The provision of virtual care can improve equity, especially in rural and remote areas. As at September 2024, 38 patients received care through **rpa**virtual's Virtual Rehabilitation service upon returning to their residence (not in the Sydney Local Health District) after cardiac or neurological surgery. Improved and more equitable health outcomes are likely to be associated with the support of staff at Broken Hill Base Hospital. This service provides virtual Emergency Medicine consultant access and advice for a group of patients who would not have otherwise received it.

Finding 3: The relative value of **rpa**virtual depends on its volume of activity and its contribution to reducing health system pressures

The value of **rpa**virtual depends on its volume of activity and its contribution to reducing health system pressures. Most, but not all, models of care evaluated were delivered at a lesser cost virtually than in-person.

The pandemic resulted in a massive use of **rpa**virtual's services, but the volume of activity has since fallen. Economies of scale have not thereafter been seen to the same extent. As a result, the average cost of providing services has increased.

During 2020-2022, the services that substituted for inpatient COVID-19 treatment were evaluated as having high value. Other models evaluated as having high value are those which deliver services that would otherwise be provided in regional areas at higher cost.

For **rpa**virtual to provide a cost-effective service in the future, there will need to be an increased number of patients treated and activity undertaken.

There is increasing healthcare activity in emergency departments and for ambulance use. If this trend continues, then the value of **rpa**virtual activity increases.

Findings 4 & 5: **rpa**virtual may not save expenditure in the shorter term, but it increases systemic resilience and sustainability in the longer term

This report finds that **rpa**virtual is unlikely to reduce expenditure in the shorter term because potential savings will be difficult to extract from hospitals. However, it increases capacity within the health system. Several models of care delivered by **rpa**virtual free up resources that can be used for other treatment purposes. Hospital beds are available to other patients, ambulances are free to care and transport other patients, and clinic spaces are available for other patients.

A total of 1,094 occupied bed days were estimated to be freed up in SLHD hospitals during 2023 because of the Virtual Trauma, Emergency Department to Community and Virtual Rehabilitation models of care delivered by **rpa**virtual. The benefits of this increased capacity can be considered in three ways: it reduces overcrowding; it reduces the need for additional physical capacity in the future; and it facilitates increased treatment, improving equity of service provision.

Over the longer term, these freed up resources and **rpa**virtual's capacity to pivot to address urgent or evolving challenges demonstrates its contribution to systemic sustainability and resilience.

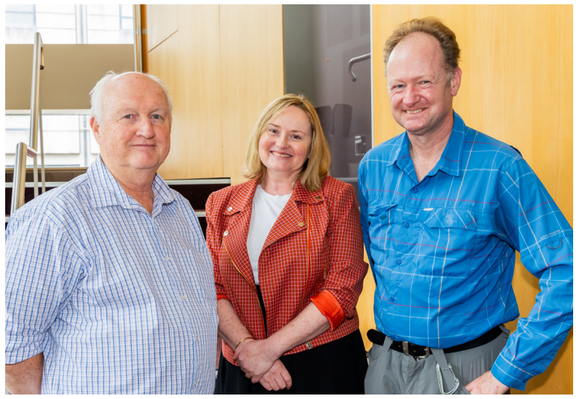
Finding 6: Current funding structures are unlikely to support public virtual hospitals financially

Currently, **rpa**virtual is funded via a block grant and records its activity using the outpatient classification scheme. The funding for this classification scheme does not readily facilitate the development of an effective virtual hospital. The experiences of **rpa**virtual will help inform exploration of appropriate funding mechanisms for virtual hospital care.

Finding 7: Confidence in **rpa**virtual would be increased by further research and continuous evaluation

There is uncertainty around the value of the benefits associated with the introduction of virtual care. Uncertainties include a lack of information about the health benefits for individuals who receive virtual care compared to traditional in-person care; the incremental costs associated with virtual care compared to traditional in-person care; and the benefits to the health system of reducing overcrowding in physical spaces.

The evolving context, continued implementation of new models of care, and uncertainties in the evidence require continuous evaluation and implementation of appropriate research programs.



Conclusions

Virtual care has enormous potential to deliver positive benefits for patients and care givers, health workers and institutions, and the wider health system. The services delivered by **rpa**virtual and evaluated in this report demonstrate these benefits. Most, but not all, of the five models evaluated have a lower average cost from being delivered virtually than in-person. Increasing activity over the near future will help assure the cost-effectiveness of **rpa**virtual.

Virtual care has enormous potential to deliver positive benefits for patients and care givers, health workers and institutions, and the wider health system

1. Overview

What is virtual care?

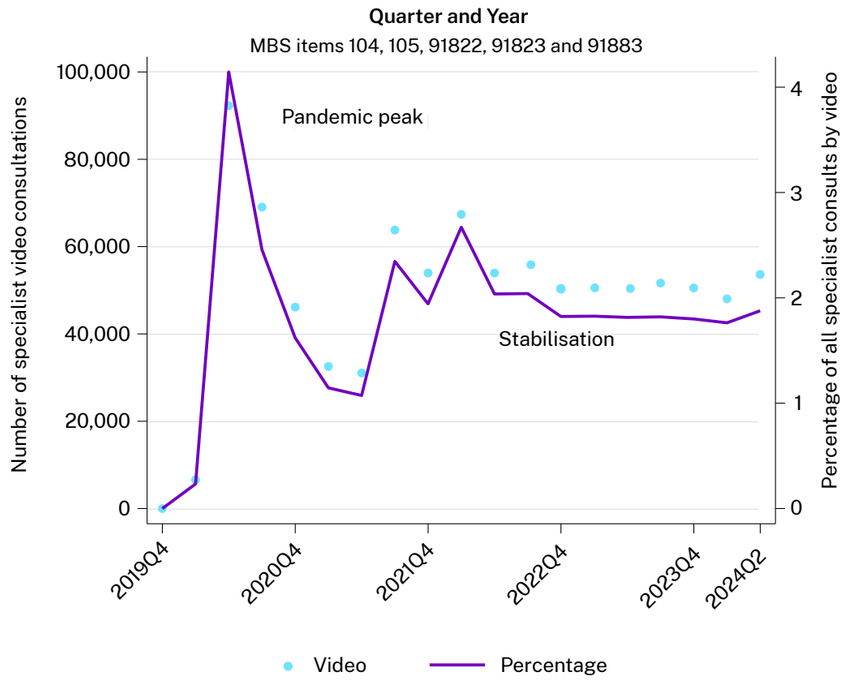
Virtual care is the use of any interaction between consumers and clinicians (or between clinicians) that occurs remotely using technology (NSW Agency for Clinical Innovation). The use of video conferencing is a common example.

Virtual care is part of a wider transformation in the health system involving the increasing use of digital technologies. This transformation has the potential to benefit consumers, the health system and wider society (Productivity Commission, 2024).

This transformation was accelerated by the COVID-19 pandemic, during which physical distancing to reduce the transmission of an infectious, deadly disease saw an expansion in the delivery of virtual services globally (OECD, 2023).

In the Australian context, Figure 1 shows the rapid acceleration in specialist consultations undertaken by video and funded through the Medicare Benefits Schedule (MBS) at the beginning of 2020, from a very low base in 2019. This stabilised in 2023-2024 at a volume approximately half that of the peak, although it remains much higher than before the pandemic.

Figure 1: Specialist video attendances funded through the Medicare Benefit Schedule



2. What is the RPA Virtual Hospital?

Since its inception in February 2020, **rpa**virtual continues to evolve into one of Australia's largest, most advanced, and complex virtual healthcare services (Wilson & Shaw, 2022).

It was conceived and developed as a purpose designed service embedded within the Sydney Local Health District (Shaw & Wilson, 2021).

The vision of **rpa**virtual is to be a world leader in virtual care. Its core strategic objectives were developed in 2020, expanded in January 2022, and refined in 2024. These nine objectives are outlined below.

1. Support patient flow in the acute hospitals of Sydney Local Health District (LHD) by delivering hospital care in the community.
2. Deliver safe, high quality and efficient services.
3. Enhance the patient experience of healthcare.
4. Inform the role of virtual care by articulating the model and its capabilities and demonstrating its viability and financial sustainability.
5. Continue to leverage Sydney LHD specialist services to identify opportunities for collaborative case management.
6. Strengthen integration with primary care on identified patient cohorts, communication and referral pathways and delivery of shared care with general practice.
7. Continue to investigate opportunities to support Sydney LHD services to enhance existing models of care through the introduction of virtual care.
8. Inform the broader adoption of virtual health across Sydney LHD and NSW by conducting original research and piloting new technological capability.
9. Support the Far West LHD by extending virtual care programs and services to the residents of the Far West region.

As a hospital, **rpa**virtual provides many models of virtual care, with different types of activity to deliver health services for different groups of patients. It cares for people with injuries, emergencies, rehabilitation needs, respiratory disease, acute infectious diseases, chronic infectious diseases, and other conditions.

The findings and conclusions in this report are not globally applicable to all virtual care or virtual hospitals. **rpa**virtual is funded through the public system in Australia. Private virtual hospitals or virtual hospitals in other jurisdictions would face different costs and benefits.

Since its inception in February 2020, **rpa**virtual continues to evolve into one of Australia's largest, most advanced, and complex virtual healthcare services

3. How is **rpa**virtual evaluated in this report?

This is the third evaluation of **rpa**virtual, commissioned and conducted by the Menzies Centre for Health Policy and Economics at the University of Sydney (now known as the Leeder Centre for Health Policy, Economics and Data).

The first evaluation was undertaken as proof of concept in 2020-21 (Shaw & Wilson, 2021). It contains details of **rpa**virtual's conception, design and governance arrangements, which remain extant. The second evaluation was conducted using available data from February 2021 to January 2022. It found **rpa**virtual offers safe and acceptable care that meets needs beyond the existing services it complements (Wilson & Shaw, 2022). This second evaluation also found there was more to be learnt and shared as **rpa**virtual evolves.

This third evaluation is focused on an economic perspective, assessing the value associated with **rpa**virtual. The evaluation seeks to assess **rpa**virtual with maturing data and over a longer period, as it transitions to deliver healthcare beyond the context of the COVID-19 pandemic. This evaluation focuses on a selection of five non-pandemic related virtual care services provided by **rpa**virtual :

- acute hospital care substitution (Virtual Trauma);
- subacute hospital care substitution (Virtual Rehabilitation);
- improving integration (Emergency Department to Community);
- emergency department substitution (Virtual Urgent Care and Emergency Department); and
- outpatient specialist care substitution (Virtual Fracture).

These virtual services were selected because they are the best exemplars of each of the different classifications of care offered by a hospital (acute care, subacute care, emergency care, non-admitted care and other services). In general, these models of care delivered by **rpa**virtual were chosen because they had the most numerous service occasions in 2023 in each care classification. The exception is Virtual Fracture - the Virtual Tuberculosis model of direct observed therapy had more occasions of service in 2023, but Virtual Fracture was chosen because it is a more generic example of a non-admitted service.

The outcomes of interest in this evaluation are based upon the alignment between the NSW Health System Performance Framework (NSW Health, 2022) and a synthesis of **rpa**virtual's objectives, as follows:

- improved patient, family and care giver experiences;
- delivery of safe care and improved health outcomes;
- equitable health outcomes;
- engaged and well supported staff;
- a sustainably managed health system (including financial and environmental sustainability in response to disruptions, mindful of the needs of patients, their families and carers); and
- research and innovation inform service delivery.

Improved patient, family and care giver experiences

Virtual care can benefit patients, families and care givers. Moving care to where consumers live may increase access by reducing the impact of distance. It may benefit patients in other ways, saving time and money on travel and waiting at hospitals and clinics (Productivity Commission, 2024).

This report evaluates the experience of virtual care using the proportion of patients consenting to virtual treatment and patient reported experience surveys. It compares the time and financial costs associated with seeking treatment. These results are discussed in Chapter 1.

Safe and improved health outcomes

Virtual care may improve health outcomes and some aspects of safety. Less crowded emergency departments may improve the quality of patient care, both for those receiving virtual care and those in the physical emergency department (Sartini et al., 2022).

This report evaluates the achievement of these objectives by the number of adverse events, clinical outcomes and use of unanticipated or urgent health services.

Equitable health outcomes

Virtual care may improve access to care, especially for geographically isolated populations. There are both facilitators and barriers to equitable access to virtual care.

This report evaluates the achievement of this objective by counting the use of specialised services in rural and remote communities, as well as the numbers of patients and attendances that would have had to travel over fifty kilometres to access care.

Staff are engaged and well supported

Virtual care may support the health workforce in multiple different ways. It may facilitate the use of teams of providers and telementoring (Snoswell et al., 2020). Additionally, virtual care may add expertise or add resources to staff who are working in very busy conditions.

This report evaluates the achievement of this objective using surveys of staff reported experiences, as well as the number of incidences where **rpa**virtual supported staff remotely.

The health system is managed sustainably

Virtual care may reduce costs for the health system, by reducing demand for the physical resources of hospitals, emergency departments and clinics. In effect, virtual care may increase the capacity of the health system, with a greater number of patients able to be cared for with a given level of resourcing (Snoswell et al., 2020). Virtual care is particularly suited to reduced costs associated with transportation, both monetary and via reduced carbon emissions. For some consultations, virtual visits may be more efficient for providers (Guetterman et al., 2023).

This report evaluates the achievement of this objective by estimating the resources that could be used for other purposes because of the use of virtual care, the cost of the resources that have been made available for other purposes, and the reduced requirement for future capital investment. This has been discussed further in "The economics of virtual care appear simple - deceptively so" on page 17.

Research and innovation

Research and innovation contribute to the public good, improving care for all. The achievement of this objective is demonstrated by the contribution of **rpa**virtual to the virtual care research agenda through clinical trials, publications, presentations and grant submissions. It is also demonstrated through the innovative project funding grant from the Department of Health and Aged Care, leading a virtual care costing study, the number of virtual care consultations to external agencies, and the sharing of innovative models of virtual care across NSW Health.

There have been over 70 academic outputs from **rpa**virtual: 29 publications in peer reviewed journals; 40 oral and 6 poster presentations at conferences. Twenty-five research and evaluation projects have been completed. Currently, there are 14 research projects that include 2 clinical trials.

Grant submissions have resulted in success, including:

- $670,00 Medical Research Future Fund - 'Integrating remote monitoring technology into digital health infrastructure';
- $315,763 HCF Health Services Grant - 'Optimising outcomes for patients with back pain by preventing hospital admission'; and
- $499,878 NSW Health Translational Research Grant Scheme (TRGS) - 'Enhancing healthcare for rural Aboriginal communities through a co-designed and virtual model of care: a mixed methods experiential analysis'.

There have been over 70 academic outputs from **rpa**virtual

4. Structure of this report

This overview is supported by seven chapters. These chapters detail the data, assumptions, modelling and literature supporting the findings of this evaluation of five models or programs of care delivered by **rpa**virtual. These chapters are:

- Patient and staff reported benefits and experiences with **rpa**virtual
- Acute hospital substitution programs (Virtual Trauma)
- Subacute hospital substitution programs (Virtual Rehabilitation)
- Programs that improve integration (Emergency Department to Community)
- Emergency department substitution programs (Virtual Urgent Care and Emergency Department)
- Outpatient substitution programs (Virtual Fracture)
- Financing **rpa**virtual

5. Context

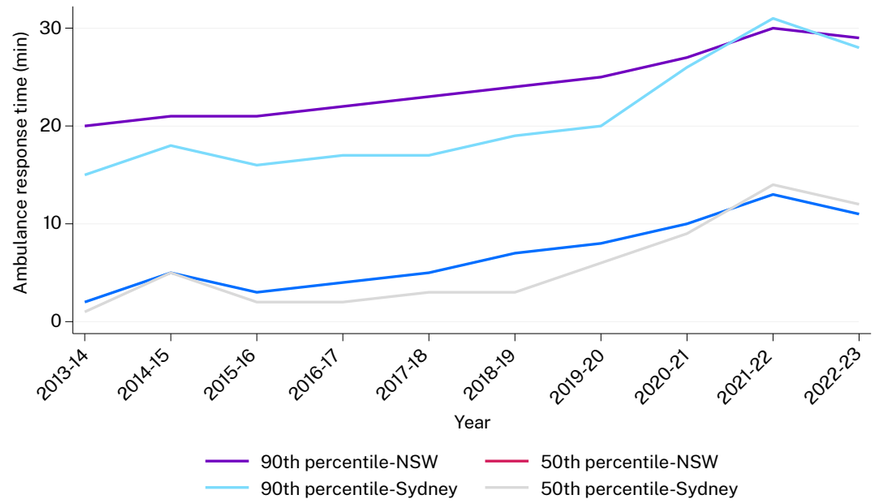
Health systems are complex and under stress

There are interactions and dependencies between different functions, institutions and sectors comprising the NSW health system. For this reason, it is important that evaluations, such as this report, not consider **rpa**virtual in isolation.

This report evaluates the available evidence on the impact of **rpa**virtual on patients, their carers, other health professionals and organisations, as well as wider society. The conclusions are dependent on the availability of high-quality linked data.

This report also recognises the challenging environment in which **rpa**virtual has been operating. In recent years, the pandemic has placed extreme demands on the health system. Additional systemic strains are evident due to demographic and other trends: older populations, more people with chronic diseases, and more people with multiple chronic diseases. These strains continue to place increasing demands on healthcare services. Figure 2 demonstrates this by detailing Ambulance response times across NSW over a decade.

Figure 2: Ambulance response times across NSW from 2013 - 2023

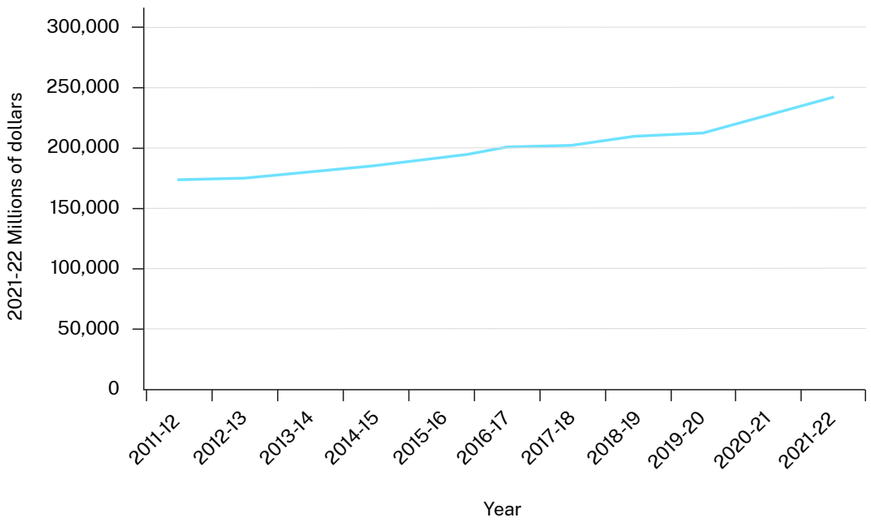


Source: Productivity Commission -Report on Government Services 2024 (Table 11A.5 – Ambulance Response Time).

Note: Caution should be used when comparing 2021-22, 2020-21 and 2019-20 data across jurisdictions and over time as response times were affected by an increase in triple zero calls during the COVID-19 pandemic.

The impact of health systems under stress is reflected in the increasing health expenditure in Australia (Australian Government, 2023). Health expenditure across Australia has increased by 40% (in constant 2021-22 dollars) between 2011-12 and 2021-22 (Figure 3) (Australian Institute of Health and Welfare, 2023).

Figure 3: Increasing health expenditure in Australia (2011-12 to 2021-22)

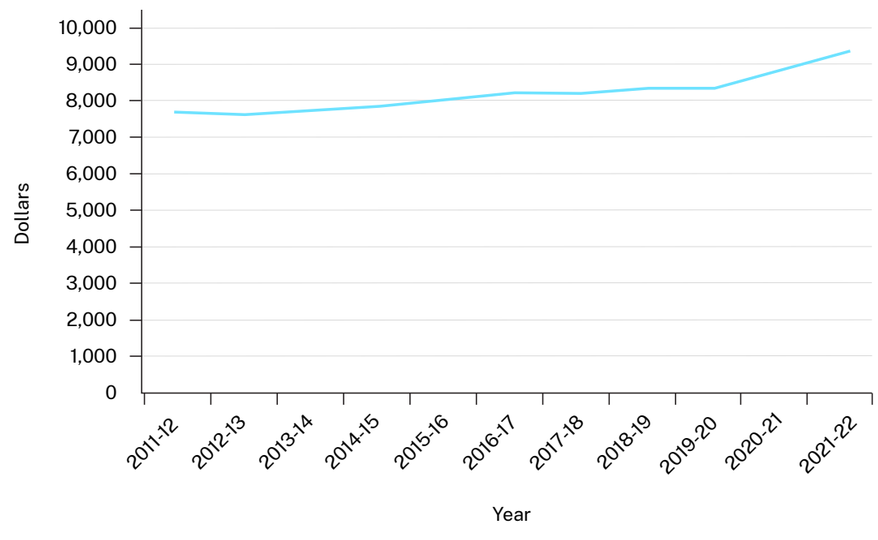


Source: Health Expenditure Australia 2021-22 (Australian Institute of Health and Welfare, 2023).

Note: Constant prices which is in 2021-2022 prices.

Health expenditure per person has increased by almost 21% over the same time period (Figure 2) (Australian Institute of Health and Welfare, 2023).

Figure 4: Increasing expenditure per person in Australia (2011-12 to 2021-22)



Source: Health Expenditure Australia 2021-22 (Australian Institute of Health and Welfare, 2023).

Note: Constant prices which is in 2021-2022 prices.

Projections into the future expect these trends to continue, namely that the pressures from ageing and technological changes will drive health costs higher into the future (Productivity Commission, 2024).

Virtual care will increasingly become an important component of healthcare delivery, within this environment of increased pressure on the health workforce and physical infrastructure, its demonstrated benefit during the pandemic, and its potential to deliver improved access to lower cost quality healthcare.

6. The economics of virtual care appear simple - deceptively so

The promise offered by virtual care is greater access, improved equity and benefits that patients value at a lower cost for the health system and society. This might suggest that the choice of virtual care would – or should – come to dominate over traditional in-person care when it is clinically appropriate.

Synthesis of studies suggests, however, that this has not been achieved consistently. In their review of 17 cost-minimisation studies, Snoswell and colleagues found 53% of telehealth models to be cost-saving, 35% to be cost-saving only when a sufficient threshold has been reached, and 12% to be more expensive than traditional in-person care (Snoswell et al., 2020).

A similar lack of consistency is evident in studies on the cost-effectiveness and cost-utility of virtual care. Most cost-utility studies (68%) found that there was an increase in quality-adjusted life years with an increase in costs. Approximately one-third of studies found virtual care to be both cost-saving and utility-enhancing (Snoswell et al., 2020).

There are several reasons for this apparent discrepancy between the lower marginal cost associated with virtual care and a lack of consistent evidence of cost-minimisation with the implementation of telehealth. Telehealth is more likely to be cost-minimising if health-system funded travel is avoided or it reduced the requirement for specialist review (Snoswell et al., 2020). A sufficient volume of care should ideally be virtual, to allow the lower costs of delivering virtual care to overcome the setup and fixed costs of providing this new modality.

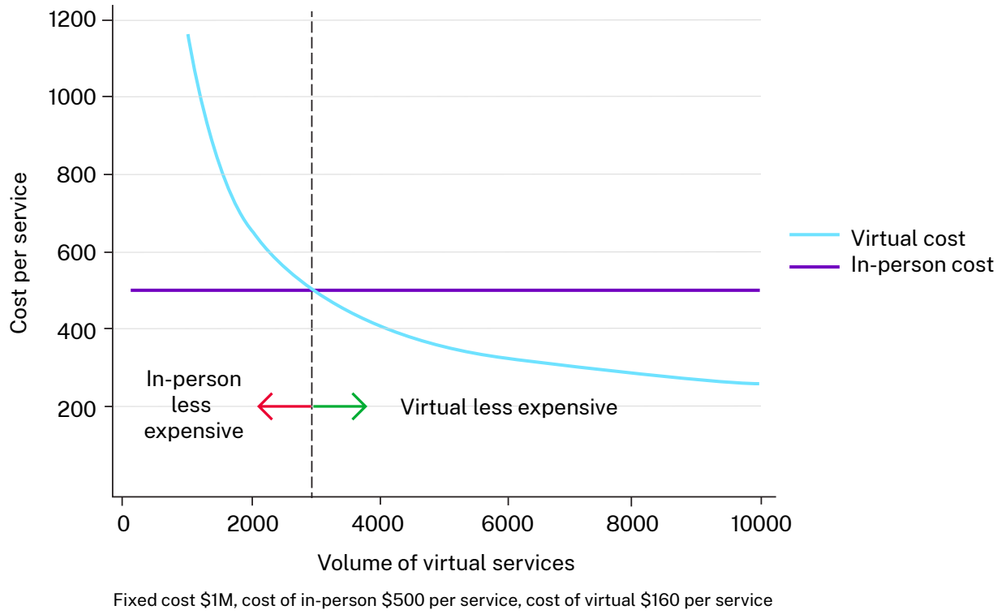
More consistency was found in a narrower review of "virtual wards" by the HTA Innovation Laboratory (2023). These studies were a combination of hospital-in-the-home programs as well as virtual wards. Thirteen of fifteen studies found savings but concerns about the methodological quality and the very short time horizon of the studies may have contributed to an overestimate of savings.

Virtual hospitals have a fixed cost

Virtual hospitals, such as **rpa**virtual, are an investment with a fixed (or at least inflexible) cost component – the provision of the technology, the facilities, the staff and the organisation structure. This cost, when combined with low levels of activity, results in increased average costs that may be higher than traditional alternatives with greater volume.

Figure 5 demonstrates this, using a virtual outpatient clinic as a hypothetical example. Despite this virtual clinic incurring a cost of less than one-third of the in-person cost, it will be more expensive, on average, unless approximately 3,000 services are delivered.

Figure 5: Decreasing average cost with increasing volume



Fixed cost $1M, cost of in-person $500 per service, cost of virtual $160 per service

The impact of the fixed costs issue can be seen in the experience of **rpa**virtual which commenced with a very high volume for a new virtual hospital, which subsequently fell as the requirements for monitoring and isolating patients with, or suspected of having, COVID-19 waned. Table 1 demonstrates this change. While the non-COVID activity has increased by a factor of 10 over four years and doubled over three years, these changes are dwarfed by the much larger swings in the COVID-19 activity for **rpa**virtual.

Table 1: Occasions of service (OOS) associated with rpavirtual

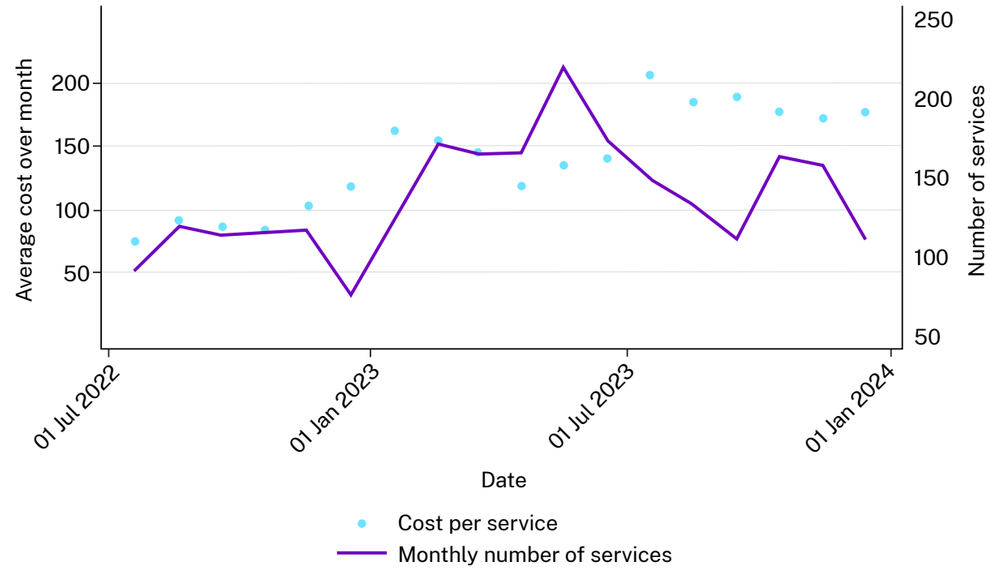
Financial Year	2019-2020	2020-2021	2021-2022	2022-2023
Non-COVID activity (OOS)	2,141	11,583	19,904	21,184
COVID activity (OOS)	14,555	94,461	149,289	20,456
Total	**16,696**	**106,044**	**169,193**	**42,113**

In aggregate the level of activity has fallen since 2022. This is the opposite experience of the discussions in the literature for virtual services, where volume takes time to achieve, and virtual hospitals initially have relatively high average costs before volume increases result in a reduction of average costs.

Distributing the fixed costs over a smaller number of activities increases the costs per activity. Even services that are running at capacity will have their attributed average costs increase because the administrative and fixed costs of a hospital are distributed over its activity.

Figure 6 below demonstrates the average monthly cost for Virtual Fracture services has not decreased with increasing monthly volume but rather has increased. This is because of the reduction in the volume of COVID-19 related services for **rpa**virtual overall. Estimating the relative benefits of virtual care during the 2020-2022 would increase the apparent benefit of virtual care.

Figure 6: Association between activity and estimated cost for virtual fracture clinic



Virtual care improves the efficiency of other health system components

Virtual care has the potential to improve the efficiency of other components of the health system. Two distinct components can be considered. First is the “bricks and mortar” infrastructure of the health system: hospital beds, emergency department space and outpatient cubicles. Second is the human capital of the health system: doctors, nurses, allied health professionals etc.

A future reduction in capital requirements

For the “bricks and mortar” component, the substitution of virtual care for in-person care reduces the quantum of facilities required to service a population. This reduces the number of extra buildings and beds that will be required to be delivered in the future. If 50% of outpatient services can be delivered virtually, then 50% less outpatient cubicles will need to be built in the future.

In this case the benefits of virtual care occur in the future, when the extra building would have occurred. The benefit is a reduction in the spending required in the future, albeit with an increase in virtual care infrastructure.

Efficient use of current capital stock of hospitals

Virtual care can also improve the efficiency of use in the current capital stock of building contemporaneously. For example, programs like Virtual Rehabilitation or Virtual Trauma which allow the earlier release of patients from hospital post-surgery allow the same number of beds to treat a greater number of patients. More surgery (or other care) can be conducted with the current number of hospital beds. The efficiency of the health system in producing operations from hospital beds has increased.

The opportunity cost or the value (to society and the health system) of the freed-up infrastructure is the next best alternative that the infrastructure can be used for (Sandmann et al., 2018). This can depend on whether there is spare capacity or not.

If hospitals are not full and there is no physical capacity restriction, then the freed-up infrastructure is of minimal or no value (Page et al., 2017). If the purpose of reducing hospital activity is to recover financial savings, then these can only be recovered if there is a reduction in activity to the extent that entire wards, or multiples of four or twelve beds, can be closed. Previous estimates have suggested that most hospital costs are fixed in the short term, which reinforces a low valuation on a reduction in bed days as a mechanism for savings (Page et al., 2017).

If, however, hospitals are full and elective surgery is not able to be done, then one assessment of the value of the freed-up infrastructure is the treatment of additional patients. In this case, the benefits occur contemporaneously and may not result in decreased expenditure but rather an increase in expenditure associated with an increase in costs.

In this case, the benefits of virtual care are not just in the differences in cost between providing a service in-person or virtually, but also the additional services that could occur because of the freed-up infrastructure. That is, virtual hospitals have a two-step impact: first they substitute for services provided in-person freeing up space (but not necessarily staff), and secondly that space is used to treat additional patients. Most health benefits may accrue not to those who use virtual services but rather to those who now get treated with in-person hospital services.

The benefits of a reduction in the burden of infrastructure may not simply be additional services but also a reduction in overcrowding and an improvement in patient safety. The health benefits also may accrue to those who are not receiving virtual care. For example, very high inpatient occupancies in hospitals may result in earlier discharges and a greater chance of readmission (Friebel et al., 2019). High inpatient occupancies may also transmit stress through the healthcare system, for example, reducing the ability to transfer admitted patients from the emergency department into the hospital (Friebel & Juarez, 2020).

Efficient use of staff

A similar argument is applied for the health workforce. Virtual care could allow this workforce to be deployed more effectively, reducing the time spent in travel, being able to look after more patients, and able to be deployed where they can be more effective. These are all examples of how virtual care may result in a greater efficiency of staff.

These types of efficiencies are evident and could be fostered further by **rpa**virtual.

- Reduced travel is evident in the delivery of services to Far West LHD, when the alternative would have been to send medical, nursing and allied health staff to Broken Hill. Specialist services, such as wound care, also entail less travel because clinicians do not have to travel between wards or hospitals to deliver their services. Reduced travel time allows more time to deliver services to patients.
- Virtual Urgent Care and Emergency Department services can be deployed where they may have the most impact. The virtual practitioners could relieve pressure at one of several emergency departments across the Sydney LHD, effectively being more agile than if deployed to a specific emergency department.
- Remote monitoring, the ability to quickly assess who requires treatment and reduced physical demands may increase the number of patients staff can manage simultaneously. For example, a ward nurse might be able to manage eight COVID-19 cases virtually, compared to in-person. If evening or overnight services are provided, there does not need to be a minimum number of nurses per ward.

A virtual hospital has societal benefits beyond healthcare

Patient transport and travel is a healthcare cost when it is subsidised; without subsidy is an additional out of pocket cost to the patient and their families and has indirect consequences in the resulting carbon emissions. Where patient transport and travel are subsidised the virtual services will be more likely to demonstrate health system savings.

Indirect impacts, or externalities, in economics, occurs when the there is an impact on a third-party production or consumption (NSW Treasury, 2023). A common example is the impact of pollution. The introduction of virtual hospitals (and virtual care in general) alters these externalities. Carbon emissions, patient time and the costs of transporting patients may be considered as externalities and the use of virtual care reduces their impact. Conversely, some costs may be transferred out of the health system with virtual care and worsen externalities. Carer burden may increase with some virtual models.

Benefits (and costs) of virtual care fall onto those outside the health system. This evaluation is cognisant of these altered externalities and has included them as a supplemental step. The addition of these costs and benefits may result in changing conclusions about value for money.

Altering costs and capacity may impact clinical virtual care

The alternative of virtual care will alter clinical care. There are many reasons that this will occur. The assumption that the outputs of care (appointments, occupied bed days, emergency department visits etc.) will be the same is uncertain.

Two reasons are highlighted. The first reason is that when pressure is released on a health system under stress, the treatments given may alter. For example, reducing a very high occupancy level for hospital inpatients may lengthen the length of stay for remaining inpatients. Previous studies have demonstrated that when hospital occupancy is high the discharge rate for younger and less complex patients increases and is associated with a higher rate of readmission (Friebel et al., 2019). This could be interpreted as using a scarce resource (inpatient beds) most effectively for older and more complex patients, reducing the quality of care for others.

The second reason is that a lower cost for delivering virtual services may increase the number of services delivered, as the relationship between cost and benefit has altered. The benefit maximising number of services occurs when the marginal cost equals the marginal benefit of the service. If the cost is lowered, then the marginal benefit of an additional service may exceed the marginal cost, and it would be benefit-maximising to increase the number of services. This also occurs with the equity enhancing aspects of virtual care – increasing access and providing services where they were not provided previously may increase expenditure, albeit in a cost-effective manner (Uscher-Pines & Mehrotra, 2024).

Cost-effectiveness alone does not guarantee uptake of virtual care

It should also be recognised that cost-effective interventions may not be adopted, or may be insufficient, because of budgetary constraints or inflexible funding models. A requirement for savings to be demonstrated within a budgetary cycle and implementation to demonstrate no net cost may result in the avoidance of otherwise cost-effective virtual care programs.

Likewise, if funding models are not aligned with the model or program of care then cost-effective programs requiring a funding increase for improved outcomes may not see that increase. This is an ongoing challenge in Australia's health system, in which funding is fragmented. When the benefits of virtual care are spread over different funders within the health system (and beyond), but the costs are concentrated in one, it may be difficult to fund virtual care effectively.

How have the costs and opportunity costs been estimated?

This report sequences the reporting of costs and benefits, widening the assessment and the perspective. A substantial limitation in the evaluation has been a lack of comparative data, and therefore, analysis of the health outcomes between virtual and in-person care – for those who receive the intervention and those who benefit from the impacts of additional capacity.

Most comparisons in this report undertook the more limited basecase estimation of costs because of a lack of valid data about the wider impacts of the models of care delivered. Up to four different assessments of the cost and benefit have been made. The costs are reported for 2023, unless otherwise noted.

Basecase- Demonstrated savings using public health system costs: Comparisons of average costs from the perspective of the public health system for the patients receiving virtual care. The assumption is that virtual and in-person care is equivalent for health outcomes and a comparison of costs is undertaken. The estimation of costs is based on average costs (sourced from activity-based funding estimates). These results are reported as the benefits (costs of providing the service in-person) divided by the costs (cost of providing the service virtually). When the Benefit-Cost Ratio (BCR) it is greater than one, the virtual alternative is less expensive. When the BCR is less than one, the in-person alternative is less expensive.

$$BCR\ (Benefit\text{-}Cost\ Ratio) = \frac{(cost\ of\ providing\ the\ service\ in\text{-}person)}{cost\ of\ providing\ service\ virtually}$$

Basecase extension- Inclusion of patient benefits and societal carbon reduction: This extension to the estimation includes the benefits to patients and society. These benefits have only been included for models of care in which travel would be expected, for example, for outpatients and those patients accessing emergency departments. The benefits have been applied as an addition to the cost to the non-virtual alternative altering the BCR ratio.

$$BCR = \frac{cost\ of\ providing\ the\ service\ in\text{-}person + costs\ avoided\ in\ travel}{cost\ of\ providing\ service\ virtually}$$

Cost-consequence analysis: This analysis estimates the resources that become available from a model of care. These are potential inputs to care. For example, unoccupied bed days, emergency department freed spaces, outpatient cubicles etc.

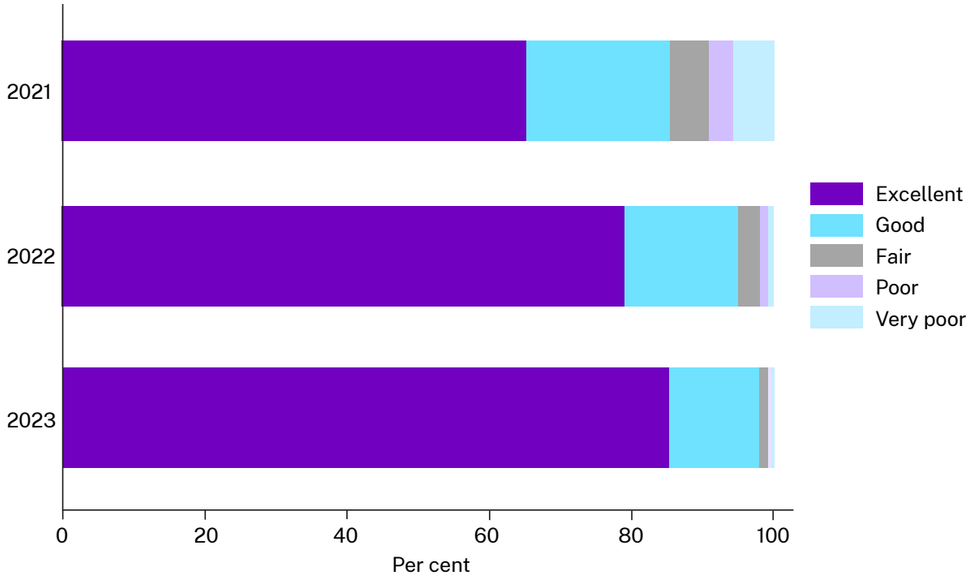
Willingness to pay for resources analysis: This analysis is only applied when the BCR is less than one. It estimates the required willingness to pay of the decision maker for the freed-up resources. This is used as a proxy for the willingness to pay for the health impacts that have been unable to be estimated because of overcrowding in hospital emergency departments etc.

7. Findings

Finding 1: The care that **rpa**virtual delivers is safe and valued by users

Providing hospital level care via virtual technologies is safe and valued by patients who receive it. In 2023, patients reported high levels of satisfaction that the services delivered by **rpa**virtual were safe and effective (see Figure 7).

Figure 7: Patient reported rating of care



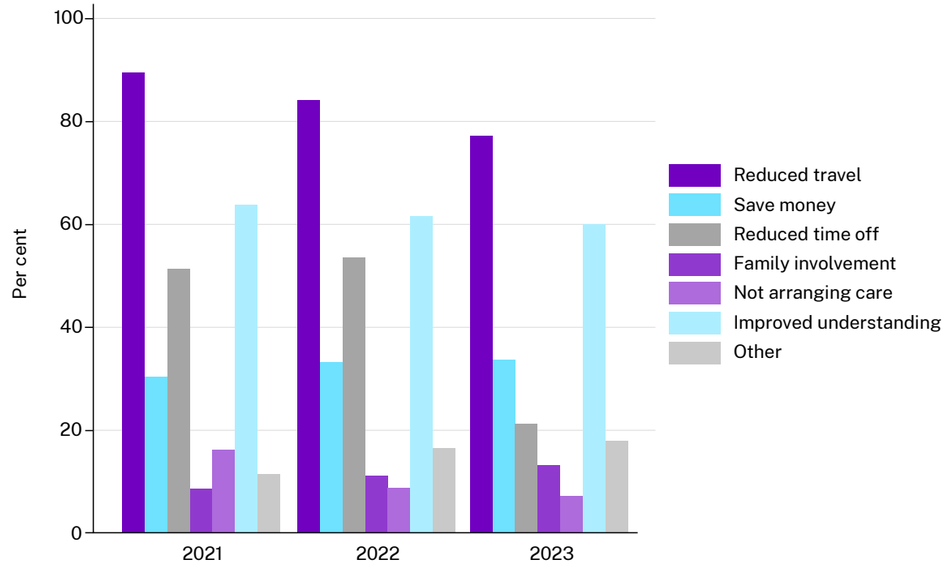
New models of care at **rpa**virtual are developed to be safe and effective for patients. Development of these models involves comprehensive stakeholder engagement and is recognised as a prerequisite for successful implementation. This approach, however, also results in a high cost per activity at low levels of activity, when new models are introduced over the short-term (see Finding 3).

The finding that virtual care is valued by those who use it is reinforced by the findings of the NSW Bureau of Health Information report into virtual care. This report found that 89% of patients receiving hospital outpatient care virtually described it as either very good or good. Further, 61% of patients thought virtual care was as good as in-person, 17% better than in-person and 22% worse (Bureau of Health Information, 2024).

rpavirtual produces benefits for patients beyond healthcare

Over 90% of patients reported that they benefitted from using **rpa**virtual services. A reduction in travel is the most frequently cited benefit of virtual services for patients. This has been consistently ranked as the top benefit delivered by **rpa**virtual across 2021-23.

Figure 8: Benefits reported by patients with rpavirtual **from 2021 to 2023**



For patients residing in the Sydney Local Health District, each virtual attendance saved an hour in time and generated $69 in value, using very conservative assumptions (see Chapter 1). For all patients, on average, there was an estimated saving of two hours of time per attendance. The monetary value of the time and the benefits to patients increase when the length of travel increases, for example patients from out of area benefit from both reduced costs and increased access, improving equity.

Improved understanding by patients of their condition was the next most frequently cited benefit. Again, patients of **rpa**virtual have consistently reported this benefit across 2021-2023.

The reduction in travel was associated with a reduction in carbon emissions of approximately 80 tonnes of carbon dioxide equivalent in 2023.

Finding 2: Virtual hospitals, like **rpa**virtual, solve difficult problems

The services that **rpa**virtual has deployed have had diverse positive impacts on people and on the health system more generally. Some programs have reduced or avoided hospital lengths of stay for people, for example, Virtual Rehabilitation and Virtual Trauma. Some have provided care that would traditionally be given in an outpatient clinic or face to face, for example, Virtual Fracture. Others have provided care that would usually have been given in an emergency department setting, for example, the Virtual Urgent Care and Emergency Department.

The **rpa**virtual has relied on the advantages of virtual technologies for ongoing monitoring of vital signs, and to deliver care and expertise where it has been traditionally difficult and expensive to do so. The provision of emergency and physiotherapy services to the Far West of NSW is a good example.

The information and communication technologies that underpin virtual services can also improve care integration, such as is occurring in the ED to Community program and the Wound Care Command Centre. Multi-disciplinary care is also easier to organise and implement.

The plethora of alternative options available to virtual care require careful management and governance. The benefits of virtual care need to be assessed relative to the constraints that exist. If the availability of virtual care, or the skills to implement virtual care is a constraint, then a choice needs to be made between effective virtual models of care.

Finding 3: The relative value of **rpa**virtual depends on its volume of activity and its contribution to reducing health system pressures

During the peaks of the COVID-19 pandemic, the demand for virtual care was very high. This saw the fast development and roll-out of new models of care for the specific needs of the community. This increased the use of virtual care many times over what might have been otherwise expected for a new initiative.

In particular, the pandemic resulted in a massive use of **rpa**virtual's services, but the volume of activity has since fallen. That is, there are economies of scale associated with **rpa**virtual that were exploited during 2020 and 2021, during the first two years of the COVID-19 pandemic.

Since 2022, these economies of scale have not been seen to the same extent. During 2023, the volume of care for some virtual services was such that the cost per activity was potentially higher than alternative methods of providing care.

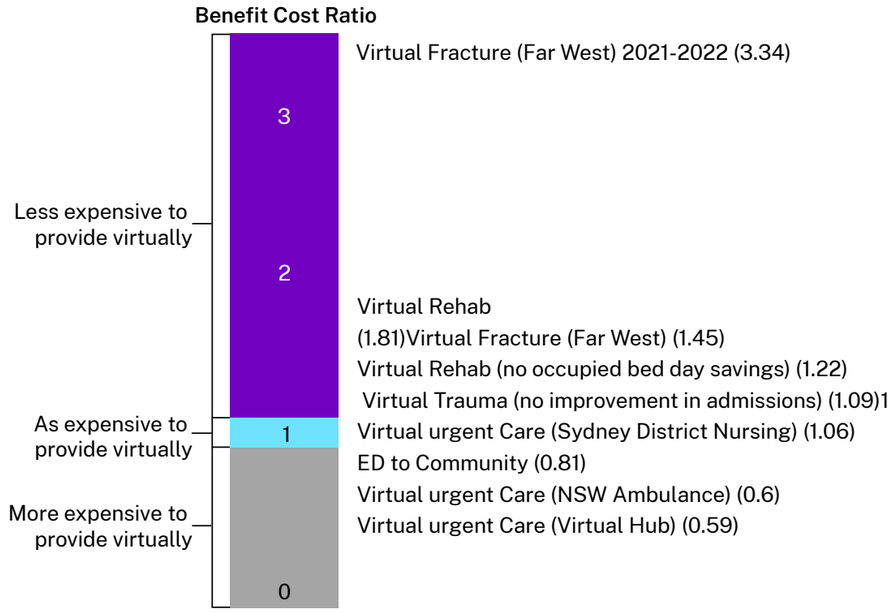
Choices regarding the types of activities and sorts of care **rpa**virtual delivers matters. Some programs, such as Virtual Urgent Care and Emergency Department, may have to double or triple in size to deliver care at a lower cost. Others with a higher volume of activity, such as Virtual Trauma, are delivered at less cost than the alternatives.

There is increasing healthcare activity in emergency departments and for ambulance use, as the chapter on urgent care highlights. If the current trend continues in these components of the health system, then the value of **rpa**virtual activity would increase.

Most models of care reviewed in this report were less expensive to deliver virtually than the equivalent average cost of providing the care in-person (Figure 9). Those models that delivered the most value do so at times of high stress for the health system (e.g. during the COVID-19 pandemic) or delivered healthcare to patients in non-metropolitan areas. Beyond that, models that substituted for inpatient services were estimated as providing more value.

Models that have relatively low volume of activity, such as ED to Community and elements of Virtual Urgent Care, were more expensive to deliver virtually than in-person. This will alter as the activity volume increases.

Figure 9: Basecase estimation of rpavirtual's models of care



Finding 4: **rpa**virtual may not save expenditure in the shorter term

The healthcare expenditure that may be saved from the use of virtual care is difficult to quantify. Nonetheless, **rpa**virtual is unlikely to reduce healthcare expenditure in the short term.

In the short term, the net effect of virtual care is increased treatment activity and improved quality at lower marginal cost than alternative methods of expanding healthcare volume. That is, it reduces waiting lists and overcrowding. While measures using the average cost of providing the activity displaced by virtual care almost certainly overstate the potential savings in the short term, they also may underestimate the value of the additional activity that can now be provided.

An increased number of patients will need to be treated and greater activity will need to be undertaken for **rpa**virtual to provide a cost-effective service in the future. For some virtual care services it delivers, the required activity increase will need to be substantial.

Increasing through-put requires risks and benefits to be managed. A greater volume of referrals is required for cost-effective care but not at the expense of delivering care to people who would be best served by alternatives, such as primary care.

Finding 5: **rpa**virtual increases the resilience and sustainability of the health system in the longer term

The services delivered by **rpa**virtual increase capacity within the health system in the longer term, even though they may not reduce costs in the short term (finding 4). **rpa**virtual services free-up resources that can be used for other treatment purposes. Hospital beds are available for other patients, ambulances are free to care and transport other patients, and clinic spaces are available for other patients. The five models of care evaluated in this report produce different capacity-increasing benefits. These benefits are summarised in Table 2 below. A total of 1,094 occupied bed days were estimated to be freed up during 2023 by Virtual Trauma, ED to Community and Virtual Rehabilitation.

Table 2: Benefits to system capacity from rpavirtual care models evaluated

Model	System Capacity Benefit	Quantum of benefit per attendance/patient	Assumed rate of substitutability
Virtual Trauma	Reduced occupied bed days	2 occupied bed days	79%
Virtual Rehabilitation	Reduced clinic and occupied bed days	1.9 occupied bed days	100%
Emergency Department to Community	Reduced emergency department occupancy	7 occupied bed days and 1,000 occupied minutes of emergency department	100%
Virtual Urgent Care and Emergency Department	Reduced emergency department occupancy	102 to 166 occupied minutes of the emergency department	66-100%
	Reduced ambulance ramping time	10 to 16 minutes less of ambulance ramping	66-80%
Virtual Fracture	Reduced use of clinic space	20 minutes of physical clinic time	100%

The benefits of this increased capacity can be considered in three ways. First, it reduces overcrowding. Second, it reduces the need for additional physical capacity in the future. Third, it facilitates increased treatment, improving equity of service provision.

The capacity of **rpa**virtual to pivot and adjust the services it offers to increase systemic capacity advantages resilience. It has demonstrated the benefits of virtual care to boost resilience during the COVID-19 pandemic. In the future, the capacity of **rpa**virtual to deliver additional healthcare would contribute to effective systemic responses to shocks and challenges.

For example, **rpa**virtual improves health system resilience by being deployable in future infectious disease outbreaks, not limited to pandemics. Limiting contact, rapid speed, remote monitoring and centralised electronic medical records are advantages of virtual care.

Beyond infectious diseases, **rpa**virtual has the potential to deliver care into areas with limitations in staff and physical capacity. It has the advantage of spreading scarce professional time over a greater geographical area and within a multidisciplinary context, as well as directing resources across the system to where they have the most impact. For example, the Virtual Urgent Care and Emergency Department supports emergency departments under the most pressure.

The adaptability and responsiveness that is a feature of **rpa**virtual, however, may also result in increased costs as short-term implementation and set up costs are required for each pivot.

Finding 6: Current funding structures are unlikely to support public virtual hospitals financially

Current funding mechanisms may hamper the future roll-out of virtual hospitals.

At present, there is not an appropriate activity-based funding classification scheme for some virtual care services. For example, **rpa**virtual is reporting its activity as outpatient clinics through the Outpatient Tier 2 classification scheme (Independent Health and Aged Care Pricing Authority, 2023). While this is appropriate for some services, for example Virtual Fracture, it is not for others, for example, **rpa**virtual services that substitute for in-person emergency department and inpatient services. Underinvestment would be the result.

The benefits of virtual care are also linked to the replacement of capital stock. A lack of appreciation of the cost of capital diminishes the value estimated for virtual care.

Based on the **rpa**virtual experience, future models of virtual care need to continue to be designed collaboratively with key stakeholders. They take time to develop and implement, including time to build patient confidence in the service and to increase the rate of referral and volume of activity.

Recognising the financial risks to be managed in the delivery of virtual services by a virtual hospital, these risks may be mitigated by block funding in the future. The period of block funding, however, needs to be tied to a realistic time span to increase service delivery.

Furthermore, the substitutability of virtual care services for in-person services continues to develop and will change over time. The exact proportion of hospital equivalent services that can be delivered virtually is subject to uncertainty.

Finding 7: Confidence in **rpa**virtual would be increased by further research and continuous evaluation

There is uncertainty around the value of the benefits that are associated with the introduction of virtual care, such as that delivered by **rpa**virtual. Uncertainties include limited data from which insights and information can be generated about the:

- health benefits for individuals who receive virtual care compared to in-person care;
- the incremental costs to the health system associated with virtual care compared to
- in-person care; and
- the incremental benefits to the health system of reducing overcrowding in physical spaces.

Assumptions of complete substitutability of virtual care may also overestimate the cost savings of virtual hospitals. Studies have – and will continue to - reach different conclusions, based on the assumptions they use and the evidence they have available.

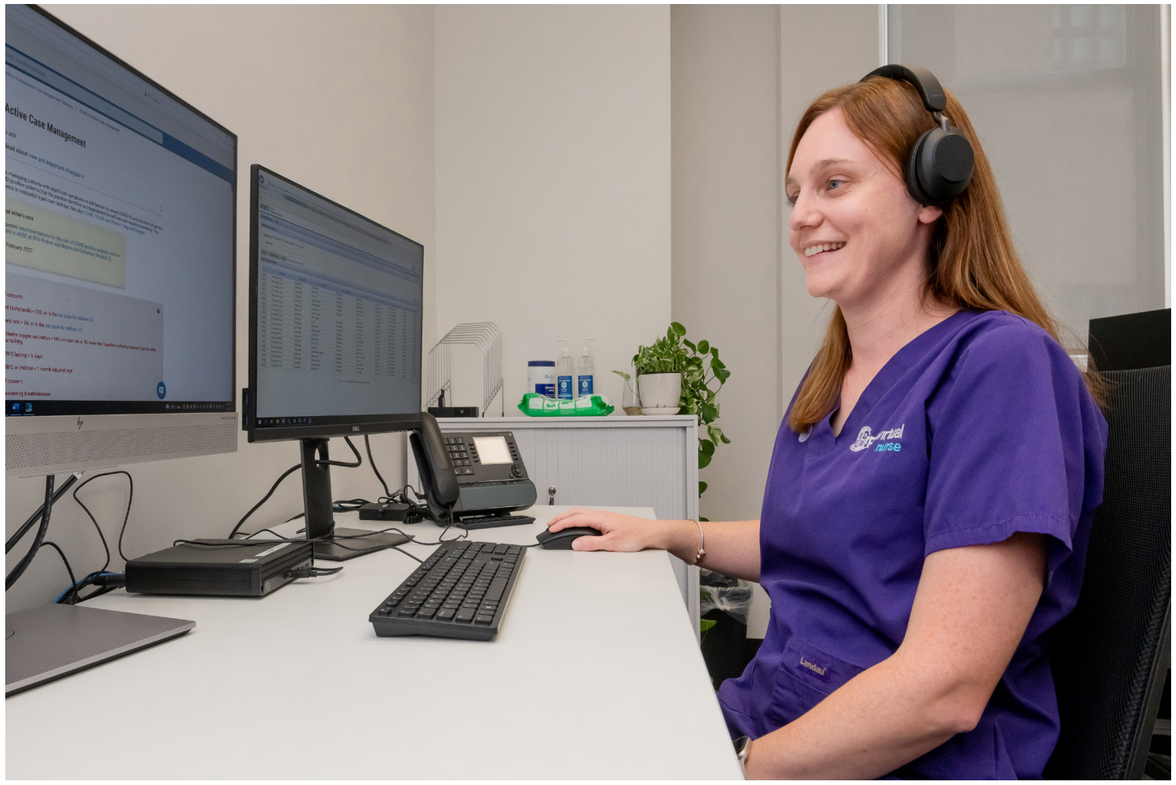
In this evaluation, complete substitution was not assumed for each of the five virtual models of care examined in this report. Rather, the level of substitution was based on the empirical evidence able to be generated for each of the five models, with a derived rate of substitutability between 66-100%. Moreover, the degree of substitutability for a model may change over time as experience is gained and practice change occurs.

These types of uncertainties could be narrowed via further research, and better monitoring and evaluation. A virtual hospital that continues to respond to new challenges requires a continually evolving monitoring and evaluation framework. A narrower evaluation framework, undertaken in this report because of data limitations, underestimates the benefits of virtual care to the health system.

There are a number of concurrent evaluations occurring regarding other **rpa**virtual models of care that will contribute to our understanding of the benefits of virtual care:

- A Randomised Controlled Trial of Remote Monitoring for Acute Diverticulitis has been completed in collaboration with the RPA Institute of Academic Surgery. The trial has concluded with positive clinical results and an economic evaluation is planned.
- A Virtual Fracture Clinic Randomised Controlled Trial is underway in collaboration with the Institute for Musculoskeletal Health.
- An economic evaluation of the Wound Care Command Centre is being completed by an external consultancy firm.

The potential benefits of integrated care from virtual care are substantial. The availability of patient information is insufficient for these benefits to be realised - the information also needs to follow the patient across care providers, including primary care. This facilitates multi-disciplinary teams to seamlessly help patients across care settings. An interoperative information technology ecosystem is required (Slawomirski et al., 2023). The investments that have been made in models such as ED to Community and the Wound Care Command Centre need to be further built upon to realise the full benefits of care integration and co-ordination.



8. Conclusions

Virtual care has enormous potential to deliver positive benefits for patients and care givers, health workers and institutions, and the wider health system.

The services delivered by **rpa**virtual and evaluated in this report demonstrate these benefits.

Most, but not all, of the five models evaluated have a lower average cost from being delivered virtually than in-person. **A total of 1,094 occupied bed days were estimated to be freed up during 2023**.

Beyond bed days there are additional benefits to patients and the health system. These include **savings in avoided costs and time for patients, and improved equity of access**.

In 2023, COVID-19 related activity reduced. While non-COVID activity increased, overall, there was a reduction in **rpa**virtual activity. The comparison made in 2023 will likely comprise the most deleterious comparison between virtual and in-person care, as prior and future activity will be higher and the average costs lower. The expectation is that the Benefit-Cost Ratio will be higher in 2024 if referrals and activity increase and the average cost decreases.

Three risks identified in this evaluation report need to be managed carefully to realise the great potential of virtual care in general, and **rpa**virtual in particular.

1. The risk of not using virtual care

Virtual hospitals and other forms of virtual care may be the subject of under-investment because of a lack of incentives and information. Further, the impact of virtual care on the broader functioning of the health system and beyond needs to be considered.

First, the benefits of virtual care may accrue to other participants in healthcare (for example time and cost to patients, benefits to other providers and ambulance services) or found beyond healthcare (benefits in the reduction of CO_2 emissions).

Second, the benefits of virtual care may not be easily evaluated, and this uncertainty reduces the investment in virtual care. This includes the benefits of virtual care to systemic resilience which will be intermittent in nature or constantly changing. A lack of valid data about the wider impacts of the five **rpa**virtual models of care evaluated in this report limited the way benefits and costs could be estimated. An inability to produce robust comparative information about the benefits and costs (including the impact on the health system) may reduce willingness to invest in virtual care.

Finally, the financing and timeframes necessary for investment in virtual care to demonstrate further benefits may be incompatible with the budgetary cycle of relevant institutions and health funders. This is especially true if the benefits of virtual care are associated with the avoidance of capital investment or, for organisations with fixed budgets, they result in an expansion of care.

Long term support of virtual care requires data on their value to be generated and a funding system that supports their appropriate use.

2. The risk of using virtual care inappropriately or in a manner that worsens health system performance

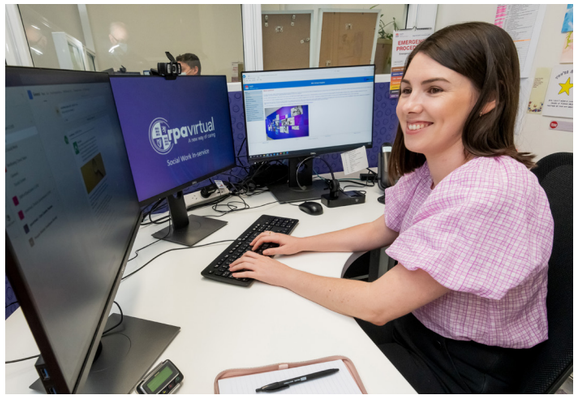
A lack of sufficient activity in virtual care, and the subsequent production of cost-inefficient virtual care, may be the result of a lack of growth associated with virtual care. The fixed investment associated with a virtual hospital requires a minimum level of activity to be cost-effective. A lack of referrals would exacerbate this risk.

Beyond that, the fragmented nature of the Australian healthcare system may result in the use of less cost-effective hospital services (whether in-person or virtual), when the preferred option would have been more cost-effective primary care. A similar situation may occur if a division between virtual and in-person services does not include the use of hybrid services.

3. The risk of not using the benefit maximising suite of virtual care services

Virtual care can be used in a variety of different clinical situations, as **rpa**virtual demonstrates. Many may be beneficial relative to the alternative of no virtual care when simply comparing the costs of service provision virtually and in-person.

If the availability of virtual care is finite, the opportunity cost of providing one virtual service is the other virtual or hybrid services that have been forgone. A full suite of virtual alternatives should be considered to identify what is benefit maximising and cost minimising. Without this, the right mix of virtual care will not be invested in, and a lesser benefit will result. That is, much like a physical hospital, virtual hospitals should engage in the activities that generate the most benefit. This would suggest **rpa**virtual should continue to evaluate the multitude of services it delivers.



A total of 1,094 occupied bed days were estimated to be freed up during 2023

9. Future evaluations of **rpa**virtual

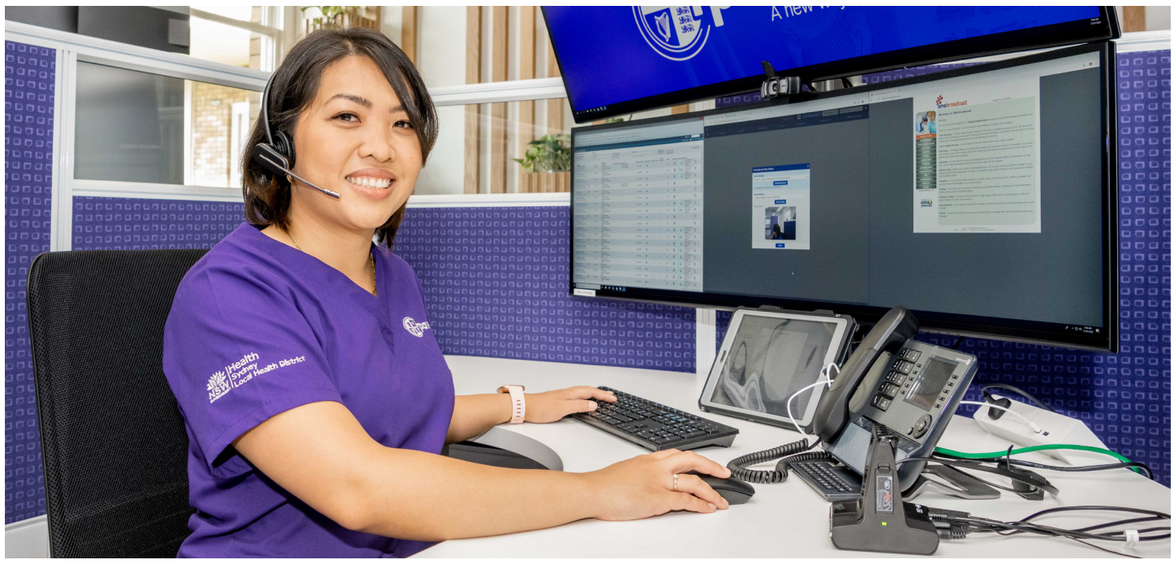
The next evaluation of **rpa**virtual in 2025 will move beyond the direct comparison of virtual and in-person services. It will estimate the systemic impacts of two models of care: Virtual Rehabilitation and Virtual Urgent Care. The selection of these two models is based on their importance in supporting patient flow through the Sydney LHD and the uncertainty of their benefits. Both services may produce greater benefits than assessed in this report.

Virtual Rehabilitation is an increasingly important service. Its use is increasing, and the complexity and variation of patients that are receiving this care is evolving. There is inequity in the availability of these services, especially for patients from rural and remote communities. Increasing practice change in the use of intensive rehabilitation services may result in improvements in earlier discharges, reduced readmissions and improved equity. The estimation of these benefits will require a more comprehensive evaluation program.

Virtual Urgent Care is anticipated to have a substantial growth in activity associated with recent announcements that a suite of virtual care initiatives will be funded to allow 180,000 people to avoid a trip to the emergency department (NSW Health, 2024). This increased activity may lower the average cost of Virtual Urgent Care attendance. It may also increase access and help avoid the crowding in emergency departments, improving the quality of care.

A key requirement for the cost-effectiveness of virtual hospitals will be a sufficient volume of activity, as this report highlights. This will require continuing the integration of virtual care into hospital services. The evidence, incentives and governance structures need to support this. Beyond the evidence development and maintenance of senior leadership championing of virtual services, additional mechanisms could include review of waiting times and equitable use of services that could be expanded through virtual care. Incentives, including financial incentives to align the patient benefits with the clinical decision-making, could be included.

Virtual services, and virtual hospitals, demonstrate improvements in sustainability, cost-effectiveness and patient benefits. Managing them to maximise their benefits will require ongoing monitoring and evaluation efforts.



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Chapter 1: Patient, staff and societal benefits of RPA Virtual Hospital

Summary

The vast majority (84%) of **rpa**virtual's patients reported that their care was excellent. This is an improved outcome for **rpa**virtual since 2021. Most patients who responded to the survey said they were treated with respect and dignity. Patients also thought that their privacy was upheld.

Patients identified comparative benefits associated with virtual care delivered by **rpa**virtual as opposed to in-person care. Reduced travel was the most common benefit identified by patients. The next most common benefit was improved understanding of their health condition.

The value of reduced travel for patients has been estimated in this report, based on the distance between their residences and the Royal Prince Alfred Hospital (RPA). There was substantial value of reduced travel to patients on an individual basis. A minimum saving of approximately one hour per patient per attendance occurred, based on very conservative assumptions. Unsurprisingly, those travelling larger distances received a larger benefit, with the average benefit among this group of approximately 2 hours of time saved per patient per attendance.

The value to be allocated nominally to saving of time and travel is uncertain. Nonetheless, this report values these savings at $69 per patient per attendance, using conservative assumptions. This benefit could be as high as $222 per patient per attendance, using a common set of alternative assumptions. For **rpa**virtual's patients who would otherwise be required to travel a substantial distance from their residence to receive in-person care, this benefit could be as high as $800 or more per patient per attendance.

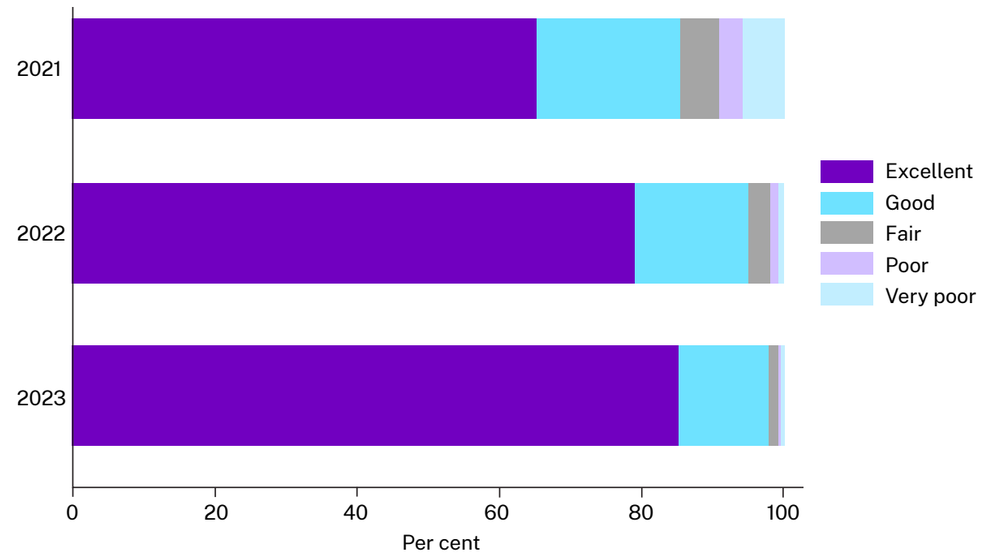
The results of the **rpa**virtual staff survey supports the patient reported outcomes above, namely that care provided was positive for patient outcomes and their experience of care. However, the number of staff participants in the survey was relatively low, limiting confidence in the results.

There are also additional benefits for virtual care related to a reduction in travel that do not accrue to individual patients but do accrue to the sustainability of the health system and to society. A key example would be reduced emissions of carbon dioxide. The reduction is carbon dioxide equivalent is approximately 80 tonnes, which is valued at over $10,000.

Patient reported experiences of care at **rpa**virtual

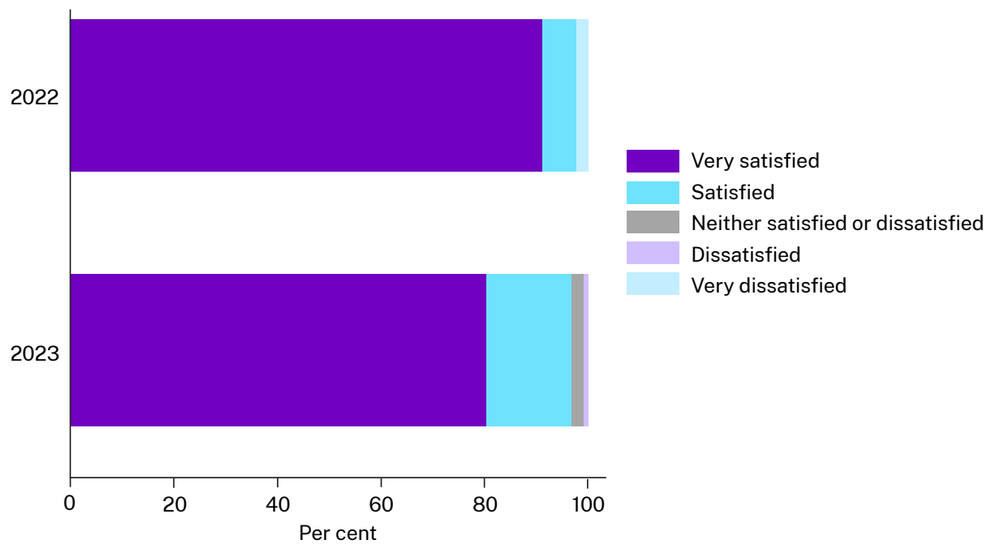
Most patients reported that their care was excellent, with five in six patients (84%) rating their care as excellent in 2023. This is similar to the outcomes of 2022 (79%) and an increase since 2021, where almost four in six patients (65%) reported their care as excellent (Figure 1).

Figure 1: Overall rating of care by year



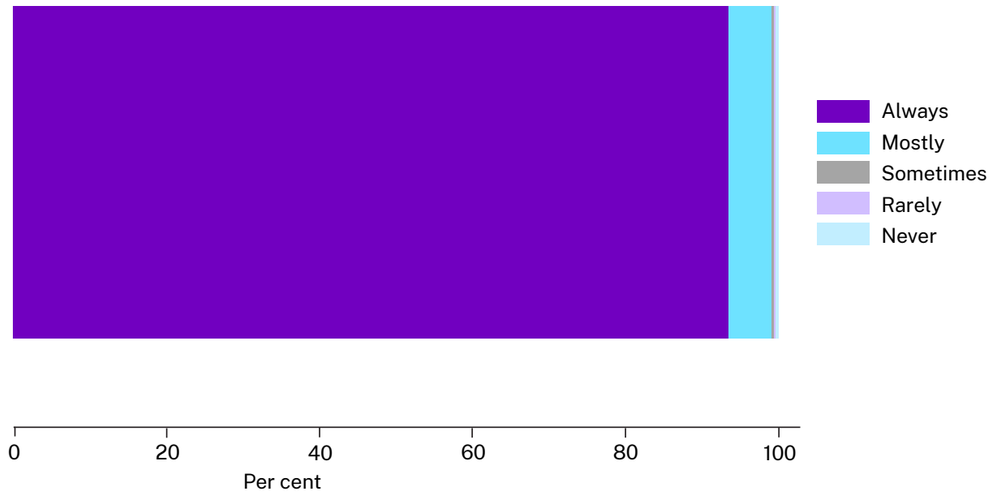
Most patients also responded that they were satisfied or very satisfied with their experience, if they were asked this question by their family. From a relatively high bar, there was a decrease in the percentage of patients that would describe their experience as very satisfied in 2023 (80%) compared to 2022 (86%) (Figure 2).

Figure 2: Portion of patients satisfied with their experience



More than 9 in 10 patients (94%) reported that they were always treated with respect (Figure 3). Less than 1% of survey respondents reported that they were sometimes, rarely or never treated with respect. This is a strong result for **rpa**virtual.

Figure 3: Patients reporting that they have been treated with respect

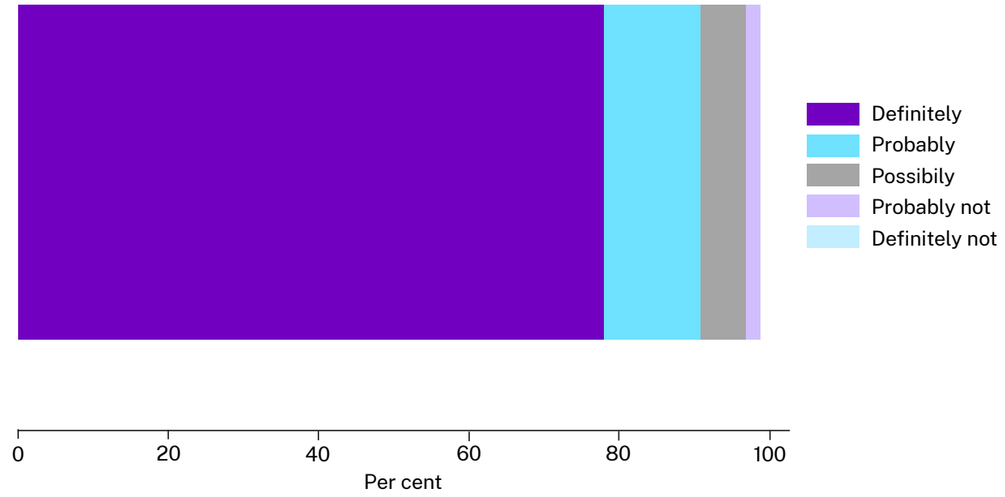


More than 9 in 10 patients (94%) also reported that they either strongly agreed or agreed that their privacy was maintained during their interactions with **rpa**virtual (Figure 4). This is another very positive result.

Figure 4: Maintenance of privacy

If given the choice, 97% of patients would definitely (78%), probably (13%) or possibly (6%) use virtual care again. Only 3% reported that they would definitely or probably not use virtual care again if given the choice (Figure 5).

Figure 5: Using virtual care again, if given the choice between it and traditional in-person care

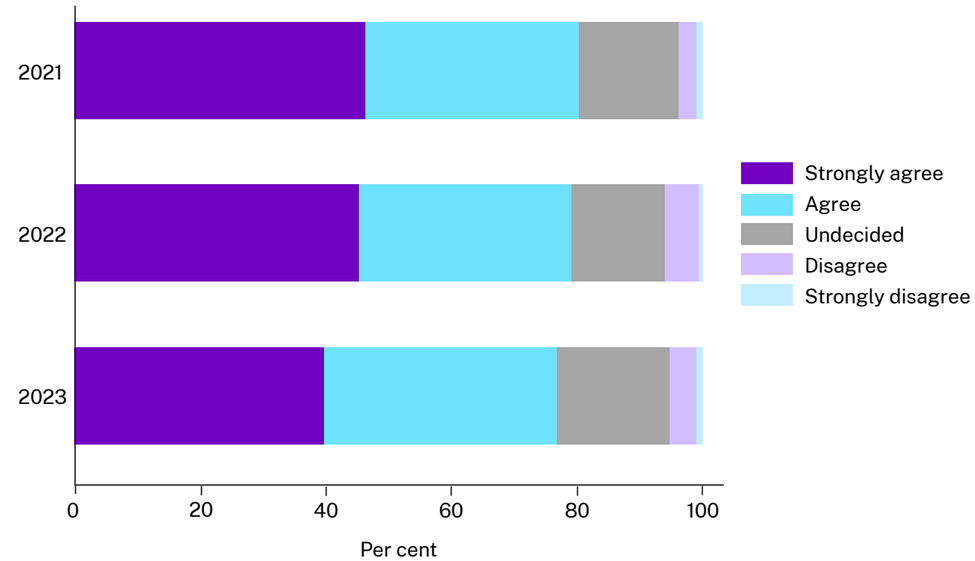


Comparative experiences of virtual care

Eight in ten (77%) either agreed or strongly agreed that their virtual care appointments were the same or better than a traditional in-person appointment (Figure 6). There has been a slight decrease over the last three calendar years in those patients reporting that virtual care is better than traditional in-person appointments. Five in ten patients (50%) strongly agreed their virtual care appointments were the same or better than a traditional in-person appointment in 2021.

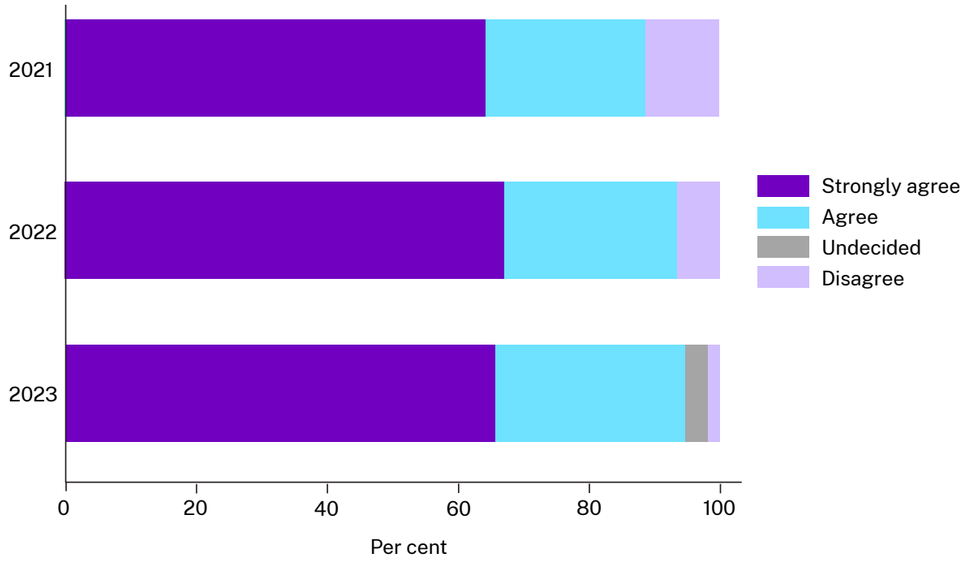
There has been a change in the conditions treated over these three years, with a decrease in the proportion of patients treated within the COVID-19 model. During 2021-2022, the benefits of avoiding in-person care because of the risk of transmission may have increased the proportion of respondents who thought virtual care was the same or better than in-person care.

Figure 6: Perceptions of the comparative value of virtual and in-person appointments



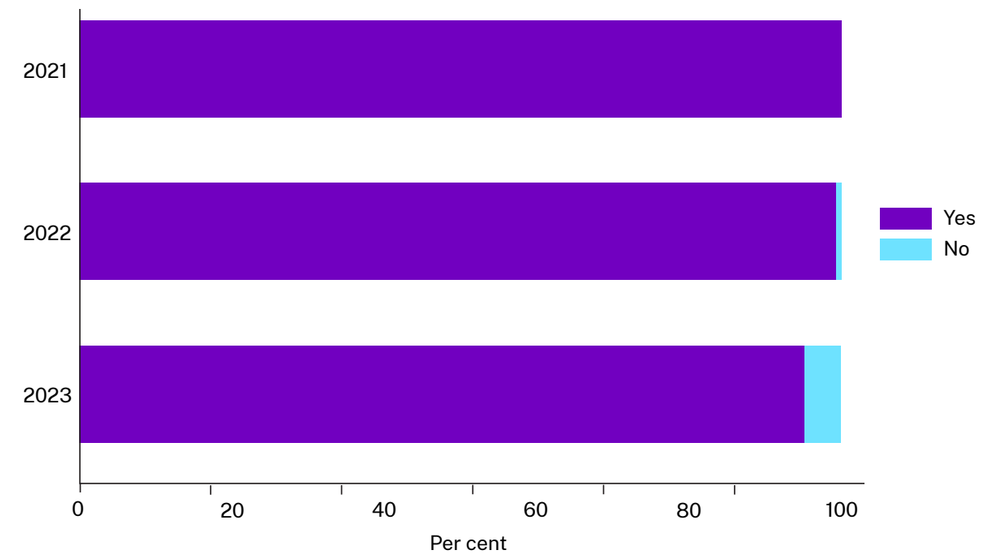
The vast majority of patients (94%) agreed or strongly agreed that virtual care made it easier for them to receive treatment (Figure 7).

Figure 7: Portion of patients agreeing that virtual care made it easier to receive treatment



Over nine in ten people (95%) reported that they benefited from using virtual services (Figure 8). There has been a slight increase in the proportion of those patients responding who considered that they did not benefit from the use of virtual services in 2023 (4%), compared to 2021and 2022.

Figure 8: Percentage of patients who experienced a benefit from the use of virtual services



A reduction in travel is the most frequently cited benefit of virtual services for patients (Figure 9). This has been consistently ranked as the top benefit across 2021-2023. Improved understanding by patients of their condition was the next most frequently cited benefit. Again, this has been consistent across 2021-2023.

Reduced time off work or school was the third most cited benefit in 2021 and 2022 but was less commonly reported as a benefit by patients in 2023. This reflects a change in the conditions managed by **rpa**virtual as COVID-19 management became less prevalent and the age range of patients treated has changed. Similarly, there has been a reduction in the portion of respondents who benefited from not having to arrange care.

Figure 9: Benefits experienced with rpavirtual

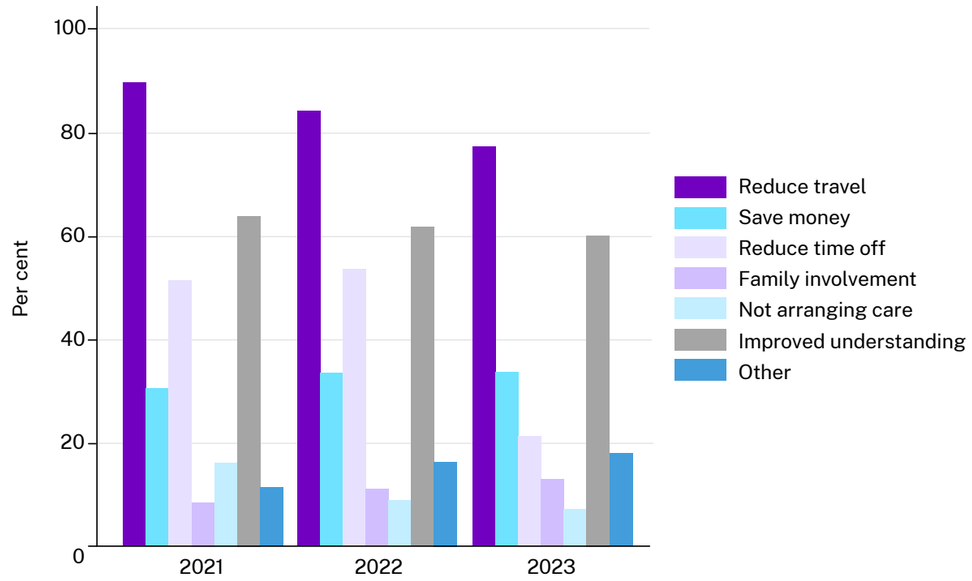
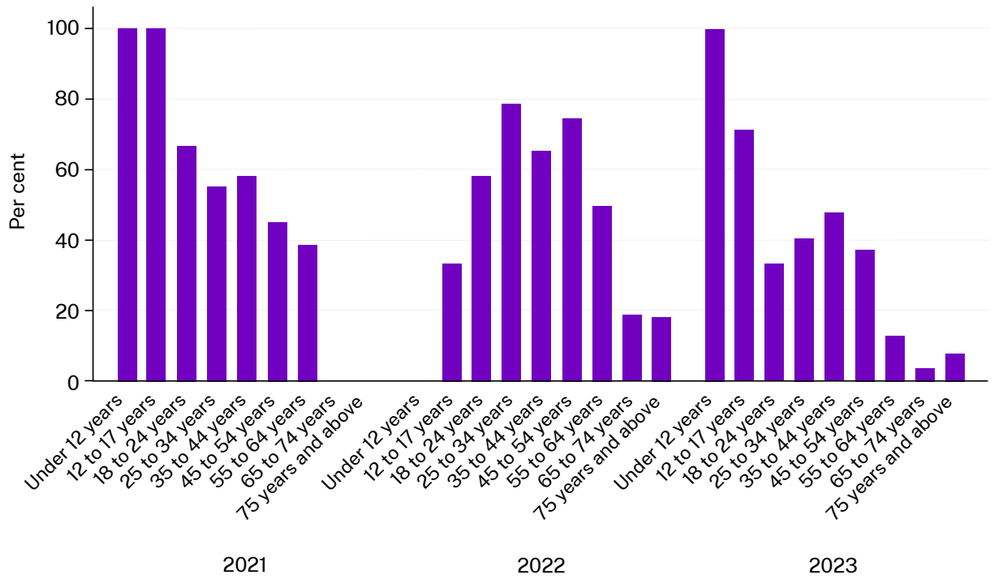


Figure 10 demonstrates that the benefits of reducing the time off from work or from education fall with increasing age. This benefit will be dependent on the age structure of the population treated by virtual care.

Figure 10: Assessment of benefit of reduced time off stratified by age and year



Methodology: Electronically generated patient reported experience measures were generated for all patients discharged from **rpa**virtual using a desktop to SMS system (Wilson & Shaw, 2022). A reminder text message was also sent to patients two weeks after the initial text message to prompt a response. The responses from 2023 are analysed as the basecase (n=796). The response rate was 36.7% for 2023. For some longitudinal reports the responses from 2021 (n=1,283) and 2022 (n=1,828) were used as well. The questions and response options are outlined in the appendix to this Chapter.

Estimating the value of reduced travel for patients

Reduced travel was identified as the benefit most patients experienced as a result of **rpa**virtual care, as highlighted above.

This finding is consistent with the literature, which identifies reduced movement as one of the major benefits of virtual care (Snoswell et al., 2020).

This section estimates the value of the benefits of reduced travel. Reducing travel can benefit patients in two main ways:

1. It saves time that patients can use for another purpose; and
2. It saves expenses by not travelling.

There are other benefits from reduced travel that do not accrue to individual patients, including a reduction in carbon emissions and congestion around RPA.

Saves time for patients to use for another purpose

Patients saved an average of 2 hours per **rpa**virtual appointment, assuming a 100% replacement (Table 1). The estimated benefit in time for those patients in the Sydney Local Health District (LHD) was an hour per contact with **rpa**virtual.

The results in Table 1 assume the full substitutability of care. An assumption of 100% substitutability is reasonable for some services, such as the virtual administration of tuberculosis medications.

Table 1: Benefits of decreased travel – time saved

Geographical location	Percentage of patients	Average saved time (minutes)	Average distance	Total saved time (minutes)	Total km avoided
Sydney LHD	81%	56	15	249,527	65,651
Close NSW	7%	87	52	33,309	19,922
Far NSW	9%	618	877	318,696	452,894
Interstate	1%	1546	2,374	54,115	83,115
Overseas	2%	56	15	5,110	1,345
All	**100%**	**120**	**112**	**660,925**	**622,970**

Abbreviation: Sydney LHD, Sydney Local Health District.
Note: Sydney LHD is those patients with a home residence postcode within the Sydney LHD; close is less than 50km from RPA Hospital; and far is 50km or greater in NSW. Those patients with an overseas postcode or address were assumed to be resident in the Sydney LHD.

An assumption of 70% substitutability, i.e. only 70% of services provided by **rpa**virtual would have otherwise required an in-person visit to RPA, reduces the time (and distance) saved by 30%.

The value of this time saved is estimated at approximately $216,000 for 2023 for all patients seen at **rpa**virtual, based on the 40% of average wage assumption used by Transport for NSW. An average value of $39 per attendance at **rpa**virtual flows from this estimation.

If, however, the value of this time saved was assessed at the full average wage, the value of the total benefit for 2023 for all patients would be $540,000. These estimates would double again if it is assumed that two people (the patient and a carer) would have attended in-person appointments.

Savings associated with patients not travelling

The savings for patients associated with travel have been estimated to be $162,000 based on using the Transport for NSW vehicle operating costs (which do not include depreciation). This is an average saving per trip of $29 (Table 2).

Alternative methods of estimation - Australian Taxation Office (ATO) guidelines or the NSW Isolated Patients Travel and Accommodation Assistance Scheme (IPTAAS) rate - produce even higher savings for patients, partly because of the inclusion of depreciation and partly because of a higher estimated rate of expense per kilometre.

Table 2: Benefits of decreased travel

Geographical location	Percentage of patients	Average savings (Transport for NSW)	Average savings (ATO)	Average savings (IPTAAS)
Sydney LHD	81%	$5	$12	$6
Close NSW	7%	$15	$42	$21
Far NSW	9%	$218	$715	$351
Interstate	1%	$588	$1,935	$950
Overseas	2%	$5	$12	$6
All	**100%**	**$29**	**$92**	**$45**

Abbreviation: Sydney LHD, Sydney Local Health District.

Note: Sydney LHD is those patients with a home residence postcode within the Sydney LHD; close is less than 50km from RPA Hospital; and far is 50km or greater in NSW. Those patients with an overseas postcode or address were assumed to be resident in Sydney LHD.

Methodology: The benefits of reduced travel for the patients in time and expense have been estimated by calculating the distance between the latitude and longitude of their home address and the Royal Prince Alfred Hospital emergency department. Estimation of the time taken to travel that distance was made using the HERE database accessed through Stata. All patient attendances through 2023 were used (n=5522) with multiple attendances having the assumption of multiple trips. The Transport for NSW guidelines for the assessment of the monetary value of the saved time, using 40% of the average wage (Transport for NSW, 2016). A base assumption of 30 minutes waiting for the appointment was made consistent with the Productivity Commission evaluation of digital care (Productivity Commission, 2024). It is assumed that patients are travelling by car and only one person travels. Further assumptions and detail are available in the appendix of this Chapter. The cost is calculated using the Transport for NSW methods that do not include depreciation (Transport for NSW, 2022).

The benefits to patients of avoiding travel, return time and money to them are therefore valued in this analysis at $69 per attendance. These values use very conservative assumptions. A less conservative set of assumptions (ATO rates for vehicle operating costs and two people using the value of time suggested by the Productivity Commission) would result in an estimated $222 per attendance.

This approach has also not included several other practical benefits that may accrue to patients of virtual care, such as a reduction in the need to find carers or miss work or education.

There are also additional benefits for virtual care related to a reduction in travel that do not accrue to individual patients, but do accrue to the sustainability of the health system and to society. A key example would be reduced emissions of carbon dioxide. Health systems are a substantial contributor to carbon emissions, with transport being a substantial contributor to that (Irwin et al., 2024). Virtual care reduces the carbon footprint of care by reducing travel (Purohit et al., 2021). The reduction is carbon dioxide equivalent associated with a reduction in transport is approximately 80 tonnes for **rpa**virtual, which is valued at over $10,000.

Staff survey of the outcomes of care delivery at **rpa**virtual

Participants in the staff survey reported that the care delivered at **rpa**virtual supports patients, responds to their needs, and leads to both positive patient experiences and outcomes (see Figures 11-12).

The number of staff respondents to the survey was low compared to previous surveys (see methodology). Therefore, a comparative analysis over years could not be conducted meaningfully.

Figure 11: Staff able to be responsive to the needs of individual patients

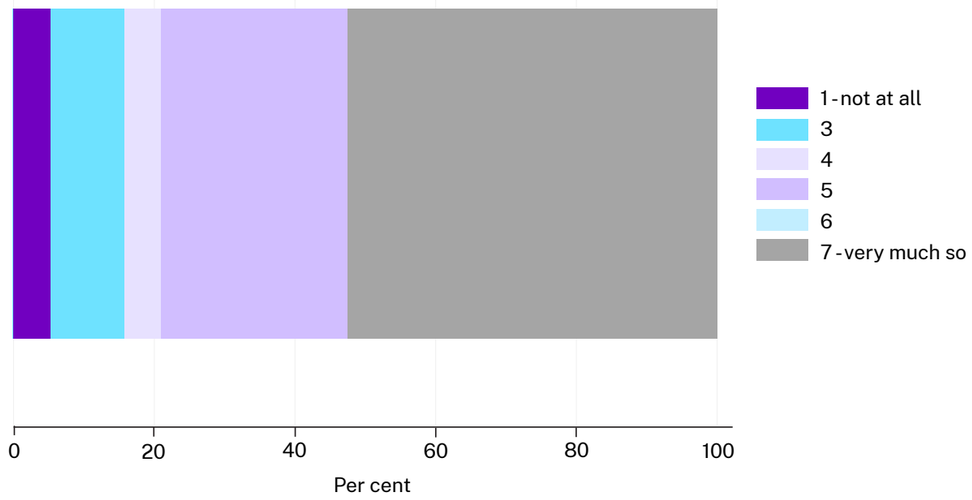


Figure 12: Staff able to provide care that leads to positive patient experience

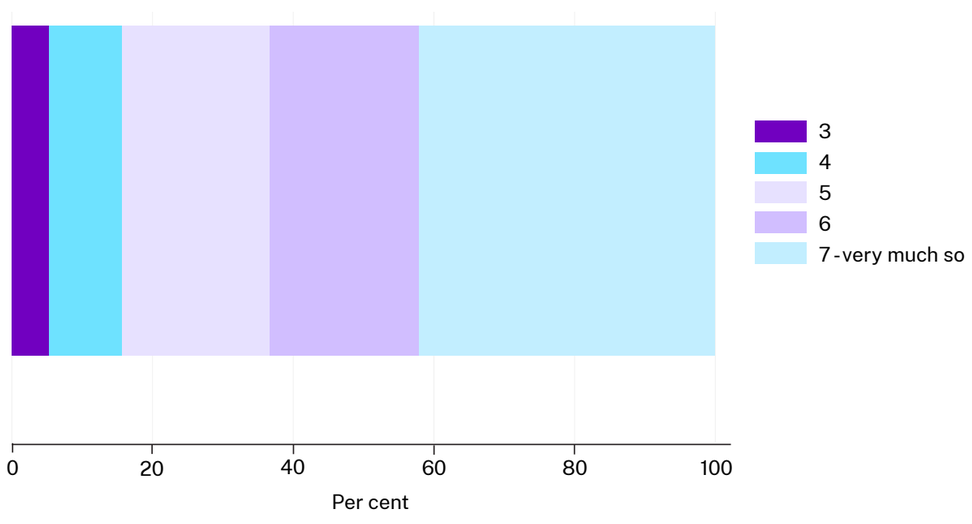
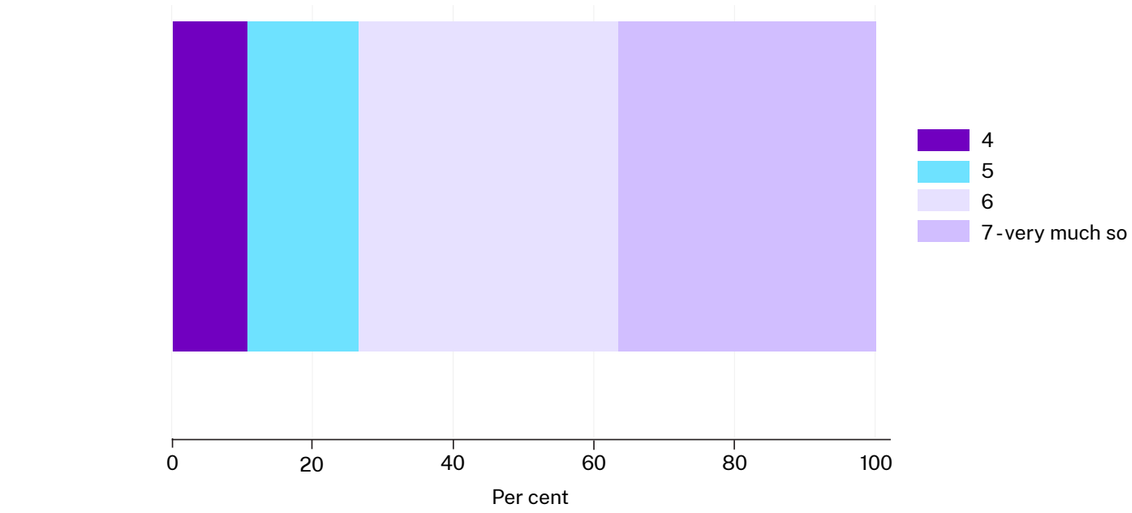


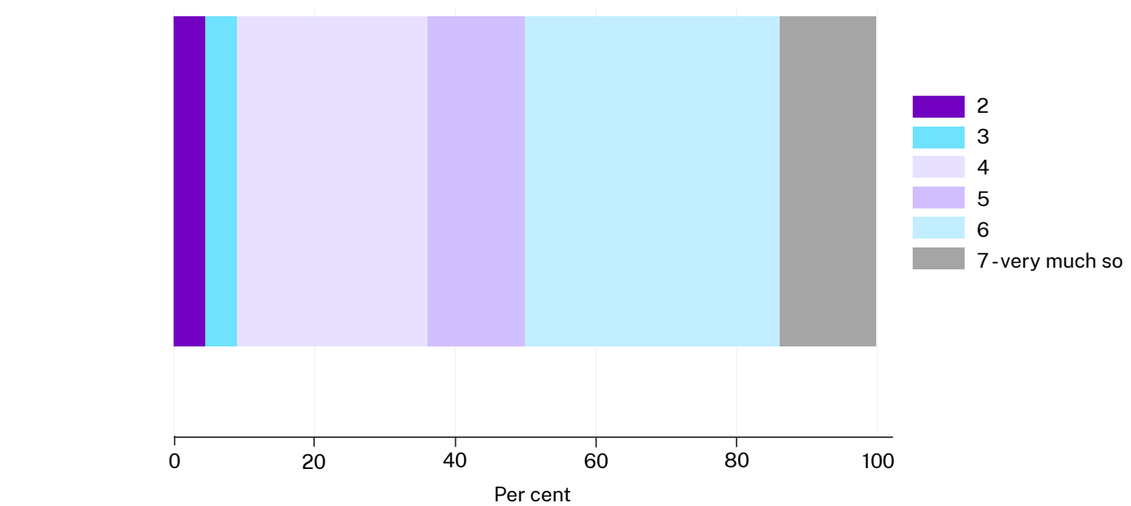
Figure 13: Staff able to provide equal or superior clinical outcomes



Methodology: The staff survey results only include the information from 2023 with 22 responses. Previous surveys in the first (n=36) and second year (n=73) of the operation of **rpa**virtual had more respondents. The lower number of respondents in 2023 lowers the confidence in the precision of the results and any comparisons between years. Due to the small number of responses, no subgroup analysis has been conducted. The majority of questions used a seven-point Likert scale, with one being, for example, "Strongly disagree" and seven being, for example, "Strongly agree".

While the staff survey supported the results of the patient survey (i.e., that virtual care can be provided in a way that benefits patients), the results of the staff survey suggest the need to balance experiences in both virtual and in-person care. Figure 14 demonstrates that approximately half of staff respondents found giving care virtually generated satisfaction relative to delivering in-person care, but half found it more ambiguous.

Figure 14: Staff experience of virtual care giving as much or more satisfaction than in-person care



Appendix: assumptions, data sources and specific questions

Questions used in patient and staff surveys

Patient survey

Overall care question and response options	"Overall, how would you rate the care you received from **rpa**virtual?" with a choice from "Excellent", "Good", "Fair", "Poor" and "Very Poor" In 2023, there were 745 responses with 50 people not answering this question (6.7%)
Comparison to in-person care and response options	"My virtual care appointment was the same or better than a traditional in-person appointment" with a choice from "Strongly agree", "Agree", "Undecided", "Disagree" and "Strongly disagree". In 2023, there were 745 responses with 198 people not answering this question (26.6%).
Virtual care benefit question and response options	"Did this virtual care appointment benefit you?" with a choice of "Yes" and "No". In 2023 there were 745 responses with 220 not answering this question (29.5%)
How the benefit of virtual care was characterised had a series of checkbox options	A reduced need to travel; saving money; not missing work or school, including family; no need to arrange care for children or dependents; better understanding my condition; or benefitting in other ways.
Overall satisfaction question and response options	"If asked about your experience with **rpa**virtual by friends and family how would you respond?" with a choice of "Very satisfied", "Satisfied", "Neither satisfied or dissatisfied", "Dissatisfied" and "Very dissatisfied". In 2023, there were 745 responses with 358 people not answering this question (48%).
Ease of treatment and the response options	"Virtual care made it easier for me to get treatment." with a choice from "Strongly agree", "Agree", "Undecided", "Disagree", "Strongly disagree" and "Not applicable". For the percentages calculated in the graph, the "Not applicable" option was removed. In the 745 responses received in 2023, 65 were coded as "Not applicable" (8.7%) and 305 were missing (40.9%).
Treated with dignity and the response options	"Were you treated with respect and dignity by the **rpa**virtual clinician?" with a choice from "Always". "Mostly". "Sometimes", "Rarely" and "Never". In 2023 there were 796 responses with 99 people not answering this question (12.4%).

Staff survey

Responsive to needs and response options	"I am able to be responsive to the needs of individual patients" with a scale from 1 (not at all) to 7 (very much so).
Provide positive patient experience	"I am able to provide virtual care that leads to positive patient experience" with a scale from 1 (not at all) to 7 (very much so).
Provide equal or superior outcomes	"I am able to provide virtual care that delivers an equal or superior clinical outcomes" with a scale from 1 (not at all) to 7 (very much so).
Satisfaction question and response	"Providing virtual care gives me as much or more personal satisfaction than a traditional in-person clinical role" with a scale from 1 (not at all) to 7 (very much so).

Data and assumptions for assessment of distance

The value of time is based on 40% of the wage rate for non-business travel, consistent with the NSW for Transport guidelines (Transport for NSW, 2016). This is less than the figure used in the Productivity Commission analysis of the benefits of digital technology in healthcare which used the higher figure of the participation rate of the labour force to adjust the average wage (Productivity Commission, 2024).

Time and value of time parameters

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Full time adult earning – ordinary time	$1863.45	Average of seasonally adjusted figure for May-2023 ($1838.10) and Nov-2023 (1888.80) (ABS, 2023)	Nil
Ordinary hours of work	38	Fair Work Ombudsman (Fair Work Ombudsman)	Nil
Average hour earning	$49.04	Ordinary earnings divided by ordinary hours of work	Nil
Participation rate	66.64%	Average of monthly seasonally adjusted participation rate (ABS, 2024)	Nil
Value of the time not spent waiting by patients	$19.62	40% of the average hourly wage	The full wage and the full range multiplied by the participation rate.
Time patients spend waiting in clinic	30 minutes	Productivity Commission (Productivity Commission, 2024)	
Distinction between close and far geographic locations	50km	Assumption	
Substitutability of care between physical and virtual services	100%	Based on the experience of **rpa**virtual Urgent Care and Emergency Department (rED) model of care	70%
Number of people involved	1	Assumption	2

The use of a higher estimate of a value of time increased the benefits of virtual care.

Costs of travel

The assumption is made that there is no depreciation advantage associated with avoiding travel in a private vehicle because of the use of **rpa**virtual. This is consistent with the advice for cost-benefit analysis from Transport for NSW which assumes that decreases in travel result for a private vehicle increases the time the vehicle was parked (Transport for NSW, 2022). Similarly, the assumption was made in assessing the carbon dioxide equivalent reductions associated with reduced travel that the life cycle approach was not appropriate because the decisions to acquire and dispose of the car is not altered.

Distance and travel time were calculated using the latitude and longitude of the address of the patient and RPA emergency department using the “georoute” command in Stata, unless otherwise noted. The total distance and travel time was calculated as twice the one-way distance.

Missing data was replaced with the average distance of those participants that had a postcode that was within the Sydney Local Health District. International addresses had their distance replaced by the average distance of those participants that had a postcode that was within the Sydney Local Health District.

Average speed for each trip is calculated as the ratio of distance and time. The method of calculation is the recommended vehicle operation cost benefit equation on page 10 of the Guidance from Transport for NSW with a decreasing cost associated with increasing speed (Transport for NSW, 2022).

Alternative methods of valuation use the ATO taxable deduction associated with travel and the IPTAAS reimbursement.

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Average speed	Individually calculated	Distance/time	
Cost per kilometre	Individually calculated	Individually calculated using average speed using Transport for NSW calculations.	81.5 cents per kilometre (the average of the 2022-23 and 2023-24 Australian Taxation Office deductions (Australian Taxation Office). 40 cents per kilometre as suggested in the IPTAAS reimbursement (NSW Health).
Carbon dioxide equivalent release per kilometre of travel in grams	131.1	Use of the MA category from the carbon dioxide emissions intensity suggested by the National Transport Commission (National Transport Commission, 2023).	
Cost of carbon emissions	$123	Technical note from NSW Treasury (NSW Treasury, 2023)	

The costs of travel increase with the use of alternative methods of valuing the time and distance.

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Chapter 2: Virtual Trauma

Summary

Virtual care can substitute for specialist inpatient services in different ways. It can substitute for an entire inpatient admission or a component thereof. The available evidence suggests that there is no higher risk of readmission associated with inpatient care at home.

This chapter evaluates **rpa**virtual's Virtual Trauma care to substitute for specialist acute inpatient services. Chapter 3 is on Virtual Rehabilitation and evaluates the substitutability of specialist subacute in-person care.

The Virtual Trauma model delivered by **rpa**virtual demonstrates the potential for patients to receive multi-disciplinary care at home, who would previously have been admitted to hospital.

Virtual Trauma is also evaluated as generating substantial benefits for the health system. It was associated with an estimated reduction of between 200 and 400 occupied bed days in 2023.

Virtual Trauma also demonstrates the benefits of a registry approach that includes both virtual and non-virtual patients. This facilitates comparison between virtual and non-virtual alternatives in a more rigorous manner than other models and programs of care evaluated in this report.

Substitution of acute inpatient services, such as for trauma

The substitution of acute inpatient services with virtual services at home is implemented widely. There is a great deal of heterogeneity applicable to this substitution (Shi et al., 2024).

One consideration is the service substituted for. There are different types of inpatient services. The classification system used by the Independent Hospital and Aged Care Pricing Authority (IHACPA) divides admitted hospital care into acute, subacute and non-acute care.

The definition of acute care used in Australia is that it is admitted care in which the primary clinical purpose or treatment goal is to:

- cure illness or provide definitive treatment of injury;
- perform surgery;
- relieve symptoms of an illness or injury (excluding palliative care);
- reduce severity of an illness or injury;
- protect against exacerbation and/or complication of an illness or injury which
- could threaten life or normal functioning;
- manage labour (obstetric);
- perform diagnostic or therapeutic procedures.

Acute care excludes care which meets the definition of mental health care (Independent Health and Aged Care Pricing Authority, 2015).

Acute care is distinguished from subacute and non-acute care because the intent is different. Subacute care is specialised multi-disciplinary care for the optimisation of a patient's functioning and quality of life (for example, rehabilitation). Non-acute care has the primary goal of support and may continue for an indefinite period.

A substitution could be for an entire admission, as is the case with the Virtual Trauma model evaluated in this chapter. Alternatively, the substitution could be for part of a total admission. For example, at the end of a hospital admission, an inpatient could be transferred to virtual care. Within NSW hospitals this could occur, not just from patients located physically within hospitals but also those admitted within hospital in the home programs. These types of substitutions are sometimes referred to as 'step down' programs (Shi et al., 2024).

However, it is not just the later part of a hospitalisation for which there could be substitution. Substitution could occur prior to surgery at the commencement of a hospital admission. An example would be monitoring and antibiotics provision at home prior to an operation (cholecystectomy) for acute gallbladder inflammation (cholecystitis) (Current Health, 2023).

A second consideration is what components of care are delivered virtually and in what combination. The care might be delivered through communication, regular phone calls and video consultations. Alternatively, there may be monitoring, either intermittently or continuously through devices, for which the data may or may not be automatically transferred to the virtual care centre. The virtual care may be supplemented by in-person home-delivered care, such as the administration of intravenous antibiotics.

A third consideration is the workforce offering the care. It could primarily be staff who would otherwise be working in hospitals, those who would otherwise be providing primary care services, or a combination of the two. The mix of staff between specialities will also differ between models, nurses, physicians, allied health providers, etc.

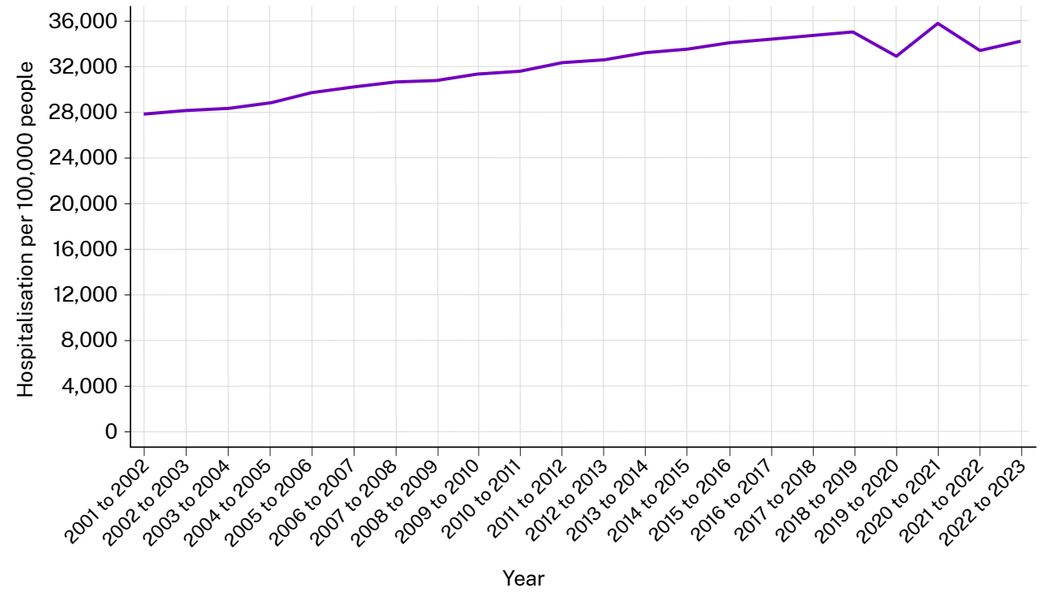
Recent systematic reviews have suggested that acute inpatient substitution services are safe (Shi et al., 2024). There is ambiguous evidence, however, about the impact on total length of stay. Some models resulted in a longer length of stay and others had a similar length of stay to a hospital admission. Similarly, the cost-effectiveness varied between models, with some being found to be cost-effective and others less so.

There in increasing demand on hospitals, including for acute care

Increasing morbidity and aging, alongside population growth, is placing greater strain on hospital services.

In NSW, there has been an increasing rate of hospitalisations over the past 20 years per 100,000 people (Figure 1).

Figure 1: Rate of hospitalisations per 100,000 persons in NSW



Source: HealthStats NSW. (https://www.healthstats.nsw.gov.au/indicator?name=-total-hos&location=NSW&view=Trend&measure=DSTRate&groups=Sex&compare=Sex&filter=Sex,Persons)

Note:: Total includes NSW public and private hospitals as well as interstate public hospitals

The **rpa**virtual models of care for specialist inpatient services

The Royal Prince Alfred Hospital is the Major Trauma Service for the Sydney Local Health District (LHD). As a Major Trauma Service, it provides on-call trauma surgeons, specialist trauma nurses, registrars, and a multidisciplinary environment.

One of the models of care delivered by **rpa**virtual is Virtual Trauma, which is the service evaluated in this chapter.

Other specialist inpatient services have been deployed by **rpa**virtual, including in both surgical and medical specialities. These are not evaluated in this report. An example is the acute respiratory model. It builds on the experience of the virtual COVID-19 pandemic response. It provides care in the community for patients with an acute respiratory infection who would have otherwise required admission. It can be provided as a substitute for hospitalisation or as a step-down from hospitalisation. It differentiates itself from other virtual inpatient substitutions by providing the services of administering IV antibiotics and monitoring vital signs within the patient's home.

Evidence to support the virtual substitution of other inpatient services is being developed. An example is the phase I/II Randomised Controlled Trial of Remote Monitoring for Acute Diverticulitis to assess safety and effectiveness. This has been completed in collaboration with the RPA Institute of Academic Surgery. The trial has concluded with positive clinical results and a formal economic evaluation is planned.

Virtual Trauma

Safe and improved health outcomes for patients

Virtual Trauma delivered improved patient outcomes, based on data from 116 patients. The most significant improvements were seen in patient's physical function, ability to participate in social roles and activities, and pain management. The data shows:

- 23% of admitted patients reported physical functions within normal limits compared to 55% of the same patient group after 6 weeks of Virtual Trauma care.
- 41% of admitted patients reported social participatory outcomes within normal limits compared to 63% of the same patient group after 6 weeks of Virtual Trauma care.
- 18% of admitted patients reported pain related outcomes within normal limits compared to 53% of the same patient group after 6 weeks of Virtual Trauma care.

Minimal changes, or a slight decline in outcomes, were seen in patient's reported anxiety, depression, fatigue and sleep disturbance.

Methodology: The PROMIS-29 is sent to patients on admission, at six weeks and three months post care.

Sustainable management of the health system

The cost associated with a patient receiving Virtual Trauma care was approximately $2,000 per person. This is less than the average cost of an occupied bed day in the Sydney LHD.

The average cost of providing the additional days of inpatient care and outpatient care that would have occurred without Virtual Trauma care was estimated at $4344.

In the scenario analysis of there being no difference in admissions between the virtual care and no virtual care options with the benefit of Virtual Trauma being limited to a reduction in the length of stay of those admitted, the average cost of provision that would have occurred without Virtual Trauma was $2217 (see Cost-consequence analysis for more detail).

Basecase

The assumptions used in the Appendix resulted in a benefit-cost ratio (BCR) of 2.1. In the scenario analysis of no difference in admissions between virtual care and in-person care, the BCR was 1.1.

Extended basecase

With the addition of the costs of travel and time for those having to attend outpatient clinics, the BCR ratio increased to 2.2 and 1.2 for the two scenarios respectively. Patients gained a value of at least $64 (or $155 in the second scenario when it was assumed that there was no difference in admissions).

Cost-consequence analysis

Under the assumptions used in the basecase, Virtual Trauma reduced the number of occupied bed days by 415 for the cohort that received treatment in 2023. Over half of this benefit was driven by assumption that admissions were less likely to occur with Virtual Trauma (see Table 1).

Applying the scenario that the admission rates were equal, there would be a reduction in occupied bed days of 177 in 2023.

Table 1: Distribution of bed-days between the two alternatives

Component	Virtual Trauma occupied bed days	No Virtual Trauma occupied bed days	Difference in occupied bed days
Not admitted into Virtual Trauma	0	238	238
Admitted for either	212	389	177
Total	**212**	**626**	**415**

Methodology: A matched case control study was undertaken on 100 consecutive patients from September 2022 to May 2023 and compared to historical controls from a trauma registry. Matching was conducted on age, sex, day of the week, mechanism of injury, trauma team activation and injury severity score. To adjust for a decreasing length of stay over time the comparator length of stay was reduced by 6%. Differences in admission rates and hospital length of stay were valued at the mean costs of admission and average bed days to generate the incremental saving associated with Virtual Trauma. For the non-admitted patients a series of allied health outpatient clinics were assumed. Only those who would be non-admitted had the benefits of time and transport avoidance applied. Only statistically significant differences were included in the basecase. The cost of Virtual Trauma is estimated using the activity-based costs associated with this model of care for patients attending in 2023 (including costs that occurred prior to 1 January 2023). All costs for individual patients were aggregated for Virtual Trauma. No discounting was applied. A scenario of assuming that there was no difference in the rate of admission was undertaken.

Limitations

The use of matching is an advantage, providing greater confidence in the comparison between groups.
A weakness, however, is that the use of matching takes the comparator group from an earlier time period – when the use of admitted services may be higher and the length of stay was longer. This analysis adjusted the calculated difference to accommodate a decreasing length of stay.

This analysis also assumed that the difference in admission rates was due to the Virtual Trauma model of care. This difference was important in generating the estimated benefit. Reducing the difference, in turn, reduces the benefits estimated.

The assumption that further care would have been undertaken by the public hospital system, rather than primary care or no care, requires further elucidation. Likewise, comparative information about the outcomes for patients would be useful.

Considerations for the future

Evaluation of Virtual Trauma benefited from the presence of a registry. This increases confidence in the findings of this evaluation.

Increased outcome information would nonetheless be useful, as well as information on the usage by patients of Virtual Trauma of other services, including primary care.

For models of hospital substitution (including Virtual Trauma), it will be important in the future to account for changes over time in admissions and length of stay. Historical information is likely to overestimate the benefits of virtual care.

Further evidence to support the substitutability of virtual care will need to be continually developed as more services are delivered in this way. This will give even greater confidence to patients and clinicians. The approach to the virtual care in acute diverticulitis is one approach, where evidence for safety and effectiveness is developed using a randomised controlled trial.

Appendix: assumptions

Alternatives and main features of the analysis

The population of interest is those who would have been treated with Virtual Trauma services, if they were available.

The alternative courses of action are:

1. Treatment of trauma with a trauma service without a virtual component at the Royal Prince Alfred Hospital.
2. Treatment of trauma with a trauma service that has a virtual component at the Royal Prince Alfred Hospital.

No discounting has been included.

Costs

Table 2: Costs

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Costs of providing Virtual Trauma	$2026.04	Use of cost data from **rpa**virtual for the Sydney LHD components. Included those with an attendance in the calendar year of 2023.	25% ($1235.24) and 75% ($2636.27) percentiles of the cost data. $2092.54 was the mean when excluding those who attended in December 2023.
Cost of occupying an inpatient bed for one day	$2308.60	Average cost of inpatient bed (dividing average admission cost by the average number of days in an admission) using Sydney LHD costing data for July-December 2023.	
Cost of non-admitted attendance	$196.10	Cost of outpatient physio tier 2 clinic attendance (40.09) using RPA costing data for July-December 2023.	

The costs associated with the treatment of trauma have traditionally been associated with higher costs. Those who are associated with virtual care are likely to require less intensive care and therefore the average cost has been used in the basecase. Excluding those who had an attendance in December 2023 had a minimal impact on the mean.

Resource usage

Table 3: Changes in resource usage

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Number of patients seen in Virtual Trauma in 2023	230	Number of unique patients in costing data for virtual care	Nil
Incremental reduction in the number of occupied bed days per patient seen in Virtual Trauma	1.80253	Calculated difference in occupied bed days adjusted for changed in length of stay	
Ratio of length of stay between 18-22 and 22-23 (B)	0.936891	Ratio of length of stay of minor chest trauma (E66B and E66C) between 2022-2023 and the previous four years	
Length of stay in the emergency department difference for admitted patients	0	No statistically significant difference found in matching analysis	145 minutes (point estimate)
Length of stay in the emergency department difference for discharged patients	0	No statistically significant difference found in matching analysis	109 minutes (point estimate)
Portion of admissions with Virtual Trauma	49%		
Portion of admissions without Virtual Trauma	79%		
Number of outpatient attendances for non-admitted patients	4.43	Mean number of distinct contacts in Virtual Trauma	

Societal benefits

Societal benefits were only counted for the attendances when the patient would not have been admitted in the non-virtual alternative.

Table 4: Monetary value of benefits to the patients

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Value of time per attendance	$39.13	Use of average cost in the Chapter 1 analysis of travel time and cost per patient ($39.13)	
Cost of travel	$29.31	Use of average cost in the Chapter 1 analysis of travel time and cost per patient ($29.31)	

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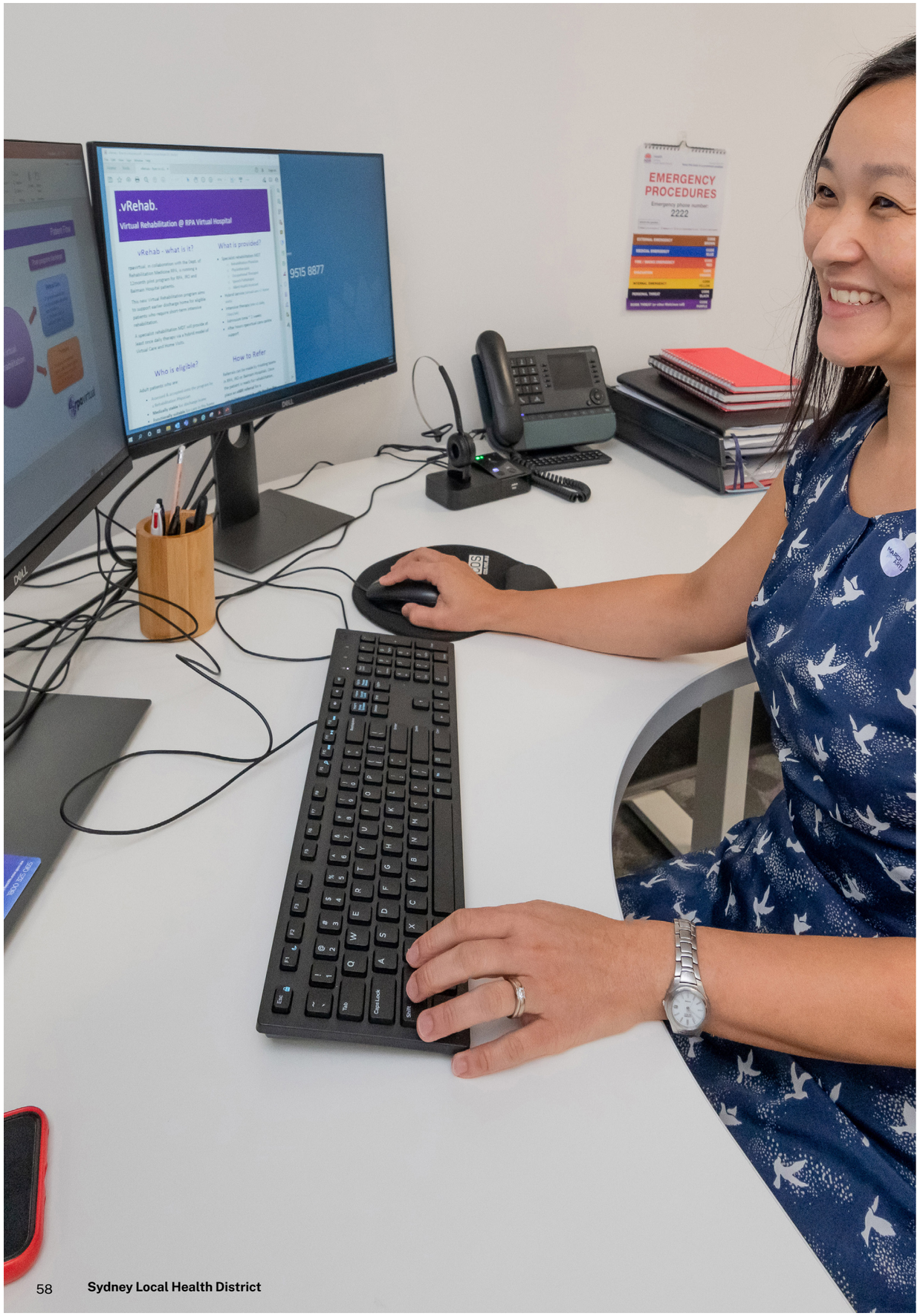

Chapter 3: Virtual Rehabilitation Service

Summary

Intensive at-home care that substitutes for specialist subacute inpatient services are of growing importance. There is an existing deficit in the availability of these services compared to the population that may benefit from them. This deficit will increase in the future with the aging of the Australian population. Beyond availability, there is also an urban-rural divide in access to these services, especially for rehabilitation.

This report found that **rpa**virtual's intensive and predominantly virtual service – vRehab - is cost saving, compared to the inpatient provision of care. While the costs of vRehab are similar to the in-person provision of healthcare, it delivers additional benefits to patients that increase the benefit-cost ratio. It saw 270 patients in 2023.

vRehab also improved equity. As at September 2024, 38 patients from beyond the Sydney Local Health District (LHD) received care through vRehab upon returning to their residence after cardiac or neurological surgery.

There was a difference in the estimates of bed days saved in the earlier and later applications of a matching approach to producing a comparator group. In other words, the estimate of how many inpatient beds were freed up using vRehab was ambiguous when using a matching approach. Estimates based on a reduction of 1.9 inpatient occupied bed days per patient suggested that vRehab freed up 513 occupied bed days for alternative uses in 2023. There has been an expansion in the complexity and variation of the patients seen by vRehab and this practice change may account for the lack of consistency in estimates of how many occupied bed days were freed up.

Improved data and a wider analytical approach would be useful to generate more future evidence about vRehab.

Substitution of specialist subacute inpatient services, such as rehabilitation

There are multiple types of admitted hospital care, as discussed in Chapter 2. These types are acute, subacute and non-acute care.

Subacute care is specialised multi-disciplinary care that aims to optimise a patient's functioning and quality of life. The Independent Hospital and Aged Care Pricing Authority divides subacute care into several categories. These categories are rehabilitation, palliative care, geriatric evaluation and management, and psychogeriatric care. In each of these categories, care is delivered by a specialist physician and with the support of a multidisciplinary team.

Admission to a subacute service may be after an acute admission, for example, after an acute admission for a stroke. Alternatively, it can occur without a preceding acute admission, i.e., the patient is admitted directly to subacute care. The admitted services are part of a continuum of care that spans outpatient care provided at facilities (ambulatory care) and at patients' homes (community care). The intensity of these services may differ. For example, rehabilitation in the home (RITH) is often considered as care that would have otherwise been delivered in a hospital.

As a proportion of total public hospital admissions, subacute admissions are a minority. Among almost 2 million public hospital admissions in NSW in 2022-23, approximately 70,000 or nearly 4% were subacute or non-acute. On average, the duration of subacute admissions is longer than acute admissions (AIHW, 2024b).

Where the services are delivered also differs. Admissions for rehabilitation care are more common in private hospitals than public hospitals. This difference is much larger per patient population that reside in major cities and inner regional areas, where private hospitals deliver most rehabilitation care. The difference is much smaller between the rate of use of private and public hospitals for rehabilitation care for residents of remote and outer regional areas (Table 1).

Table 1: Distribution of rehabilitation inpatient services by remoteness area of usual residence, public and private hospitals, 2022-23

	Remoteness of area of usual residence					
	Major cities	**Inner regional**	**Outer regional**	**Remote**	**Very remote**	**Total**
Public hospitals						
Separations	66,791	14,361	6,203	620	406	88,906
Separations per 1,000	3.0	2.1	2.1	1.9	2.4	2.7
Separation rate ratio	1.1	0.8	0.8	0.7	0.9	
Private hospitals						
Separations	299,007	46,647	11,854	369	104	359,718
Separations per 1,000	13.4	6.4	3.9	1.1	0.6	10.8
Separate rate ratio	1.2	0.6	0.4	0.1	0.1	

Source: Australian Institute for Health and Welfare, https://www.aihw.gov.au/reports-data/myhospitals/context/about-the-data

There is increasing demand for rehabilitation care services

There is a long-standing acknowledgment of the importance of access to rehabilitation services. These services may be required for people to recover functional independence, for example after surgery or a prolonged illness. These services are also essential for patient flow.

Despite the importance of subacute care, barriers to access remain. For example, palliative care in Australia has not been deployed as widely as is necessary. Although it has improved, the Australian Institute of Health and Welfare measure of timely care reports that only 21% of those who received palliative care had it commence at least three months prior to death (AIHW, 2024b). In 2019-20, it was estimated that over one hundred thousand people would benefit from palliative care and around forty thousand received specialist palliative care in the last year of life. People with cancer were more likely to receive specialist palliative care than those with other diseases (AIHW, 2024a).

Aging is driving a greater demand for rehabilitation services. This demand is expected to continue to increase. From 2015-16 to 2021-22, the increase in the palliative care admissions (29%) was almost three times that of all hospitalisations (10%) (AIHW, 2024b).

Virtual rehabilitation has been demonstrated to be effective

Telerehabilitation and virtual rehabilitation has been shown to be as effective as other methods of delivering rehabilitation care (Cox et al., 2021; Suso-Marti et al., 2021). In many cases, however, the comparator has been intensive outpatient rehabilitation (Nelson et al., 2020). The quality of evidence for some of the comparisons has been assessed as low to moderate quality (Cox et al., 2021).

There are reported benefits associated with tele-rehabilitation associated with completed rehabilitation programs (Cox et al., 2021). Cost savings for the health system and patients have been suggested when compared to in-person settings (Tousignant et al., 2015).

For some common rehabilitation populations – such as post-surgery for elective hip arthroplasty – systematic reviews suggest there is evidence that diverse rehabilitation programs may not differ in health outcomes for patients (Konnyu et al., 2023).

vRehab

vRehab acts as a short-term intensive rehabilitation service. It is a hybrid model of care involving both virtual care and home visits. It aims to have a two-week admission period before discharge from the service. Patients discharged from the service can move to other rehabilitation services within the Sydney LHD or, if the goals of the service have been met, the patient can be released from needing any further care.

This model of care was launched as a twelve-month pilot in April 2022. It was extended in 2023. Most referrals have been for rehabilitation after orthopaedics surgery.

Pre-configured iPads with a data package are loaned to patients of vRehab who do not have suitable devices available for video conferencing, or subsequently find that their own devices are difficult to use.

Assessing the benefits

Elements of admitted subacute care may generate a greater benefit within the home environment than an in-person hospital setting. Access to the intensity and quality of inpatient care at home may facilitate success for those patients who wish to have care delivered this way. That is, virtual services may improve the possibility of achieving patient and broader family goals. Virtual rehabilitation care may result in people being less disrupted in their daily lives and other activities. It may also facilitate greater engagement in physical mobilisation.

When waiting for subacute care to commence, a patient will remain admitted as an acute patient. Like other forms of virtual care, the impact of substitution of subacute services will differ according to the pressure it relieves. For example, it may free up additional capacity for subacute services or acute services, or alternatively it may allow a greater number of patients to receive the benefits of intensive rehabilitation or palliative services.

Safe and improved health outcomes for patients

vRehab was safe and effective for patients. Increasing functional independence measures scores were seen between admission and discharge from this model of care. There was an average improvement in the Functional Independence Measures of 6 between admission and discharge from this virtual service.

Methodology: Functional Independence Measures (FIM) and EQ-5D-5L surveys (among others) were completed on admission and discharge to vRehab. 202 patients had an admission and discharge FIM in the 2023 vRehab evaluation report.

Equitable health outcomes

The use of vRehab allows patients to receive specialist rehabilitation services when they might not otherwise be able to access them. Among the patients seen in vRehab as at September 2024,182 patients resided out of the Sydney LHD. Of this patient cohort, 27 were referred from cardiothoracic surgery and nine from neurosurgery – specialist services that are not widely available geographically.

Sustainable management of the health systems

Matching was undertaken in 2023 after the twelve-month pilot for 120 patients who received vRehab following an orthopaedic or stroke diagnosis. Those results suggested a decrease in inpatient attendances of 1.9 days associated with a vRehab attendance. This difference was statistically significant. This matching was repeated using 300 patients in 2024. On this occasion, there was not a statistically significant difference.

The cost associated with a patient receiving virtual rehabilitation was approximately $4,400 per person. This is less than the average cost of two occupied acute bed days or four occupied subacute bed days in Sydney LHD.

The average cost of providing the additional days of inpatient care and outpatient care that would have occurred without vRehab was estimated at $7,969. In the scenario analysis of there being no decrease in occupied bed days between the virtual care and no virtual care options, the average cost of provision was $5,372.

Basecase

The benefit cost ratio (BCR) is sensitive to differences in the results of estimating any reduction in occupied bed days.

In the case that there was a reduction in occupied bed days, the BCR was 1.81. If there was no reduction in occupied bed days, the BCR was closer to unity (1.22). This result was sensitive to the number of in-person rehabilitation services that would be replaced.

Extended basecase

In the extended basecase, the reduced number of attendances required by patients increased the BCR to 1.97 (if there was a reduction in occupied bed days) or 1.38 (if there was no reduction in occupied bed days).

Cost-consequence analysis

vRehab was found to be cost-saving (based on average costs) in 2023, if on average it reduced subacute bed occupancy by 0.7 bed days for every patient admitted to this model of care. It would also be cost-saving if vRehab, on average reduced acute bed occupancy by 0.4 bed days for every patient admitted to this model of care.

Based on having treated 270 patients in 2023, vRehab reduced the number of occupied bed days by 513 and made them available for other uses.

Methodology: Patients were matched for principal diagnosis, age, sex, and comorbidity using the Charlson comorbidity index. Patients were matched based on the ICD diagnosis of their admission immediately preceding the admission to vRehab to non-vRehab patients admitted from 2018 to 2023. Costs were sourced from the Independent Hospital and Aged Care Pricing Authority (IHACPA) and the Sydney LHD activity-based costs. The assumptions are detailed in the Appendix below. A scenario of assuming that there was no saving of occupied inpatient beds was also undertaken.

Limitations

Generally, for a health system under pressure, a lack of capacity to provide intensive rehabilitation (because of the limited availability of unoccupied bed days) would worsen outcomes for the population.

A lack of confidence in the comparator, however, limits the analysis of vRehab's impacts on the sustainable management of the health system. This is because it is unclear whether the comparator should be inpatient care, at home rehabilitation or facility-based rehabilitation.

Another uncertainty is the relative benefits that could be achieved through an intensive program of rehabilitation versus a less intensive program. More intensive programs that are provided in selected populations, such as those who have experienced a stroke, have been associated with improved outcomes (Yagi et al., 2017). For other conditions, however, meta-analysis has suggested a variety of different rehabilitation programs could result in the same outcomes (Konnyu et al., 2023).

The use of costs from the tier 2 clinics may underestimate the costs of providing in-person care. Multiple attendances per day are counted as one occasion of service and the use of the average cost may not represent the cost of provision (see the chapter on Finances for detail on the attribution rules of the tier 2 clinics).

There was a difference in the estimates of bed days saved in the earlier and later applications of a matching approach to producing a comparator group. Clinicians within vRehab suggested that more complex patients with a lengthier prior admission are being referred as this model of care matures. In these circumstances, the matching algorithm used would be biased.

Considerations for the future

The provision of intensive subacute services at home is one way of enhancing the access and equity to these services. This analysis suggests that this can be achieved at substantially lower cost than the provision of inpatient services and, at worst, at a similar cost for an entirely outpatient service.

Improved analysis and assessment of the impact of the availability of intensive rehabilitation services would improve the evidence base for vRehab. This may require assessing the impact on the entire rehabilitation service rather than a comparative analysis between receiving and not receiving virtual care.

Ideally, an assessment of the benefits of virtual rehabilitation services would include the impact on informal care and carers. A lack of support for informal carers is one reason that those who wish to be treated at home may nevertheless require in-patient care. Gaining more information and insights about this may merit future consideration.

Appendix: assumptions

Alternatives

The intervention is the admission of the patient to vRehab. The alternative is a continuation of admission for no more than 1.9 days, followed by out-patient rehabilitation. The assumption is that rehabilitation will continue as a series of outpatient visits costed by the use of Tier 2 clinics. This will be a lesser cost than a home-delivered program.

Resource usage

Table 2: Changes in resource usage

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Number of services provided in person for vRehab	22	Average number of services reported in the 2023 vRehab evaluation report	
Proportion of services delivered virtually by vRehab	95%	Proportion reported in the 2023 vRehab evaluation report	
Proportion of services associated with direct patient care	85%	Proportion reported in the 2023 vRehab evaluation report	
Length on in-patient avoidance	1.9 days	Reported in the 2023 vRehabevaluation report based on matching	0,1 and 3
Number of vRehab patients with activity only in 2023	270	From the activity-based funding administrative data at Sydney LHD	
Number of vRehab patients with activity in 2023	288	From the activity-based funding administrative data at Sydney LHD	
Average length of stay in vRehab	19.41 days	From the first to last contact in the activity-based funding administrative data.	
Number of attendances for in-person contact	10	Based on daily contact for two working weeks	4 based on twice weekly for two weeks.
Distribution between medical and non-medical attendance	8:2	Assumption	
Multi-disciplinary case conferences without patients being present	3	Based on the 85% patient contacts and 22 services provided	

Resource cost

Table 2: Changes in resource usage

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Average cost of vRehab	$4,399.47	Average cost of the 372 patients with activity recorded in 2023	25th and 75th centile ($2,122.46; $5,291.56)
Average cost of allied health rehabilitation tier 2 clinic	$284.96	Cost of 40.12 attendance at Sydney LHD	
Average cost of rehabilitation bed day in Sydney LHD	$1366.66		
	Total cost of sub-acute rehabilitation divided by total occupied bed days	$2,308.60 average cost of an acute bed day in Sydney LHD	
Average cost of rehabilitation tier 2 clinic	$516.64	Cost of tier 2 clinic 20.47 attendance at Royal Prince Alfred	
Average cost of a multi-disciplinary meeting with a medical officer	$686.5	Cost of tier 2 clinic 20.56 attendance at Royal Prince Alfred	Cost of multi-disciplinary clinic without medical officer (40.62) at Sydney LHD $453.37 and cost of multi-disciplinary clinic with medical officer at Sydney LHD $717.29

The costs of vRehab were estimated for those who admitted and discharged from the services within the calendar year of 2023. That is those who commenced treatment prior to 1 January 2023 or received treatment after 31 December 2023 were removed. This was to ensure the cost of the entire admission was captured.

Societal benefits

Societal benefits were only counted for the attendances when the patient would not have been admitted in the non-virtual alternative.

Table 4: Monetary value of benefits to the patients

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Value of time per attendance	$39.13	Use of average cost in the chapter 1 analysis of travel time and cost per patient ($39.13)	
Cost of travel	$29.31	Use of average cost in the chapter 1 analysis of travel time and cost per patient ($29.31)	

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Chapter 4: Emergency Department to Community

Summary

Improved integration and empowerment may result in many improvements for patients, carers, the health workforce, the health system and society.

The **rpa**virtual's emergency department (ED) to community model of care is targeted towards patients who would benefit from greater care co-ordination and integration who have unmet complex health and social care needs. This model is based on a time-limited, proactive and intensive virtual-based multidisciplinary approach. It was established in 2022, so long-term data are unavailable.

Potential beneficiaries of this service are identified because they require multiple ED treatments. While the identification of potential beneficiaries was successfully undertaken, only a relatively small proportion of people agreed to be enrolled. Of the 145 people identified as being eligible, 86 (60%) were reviewed for enrolment. However, most people declined to participate and only 20 patients (14%) received care, with a further ten patients in the process of being engaged to attempt enrolment. Therefore, a highly select population with chronic disease participated and received ED to Community care. These results suggest that this model may be difficult to scale up and more intensive strategies may be required to increase enrolments.

Reduced requirements for ED care suggest an improved health status of participating patients. There was a statistically significant reduction in the number of ED attendances (9.8) and admissions (2.8) per patient, based on a pre-post analysis comparing the year prior to recruitment to the year after recruitment. This is estimated to have freed up 167 occupied bed days and 30 days in the ED, assuming the benefits lasted a year. It also reduced ambulance call outs by 49. These estimates are, however, based on the weak methodology of a pre-post analysis. There is a lack of confidence in their precision.

The cost of virtual care using this model of care exceeded the average cost of the freed-up resources, assuming its benefits lasted one year. It cost $32,650 per patient to deliver. The average cost of resources saved was $26,286 per patient. If, however, the benefits lasted for more than one year, the model of care could be cost saving.

The ED to community model has the potential to improve patient care. The initial results are promising. However, three future considerations should be borne in mind. First, it needs to be understood why the model did not attract greater participation, so its potential benefits are increased and experienced by people who have chronic and often unmet health needs. There are important issues of equity and accessibility that may merit exploration. Second, better and more precise data on this model would reduce the uncertainty of the results and offer greater confidence to decision-makers. Third, the implementation of the model required effort in developing referral and co-ordination pathways and therefore the average cost per patient may be lower in the future.

Care integration for people with chronic diseases

The use of virtual care to empower people who have one or more chronic diseases to self-manage their diseases is a goal of virtual integration programs. These programs may also allow better integration of the myriad of services that exist around and support people with chronic diseases (Agency for Clinical Innovation).

A commonly cited consequence of unintegrated or siloed care is an increase in unnecessary duplication of care and avoidable complications impacting upon patients' health and welfare. Unintegrated or siloed care also increases costs for the health system. These costs include duplicated investigations and people then needing to seek care when their chronic conditions become unmanageable, via hospitalisation, ED care and/or primary care (Leijten et al., 2018). Integrating care avoids or minimises these consequences, potentially allowing preventative care and primary care to support patients and reduce ED presentations.

Integrated care places the patient at the centre of care management – patient centred care – and is a very broad concept. There are a wide variety of populations to whom integrated care could be provided and a wide range of potential programs (Rohwer et al., 2023). The programs could be conducted close to the individual (at the micro level) for example, using multi-disciplinary teams and care co-ordinators. Alternatively, they could be operationalised at the system (macro) level, for example, around policies that integrate care across organisations and sectors (Leijten et al., 2018). Integrated care policies and programs could be implemented in any of the building blocks of health systems, for example, in the workforce, service delivery, information, financing, governance or technology aspects.

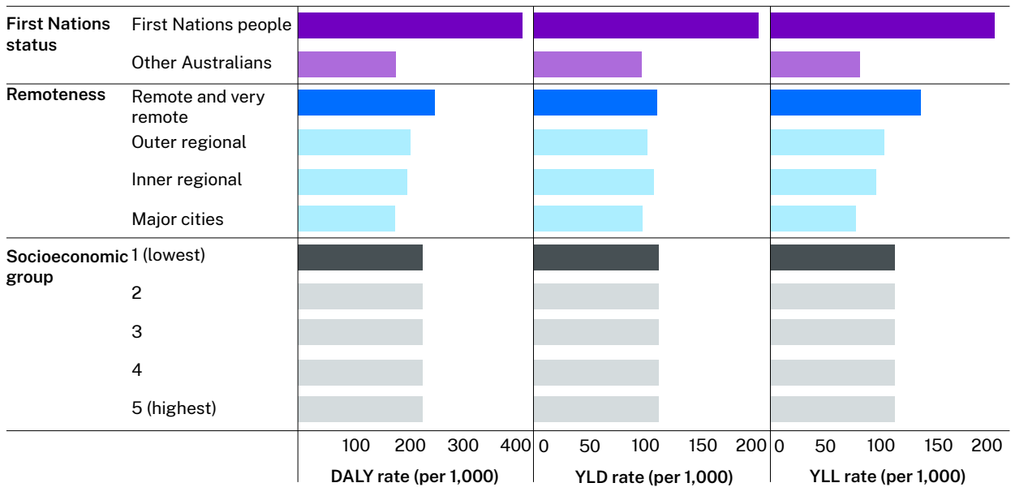
The evidence supporting the benefits associated with integrating care for those with chronic disease is mixed, partly because of the difficulty in producing valid comparisons and the length of follow-up. Most, but not all, studies suggest improved or neutral costs (85%) associated with the use of integrated care (Desmedt et al., 2016).

The evidence for co-ordination using virtual services is similarly mixed. There is evidence to support virtual care as a supplement to in-person care of patients with specific diseases, but the benefit of virtual care has not been demonstrated comprehensively (Lewinski et al., 2022). Australian studies of virtual care in populations with chronic disease have, however, shown the potential for integrated care programs to improve patient experiences and decrease costs (Carter et al., 2023). Virtual care may be particularly useful at ensuring access for rural and remote communities (Biancuzzi et al., 2023).

There is an increasing burden associated with chronic diseases

Australia, including NSW, is following the international trend of having a population that is aging and has increasing multimorbidity – the presence of more than one chronic condition. Without changes, the concern is that this will lead to preventable harm for the population and an unsustainable future for healthcare (OECD, 2023). An additional concern is that inequity compounds a greater degree of disadvantage for some people (Bauer et al., 2021). There is considerable variation in the disease burden across population groups in Australia (Figure 1).

Figure 1: Variation in disease burden in Australia (2018)

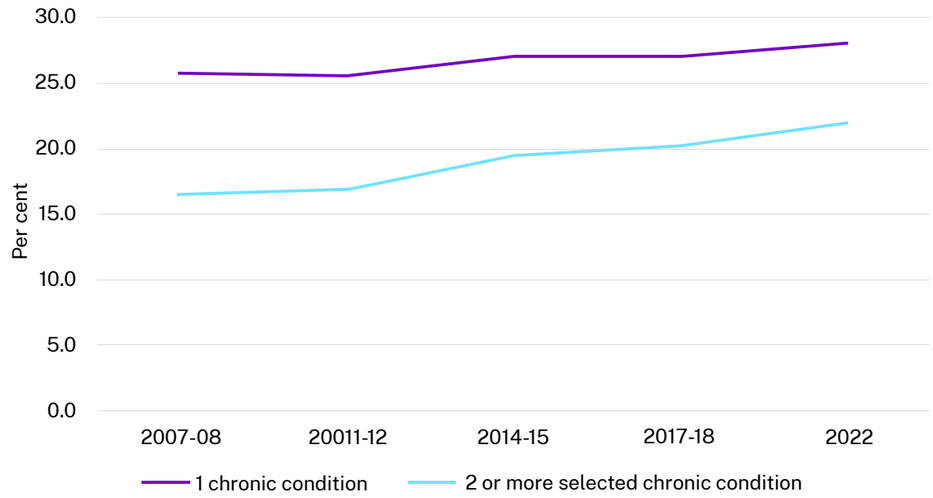


Source: ABS (Australian Institute of Health and Welfare, 2024)-Graph CC.5
Abbreviations: DALY, disability adjusted life years; YLD, years lived with disability; YLL, years of life lost

Notes: Age-standardised to the 2001 Australian Population.

More than one in five Australians live with multimorbidity and the rate is increasing. Between 2007-8 and 2022, the portion of Australians living with multimorbidity increased a third, from 16.5% to 21.9% (Figure 2).

Figure 2: Increasing proportion of Australians are living with multimorbidity



Source: AIHW (Australian Institute of Health and Welfare, 2024)- Adapted from graph CC.3

Notes: Selected chronic conditions are arthritis; asthma; back problems (dorsopathies); cancer (malignant neoplasms); COPD; diabetes mellitus; heart, stroke and vascular disease; kidney disease; mental and behavioural conditions; and osteoporosis. Includes people with a current health condition that has lasted, or is expected to last, for 6 months or more – except for people reporting diabetes mellitus and/or heart, stroke and vascular disease (which are included irrespective of whether the condition is current and/or long term). Multiple conditions belonging to the same condition type (such as mental and behavioural conditions) are treated as the one condition. For example, a person with anxiety and depression (and no other chronic condition) is treated as having one selected chronic condition.

Given these trends, there is an urgent need to develop effective models of integrated and co-ordinated care for patients with chronic disease.

Integrated and co-ordinated care model: ED to Community

Emergency Department (ED) to Community is an intervention for patients under 70 years of age with three or more complex and chronic social and health conditions who may benefit from integration and care co-ordination. Those invited to consider participating were identified by their use of 10 or more ED attendances over 12 months, or ten or more NSW Ambulance services over six months.

The patient cohort enrolled in ED to Community had multiple social and health conditions. Of the twenty patients currently or previously enrolled, 40% (6/20) had a mental health diagnosis, 10% (2/20) had an alcohol or other drug (AOD) misuse disorder, and 30% (6/20) had co-existing mental health and AOD disorders. Utilisation of urgent care services (ED and/or ambulance) was precipitated by symptoms such as chest pain, abdominal pain, sepsis, intoxication/ withdrawal and suicidal ideation. Social issues identified among the patients included: the need for National Disability Insurance Scheme (NDIS) referral; housing instability; financial stressors; legal stressors and citizenship issues.

This model of care seeks to increase the knowledge and health literacy of patients involved to facilitate a greater degree of self-management of their disease burden and connect them with appropriate services to improve their self-management over the longer-term. The initial approach was for patients to have a three-month intensive integration and co-ordination care plan, with a subsequent handover to a general practitioner for continued management. Initial case conferencing, goal identification and co-ordinating the services to achieve these goals were considered key to attaining benefits. In practice, there was a longer and more continuous involvement with patients.

This model involves a multi-disciplinary team comprising specialist general practice medical, nursing and allied health professionals. It includes a social worker and an Aboriginal Cultural Support Worker. The team uses information and communication technology available at **rpa**virtual to co-ordinate care, supplemented with face-to-face or home visits as required.

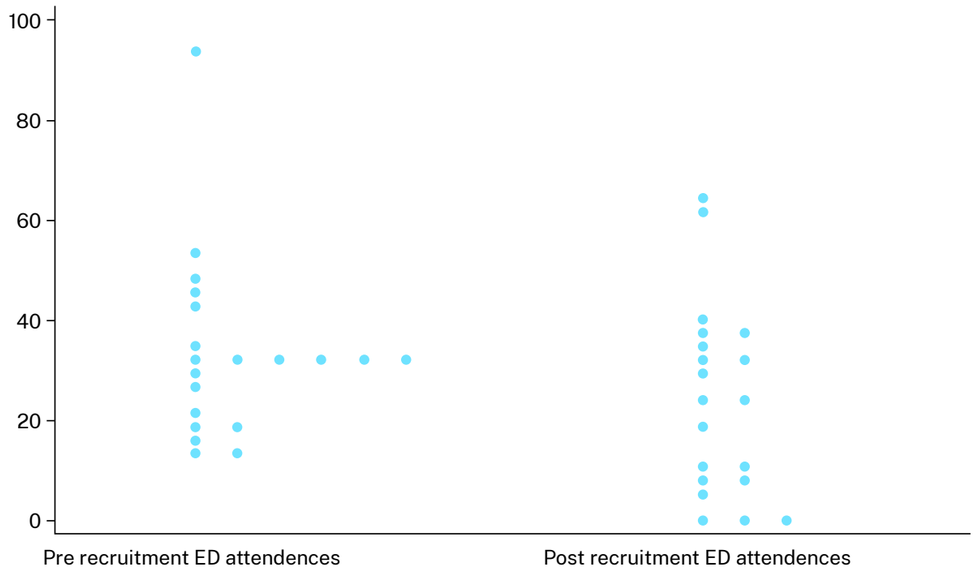
Safe and improved health outcomes for patients

In general, ED to Community delivered services for a greater length of time than first anticipated, with an average of 158 days for those who were subsequently discharged from the program. The following reflects the findings from the basecase analysis.

ED attendances reduced between the twelve months prior to recruitment compared with the twelve months after recruitment. The number of hospital admissions also reduced. These findings have been used in this report to infer that the model improved the health and social status of the patient cohort, such that they required less emergency care.

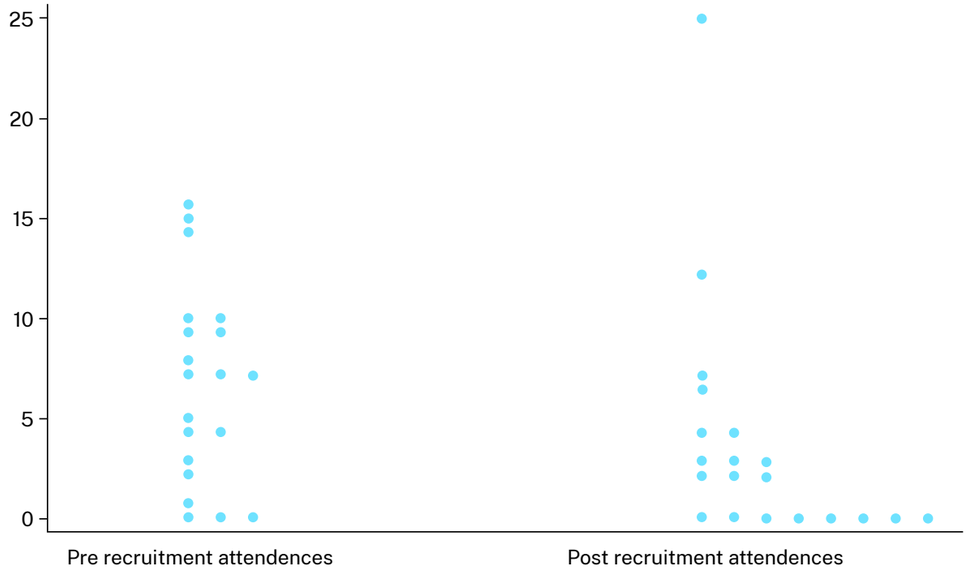
On average among the patient cohort, ED attendances reduced by ten per participant. This difference was statistically significant, both for the entire group and the subgroup with a post-recruitment period of 12 months or greater. Figure 3 demonstrates the distribution of visits prior to and after recruitment.

Figure 3: Dot plot of the number of emergency department attendances in the 12 months pre and post recruitment



On average among the patient cohort, admission reduced by 2.8 admissions (Figure 2). This was also statistically significant.

Figure 4: Dot plot of the number of emergency department admissions in the 12 months pre and post recruitment



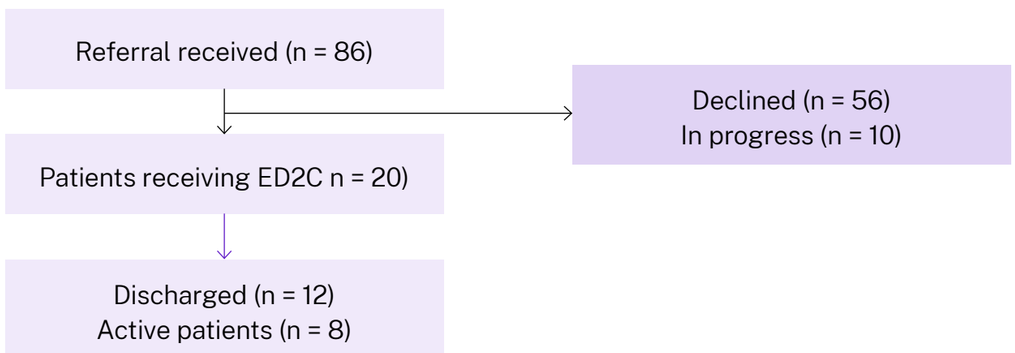
Methodology: The difference between the twelve months pre and post recruitment in the ED to Community model of care was estimated. A 95% confidence interval was used to estimate a statistically significant difference. A pre-specified number of ED visits of five and ED admissions of one was considered to assess whether an important difference was possible. A t-test of the difference was undertaken between those in the patient cohort with a complete twelve months of post-recruitment monitoring of outcomes and those with an incomplete twelve months of post-recruitment monitoring of outcomes.

Equitable health outcomes

ED to Community was designed to be beneficial to people who may not been receiving appropriate care and therefore entry into this model of care may be considered equity enhancing.

An initial screening assessment of potential beneficiaries via administrative data suggested a total of 145 patients. Figure 5 outlines the flow. Approximately 60% of the assessed population received a referral. A substantial proportion of those referred to participate declined to be involved, which limited the model's equitable impact on the population of interest.

Figure 5: Flowchart of participation of patients in the model



Sustainable management of the health system

This model of care may increase health system sustainability by moving care from hospitals to primary and outpatient care. From this perspective, every patient reduced the demand on EDs by 10 attendances and reduced the demand on hospital inpatient services by almost 3 admissions a year.

The reduction in emergency department and inpatient services was statistically significant. The reduction in community mental health services was not, however, statistically significant. Therefore, it has not been included in the above basecase analysis.

For the purpose of costing the benefits to the health system, 21 participants are included in the analysis below. (One additional participant was recruited after the flow chart in Figure 5 was created).

Basecase

The cost of providing ED to Community was $32,650 per patient. The average cost of the activity that was reduced in the model of care was $26,286 per patient. The benefit-cost ratio (BCR) was 0.81, because this model of care cost more than the activity that was reduced.

Extended basecase

The additional of the benefits to the patients of avoided travel increased slightly the benefit-cost ratio (0.83).

Cost-consequence analysis

In summary, the reduced resource use for the Sydney Local Health District resulted in 167 less occupied bed days, 30 person-days less occupancy in EDs and 49 less ambulance call-outs and transfers.

Willingness to pay analysis

If the willingness to pay of the decision makers to make available one bed day is $800, this model of care would be merit investing in from a strictly resource cost point of view.

Methodology: Resource changes were estimated for ED attendances, hospital admissions, community mental health contacts and virtual care. The results above were used to generate the potential resource reduction associated with EDs and hospital admissions. The number of contacts with community mental health care was estimated from electronic health records. Only statistically significant results were used in the basecase analysis. The costs used in the ED substitution analysis were used, and the conservative assumption of no admissions after ED was used. The cost of admissions were based on the IHACPA data portal, as once community mental health (which used the Tier 2 clinic code of 40.29). The cost of the ED to Community model was based on the attributed costs from chapter 5 (the Urgent Care chapter). Participants with an attendance in December 2023 were excluded and the benefits of the model was assumed to last one year in the basecase. Time and transport savings for the patients in the extended basecase was only applied to the ED attendances.

Limitations

A lack of a valid comparator is a weakness of any evaluation and remains so for this analysis. The pre-post nature of the comparison is a weakness. If the requirement for care was likely to fall in the subsequent year for patients, this methodology will over-estimate the benefit of this model of care.

Additionally, the number of participants in the model was low, reducing the confidence in its transferability or scalability.

Another limitation is that the administrative data upon which the analyses are built only corresponds to activity that occurs within the Sydney LHD. Movements to (before recruitment) or from (after recruitment) would bias the results.

Unfortunately, there were no patient reported outcome measures available in evaluating this model of care, so there is no evidential basis to evaluate patient experiences.

Additionally, the resources that would have been provided from primary care and other services, such as the NDIS and housing services, were not available and have not been included. This analysis cannot, therefore, be used to infer the societal benefits of this model of care.

Finally, a key piece of missing information is whether participation in this model of care resulted in medium to longer-term improvements in health status. If data on the benefits of this model extended beyond a year, then it is more likely to be found to be cost effective. Alternatively,

provided the costs are correct, then only a small increase in the quality of life of participating patients would result in this model becoming cost effective.

Considerations for the future

The benefit of this model is uncertain. The basecase benefit-cost ratio was 0.81, associated with reduced hospitalisations and reduced ED presentations. This point estimate suggests the improved health of participating patients and the freeing-up of health system resources. Small and reasonable changes in the assumptions of the analysis, however, suggest this model of care could be evaluated as cost saving or cost ineffective.

Uncertainty over the benefits and cost of ED to Community requires attention. Improvement in the model's evidential foundation could be achieved by design and data collection changes, such as a longer follow-up period of participating patients and a more precise measurement of its expected benefits. This includes understanding the health and other benefits of the model and measuring the broader health and social resource changes and costs associated with it. A more advanced methodology than short-term pre-post analyses would also be advantageous.

Participating patient engagement with this model of care was almost double the originally envisaged 12 weeks. The highly select nature of those recruited limits the generalisability and scalability of this model. Currently, most people potentially eligible to participate do not engage. Understanding why this has occurred is important. Given this experience, re-considering models of care should be undertaken and changes considered. For example, more hybrid models if access to technology and digital literacy is found to be a concern for potential participants, or changes in the composition of the multi-disciplinary team for a longer involvement with patients.

This model selects patients for complexity, where traditional health services struggle to achieve efficiency and quality of care. Clinicians working within this model must upskill in health service knowledge and develop professional networks to address needs unmet by the traditional systems. The introduction of this model also required innovation in referral and treatment pathways. Discussion with **rpa**virtual staff suggested that these types of investments would not be required to the same extent in the future. If so, some of the model's initial costs may decrease over time, thereby enhancing the efficiencies of ED to Community in the longer term.

Appendix: assumptions

Resource usage

The main assumption made in this analysis is that, for those participants who participated less than a year post recruitment, the consumption of health resources over the year after recruitment will be in the same ratio as that which occurred up to this point. The estimate of resource consumption is calculated by multiplying the actual resource consumption to achieve a full year. Full case completion (those that have had a year post recruitment) is used as an alternative. This alternative does have some biases. These biases include participants being more likely to be the first recruited and their treatment having occurred earlier in the time span of the model, minimising the benefit of any learning that may have occurred over that span.

The data extraction occurred on 15/06/2024 and the results generated from electronic health records. The reduction in resource usage was assumed to be that calculated in the section on Safe and improved health outcomes for patients. Only statistically significant results were included in the basecase analysis.

Table 1: Changes in resource usage

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Change in number of ED attendances	9.83	Point estimate of the difference between pre and post analysis	The lower and upper bounds of the 95% confidence interval (2.06 and 17.61)
Change in the number of admissions	2.85	Point estimate of the difference between pre and post analysis	The lower and upper bounds of the 95% confidence interval (0.64 and 5.05)
Change in the number of community mental health attendances	0	Non-significant difference between pre and post analysis	The point estimate of 0.81 increase in community mental health attendances and see below.
Proportion of ED attendances associated with an ambulance transfer	23.8%	Ratio of ambulance transfers to emergency department attendances	0% - assumption on no ambulance transfer

Table 2: Time variables associated with resources

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Length of stay in ED	207 minutes	As discussed in Chapter 5	Nil
Length of stay for admissions	2.79 days	Average length of stay for acute admissions in Sydney LHD in the period July to December 2023	2.11-3.07 – being the minimum and maximum average length of stay across the LHD in NSW in July to December 2023
Length of benefit	1 year	Assumption	5 years
Discount rate	0%		3%, 5% and 7%

The benefits associated with the model are assumed to continue for a year before ceasing. Changes in self-management may be assessed as continuing for longer and a length of benefit of five years may be worth considering. In general, no discounting has been applied, because all the costs and benefits have been assumed to occur within a small period of time (usually one year). Assuming that benefits would occur over multiple years, discounting has been undertaken at 0%, 3%, 5% and 7%. The results are shown in Table 3. Discounting has a minimal impact on the benefit-cost ratio. If the benefits persist for more than one year, then the ED to Community model of care is cost saving.

Table 3: Discounted benefits associated with assuming five years of ED to Community model benefits

	Year of benefit						
Discount rate	1	2	3	4	5	**Total benefits**	**Benefit-cost ratio**
0%	$26,286	$26,286	$26,286	$26,286	$26,286	$131,430	4.0
3%	$26,286	$25,520	$24,777	$24,055	$23,355	$123,994	3.8
5%	$26,286	$25,034	$23,842	$22,707	$21,626	$119,495	3.7
7%	$26,286	$24,566	$22,959	$21,457	$20,054	$115,323	3.5

Implications of using full case completion

Using the full case completion rate increases the benefit of the ED to Community model. Those who had been discharged from ED to Community had a greater decrease in admissions (3.9) and a similar decrease in ED visits (9.8).

Costs

Costs were sourced from the cost data of **rpa**virtual, Sydney Local Health District (SLHD), IHACPA and NSW ambulance.

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Cost of providing services through ED to Community	$32,650 per participant	Calculated using the costs from **rpa**virtual until November 2023. Excluded those who had an attendance in December 2023 as assumed not to have completed course of care	Used 25% ($1,128) and 75% ($48,411) percentile.
Costs saved from prevented ED attendance	$599	As discussed in Chapter 5	
Costs saved from prevented admissions	$6,441	Average cost for acute inpatients from July to December in Sydney LHD	$6,987 -Calculated using the IHACPA benchmarking portal. Using the average cost for admitted patients for Sydney LHD, increasing by 5.2% for the first year and then 6% per annum
Costs saved from prevented ambulance attendance	$882	As discussed in Chapter 5	

The results were sensitive to the assumptions made about the costs.

Utility and quality of life implications

The health-related quality of life is assumed to improve with the introduction of co-ordinated care. The improvement in the health-related quality of life is assumed to be 6%, that is, an increase in the quality of life of 6% for the year. Using these assumptions, the net increase in the quality adjusted life year (QALY) was 0.05 and the cost per QALY gained was $130,945. This is high relative to other interventions in the health system but not unreasonable, considering the characteristics of the populations eligible for (and who participated in) this model of care. Lowering the assumed health-related quality of life increased the cost per QALY.

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Utility value in the absence of co-ordinated care	0.81	Agborsangaya et al. (Agborsangaya et al., 2013)	0.73 Keramat et al. (Keramat et al., 2024)
Relative improvement with co-ordinated care	0.06	Rocks et al. (Rocks et al., 2020)	0.05 to 0.08

Societal benefits

Table 1: Monetary value of benefits to the patients

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Value of time per travel attendance for ED	$18.06	As discussed in Chapter 1	Use of average cost in the chapter 1 analysis of travel time and cost per patient ($39.13)
Cost of travel for ED attendances	$5.05	As discussed in Chapter 1	Use of average cost in the chapter 1 analysis of travel time and cost per patient ($29.31)
Value of time per hour avoided being spent in the ED	$19.62	As discussed in Chapter 1	

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Chapter 5: Virtual Urgent Care and Emergency Department

Summary

The Virtual Urgent Care and Emergency Department (referred to as 'rED') is a multi-disciplinary emergency department substitution program delivered by **rpa**virtual. It reduces the demand on the physical and human resources of emergency departments in Sydney Local Health District.

rED improves the flow of patients to and through the emergency departments at several points using different models of care. These models are delivered in combination with Sydney District Nursing (a **rpa**virtual service), NSW Ambulance and paramedics, and emergency department staff. These models differ in their impact on emergency departments and ambulance services.

The staff involved in rED are delivering care both in central Sydney and in Far West NSW (Broken Hill). The rED program has been successfully implemented for patient care and those that use it have reported that they value their experience.

The program improves patient equity of access to experienced ED clinicians. Other benefits include the efficient use of ED staff expertise and the reduced use of infrastructure. For every fourteen patients seen via rED there was freeing up of one space in the emergency room for a day. The value of these benefits is likely to increase in the future as pressure increases on ED services.

In 2023, the volume of services was relatively low within rED and subsequently the cost per service was relatively high. The benefit-cost ratio was less than one for some of the models. Other programs of virtual ED care in Australia have reported substantial growth and there is no reason to expect that this would not occur for rED. This growth will be required for the program to become cost effective in the medium to longer term.

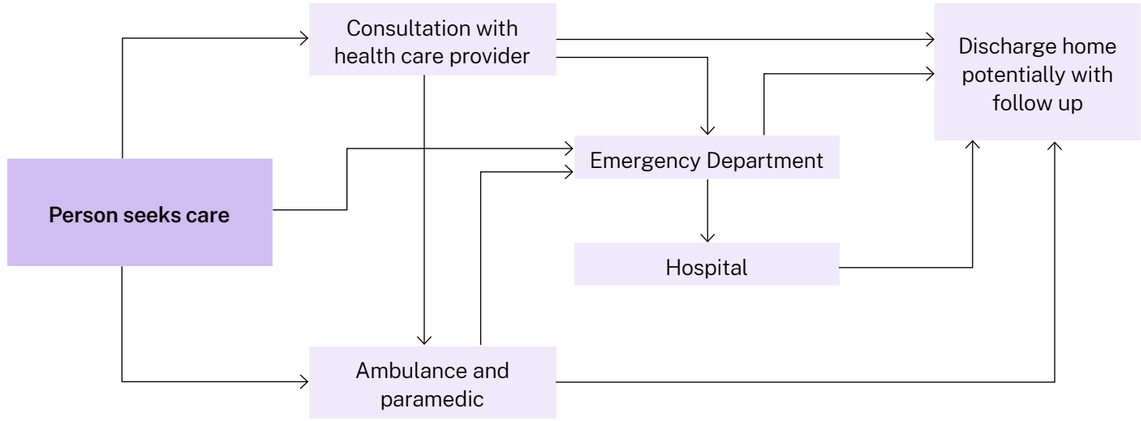
Emergency Department substitutions, such as the Virtual Urgent Care and Emergency Department

Emergency departments are a key component of healthcare in Australia. They provide care over a 24-hour period, seven days a week. They are available for urgent care of a wide range of conditions. When patients attend an emergency department they are triaged by the level of urgency – with a score of one to five, with one being those who require treatment immediately with a life-threatening condition, and five for those with less urgent conditions (NSW Health, 2022).

Emergency departments are linked to both hospital and non-hospital services. Increasing stress and strains in the health system before and after servicing by an emergency department impacts service provision. Vice versa, stress and strains in the emergency department impacts other parts of the health system. For example, a lack of availability of hospital beds in which to transfer patients increases the number of patients in the emergency department. This is known as "access block". This may lead to a situation in which patients arriving via ambulance cannot be transferred into an emergency department and clinical care cannot be transferred from the paramedics to the hospital staff. This is known as "ambulance ramping".

A simplified version of common flows within the health system can be seen in Figure 1. The number of patients in the emergency department depends on the flow into and the flow out of the emergency department.

Figure 1: Patient flows to and from the emergency department



Performance and pressure in the emergency department will increase when the number of patients requiring care in it exceeds its available resources. Three broad approaches to reduce this pressure are available:

1. Reduce the number of patients who seek care in the physical environment of the emergency department. Examples include increasing primary care afterhours coverage or providing alternative pathways for specialist care for urgent conditions.
2. Increase the availability of the resources to service the demand. Essentially, this is increasing the size of the emergency department to match the level of supply of services to the demand for these services. Examples include more emergency department beds and staff.
3. Increase the transfer out to hospital beds or other discharge destinations. Examples include fast-track programs for specialist care or inpatient care or increasing the number of available beds in the hospital.

Emergency department performance is measured in different ways to reflect elements of these three approaches. Emergency treatment performance is measured by the proportion of emergency department patients who spend less than 4 hours in the emergency department.

NSW Health's target is for 81% or more of all patients to spend less than four hours in the emergency department. For patients who are subsequently admitted into hospital, the target is for at least 50% of patients to spend less than four hours in the emergency department. Time to treatment is the time from arrival to treatment initiation and is based on the triage category: for example, the goal for triage category one is two minutes, while for triage category three it is 30 minutes (Emergency Care Institute). Transfer of care is the movement of responsibility from the ambulance paramedic to the emergency department, which involves physically moving the patient and the paramedic being free to move onto other duties. The NSW Health target is for 90% of patients to have their care transferred in 30 minutes.

There is increasing stress on emergency departments

NSW

The recent NSW Bureau of Health Information report found that the number of emergency department attendances across NSW between January-March 2024 was the highest it had been since reporting began - with over 800,000 attendances in three months. Likewise, more patients (almost 200,000) arrived by ambulance to emergency departments than had ever been recorded previously (Bureau of Health Information, 2024).

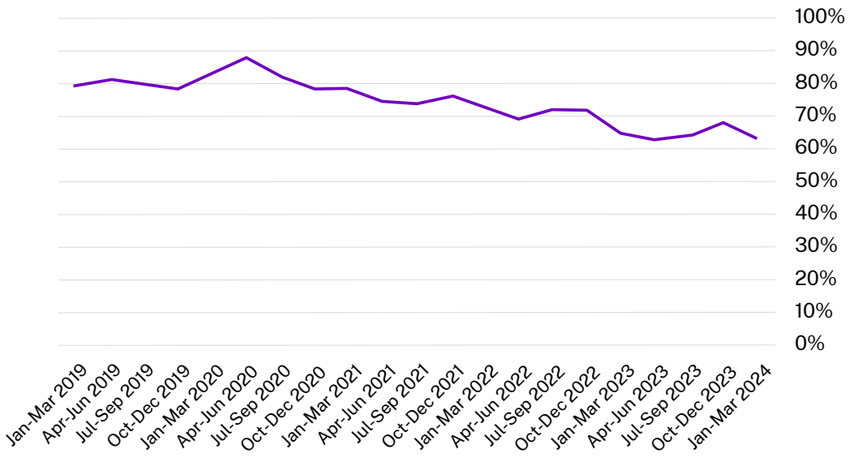
Increasing activity and pressure across NSW public hospital emergency departments can also be seen in the performance figures. For those patients arriving by ambulance, almost 80% had their care transferred within 30 minutes, with approximately 10% waiting 57 minutes or more (Bureau of Health Information, 2024). Approximately two-thirds of patients had their treatment started according to the targets. Less than 60% of patients spend four or fewer hours in the emergency department and over 10% of patients spend over 10 hours there.

Sydney Local Health District (Sydney LHD)

A similar picture emerges from data related to the Sydney LHD.

Figure 2 shows a reduced proportion of patients who were seen and discharged within four hours, from around 80% in 2019 to 60% in the first quarter of 2024. This figure only reports the results for those who were not admitted to hospital, that is, those who were treated and discharged from the emergency department.

Figure 2: Sydney LHD - percentage of treated and discharged patients completed in 4 hours (only those not admitted)



Source: BHI
Note: Includes only Sydney Local Health District.

Virtual Urgent Care and Emergency Department (rED)

The rED includes several models of care involving emergency department and ambulance substitution. These occur at multiple different points from the moment urgent care is considered and involve different actors, with potentially different impacts.

Current models of care include:

- review and treatment with Sydney District Nursing in patients' homes;
- review and treatment with paramedics in patients' homes and/or review and treatment in association with the NSW Ambulance Virtual Clinical Care Centre – NSW Ambulance Referrals;
- review and treatment after registration at the Sydney LHD emergency departments – the Virtual Hub Pilot in RPA Hospital; and
- review and treatment within the Broken Hill Emergency Department.

These models involve a degree of interaction between a healthcare provider or institution and the person seeking care. Generally, there is a referral or registration prior to review. There are exclusion and inclusion criteria for those requiring face to face care or immediate hospital care. One criterion for those models administering care in the community is that the patient is deemed appropriate for virtual care by the referring clinician.

The population of interest for evaluation in this part of the report is patients who receive emergency department expertise and care as a substitute for attending an emergency department physically for care.

The rED usage is the current (June 2024) operating hours. These are usual business hours of Monday to Friday. The most common use of the emergency department substitutions was through the virtual hub in RPA Hospital (79%).

The rED usage was relatively limited in 2023, with an increase in late 2023 associated with the implementation of the Virtual Hub Pilot and Broken Hill models of care. The estimates in this analysis are based on the results of the 440 attendances in 2023. The number of attendances has grown in 2024. For example, the average number of attendances per month at the Virtual Hub was 54 in 2024.

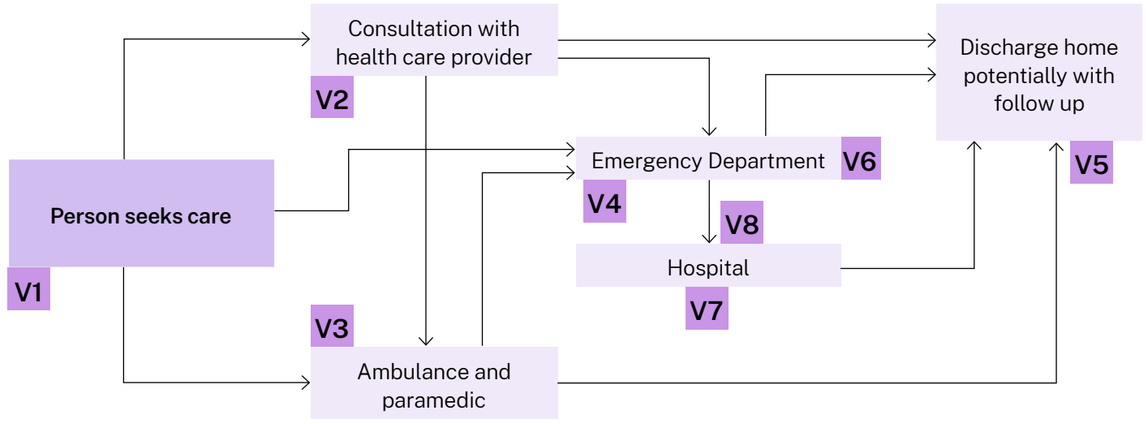
Anticipated future changes are likely to involve increasing access to virtual care at each of the points discussed. Increasing volume of virtual services may result in improved cost-effectiveness as the fixed costs are spread over a larger number of recipients.

Virtual services

Virtual services can be used to improve each of the three areas discussed above (before, around and after the emergency department) resulting in better performance within the emergency department. Eight types of virtual services have been identified (V1-8) (see Figure 3).

The models of virtual emergency department care that divert patients before or around emergency department care will generally target patients with non-life threatening and lower acuity presentations (Kelly et al., 2024). The modalities of the virtual emergency can differ, for example telephone versus video. The numbers of referrals can start relatively low and then increase quickly (Kelly et al., 2024). Some of these models have been successfully deployed in Australia and beyond (Kelly et al., 2024; Le et al., 2023).

Figure 3: Alternative virtual care models associated with a reduction in emergency department pressure



Prior to the emergency department

V1-Virtual services could be delivered to patients before they seek care from another healthcare professional. Examples include patient-initiated virtual emergency services. Potentially, this could divert demand from emergency departments, other healthcare providers and ambulance services.

V2-Virtual services could be initiated on referral from a medical provider, so the patient seeks care from a medical provider and then is referred to virtual emergency services. Potentially, this could reduce demand for emergency and ambulance services. The initial consultation could be in the patient's usual residence, for example, a Sydney District Nursing home appointment.

V3-Virtual services initiated by paramedics or ambulance services. Depending on whether an ambulance has been dispatched, this may reduce the demand for emergency department services. It may also be associated with less ambulance and paramedic time spent in the emergency department in situations of ambulance ramping.

Around entry and exit to the emergency department

V4 – Virtual services near or around the emergency department. For example, the use of virtual care for those on the emergency department waiting list. This is likely to improve the throughput of the emergency department.

V5 – Virtual services associated with the usual management of patients from an emergency department. This may improve the throughput of the emergency department and divert patients away from it. For example, an emergency department or other healthcare providers could refer to a virtual fracture clinic, such as the clinic within **rpa**virtual, potentially speeding up the disposition of patients.

V6 – Virtual services within the emergency department can be offered with specialist or register availability to consult with colleagues. This is likely to increase the level of experience and capacity within the emergency department.

Admission to hospital

V7 - Emergency department performance can be improved by eliminating access, freeing up the greater use of hospital beds. Virtual alternatives to hospitalisation within **rpa**virtual include Virtual Rehabilitation, acute respiratory, virtual diverticulitis and Virtual Trauma.

V8 - Allowing an admission to hospital to be initiated virtually before a person is located physically in a hospital. For example, a virtual admission for acute cholecystitis could involve a patient being admitted, treated virtually at home with antibiotics and monitored before being physically brought to hospital for an operation.

A combination of these services, including both of their virtual and non-virtual components, may be necessary to ensure high quality patient care and improve emergency department performance.

Considerations in assessing virtual urgent and emergency department care

It is worth considering the broader health ecosystem in assessing the benefits of virtual urgent care, in particular, the relationship between emergency departments, hospitals and pre-hospital ambulance and paramedic care.

Many low-acuity patients are seen and discharged relatively quickly in the Australian healthcare system. Therefore, speeding up the movement of patients from the emergency department to the hospital, thus relieving “access block”, may be of greater benefit than diverting patients entirely from a physical emergency department.

The use of costs for the average patient, even adjusted by the triage category, may overestimate the benefits of virtual care. For this reason, the focus is on patients who are seen and discharged, rather than the average patient, as the comparator for virtual urgent care.

A reduced waiting time for accessing care is likely to be associated with successful implementation of a virtual urgent care program. This behavioural change may increase the number of patients accessing care because they perceive the benefits of care not to exceed the costs, even in a crowded health system.

Positive patient experiences of rED

Most patients responding to the patient experience survey had positive experiences of rED. Specifically:

- 87% rated their care as excellent or good;
- 87% felt confident in the safety of their virtual treatment and care;
- 83% would recommend virtual urgent care to family and friends;
- 80% agreed that the video conferencing system was easy to use;
- 77% would use virtual urgent care again if given the choice;
- 77% agreed virtual urgent care made it easier for them to get treatment; and
- 70% felt their virtual care appointment was the same or better than a traditional in-person appointment.

There were also benefits for patients in a reduced time spent seeking care. This differs according to the type of virtual emergency service used within rED.

In general, there was a high rate of acceptance for rED virtual care. For example, the rate of acceptability was 78% for the first 145 patients referred by NSW Ambulance and paramedics.

The value for patients includes reduced time in the emergency departments. Depending on the type of virtual service the benefit for the patient is between $33.35 and $54.14 (see Table 2).

Safe and improved health outcomes for patients

There are benefits of virtual emergency medicine in facilitating access to care within Australia and overcoming the barrier of geographical distance (Leonny et al., 2024). The evidence is scant that telehealth alone solves overcrowding in emergency departments (Leonny et al., 2024).

Avoiding overcrowding has been associated with improved mortality, longer in-patient lengths of stay and decreased adverse events such as medication errors (Eidsto et al., 2024). These benefits accrue not only to those who receive virtual care but also to patients in physical emergency departments who consequently experience less overcrowding because of virtual care.

Another virtual care program in Australia found a reduction of about 70% in the transfer of patients to the emergency department, as well as a relatively low rate of return to the emergency department after treatment (Kelly et al., 2024).

rED

rED reduced the time and exposure of patients to crowding in a physical emergency department. It also reduced the burden of distance and the requirement to travel, thereby potentially providing faster and more equitable access to care and expertise.

There was a low rate of emergency department return for the patients by the emergency department substitution services delivered by **rpa**virtual. There was only a 2% re-representation rate in the first 72 hours, with no hospitalisations within this group for those seen in the virtual hub (184 people).

Rates of diversion of patients from emergency departments were consistent with the literature, ranging from 75-80% for the NSW Ambulance referral pathways.

Equitable health outcomes

Improved and more equitable health outcomes are likely to be associated with the support of staff at Broken Hill Base Hospital. This service provides rED consultant access and advice to a group of patients who would not have otherwise received it.

Engaged and supported staff

Beyond the staff in **rpa**virtual (discussed in Chapter 1), the rED models of care provide support to first responders across hospitals and the broader health system. This includes the paramedics and emergency department staff at Broken Hill.

Sustainable management of the health system

Virtual care can reduce the strain on hospitals, including overcrowding in emergency departments (Leonny et al., 2024). In the short term, there is unlikely to be a change in the physical infrastructure and the staffing of emergency departments. Accordingly, the implementation of virtual care is likely to be associated with increased performance, but not with reduced total health expenditure. However, the financial benefits over the longer-term could be more substantial, provided sufficient scale can be achieved. This is because virtual care could be provided instead of increasing, replacing or maintaining the physical infrastructure of emergency departments.

An economic evaluation of a Victorian model of care demonstrated that virtual emergency departments were potentially cost effective. The reduced use of ambulance transfers was found to be an important component of the calculated return on investment in this evaluation (Le et al., 2023).

rED

The benefits of rED differ according to where the virtual care intervened. Generally, the further up the schemata virtual care occurred in Figure 3, the less the substitutability. This can be seen in the empirical results: the substitutability of Sydney District Nursing is approximately two-thirds, and the virtual hub is assumed to be 100%.

Table 1 shows the various types of health system resources that are or can be freed up by the various models of care administered by rED. Only the Sydney District Nursing model of care is assumed to avoid an ambulance call out. Most of the other virtual emergency department models intervene after an ambulance has been dispatched or a person has attended a physical emergency department.

Table 1: Types of resources freed up by virtual urgent care models

Model	Ambulance call out	Ambulance travel	Ambulance ramping	ED time
Sydney District Nursing	Yes	Yes	Yes	Yes
NSW Ambulance Referral	No	Yes	Yes	Yes
Virtual Hub	No	No	No	Yes
Broken Hill	No	No	No	Yes

Table 2 shows the resource savings per attendance that are freed up by the various models of care administered by rED. These savings are estimated using the assumptions outlined in the appendix. Each has been adjusted by the substitutability of services. For example, one-third of those patients seen using the Sydney District Nursing model will subsequently be transferred to an emergency department.

Table 2: Resource savings per attendance

Model	Ambulance call out	Ambulance travel	Ambulance ramping	ED time
Benefit	Ambulance call outs reduced	Kilometres of ambulance saved	Minutes of ambulance ramping time saved	Minutes of ED time available for other patients
Sydney District Nursing	0.66	7.3	10.7 138	
NSW Ambulance Referral	0	3.8	12.8	166
Virtual hub	0	0	0	102

The implied savings per virtual model of care attendance associated with the resource use is shown in Table 3. The savings are driven mainly by the avoidance of ambulance costs associated with review and transportation of the patient.

Table 3: Implied dollar savings per attendance

Model	Ambulance call out	Ambulance travel	Ambulance ramping	ED time	Total
Sydney District Nursing	$560	$39	$81	$399	$1,079
NSW Ambulance Referral	$0	$32	$97	$479	$605
Virtual Hub	$0	$0	$0	$599	$599

Basecase

In 2023, the cost of providing rED virtual models of care exceeded the savings made for most but not all models. The cost of providing services was approximately $1,014 per attendance.

In terms of the average cost of displaced services the benefit-cost ratio of virtual emergency care ranged from 1.06 for the Sydney District Nursing to 0.59 for the Virtual Hub.

Extended basecase

The benefit-cost ratio improves with the inclusion of patient time, with the Virtual Hub benefit-cost ratio increasing to 0.62.

Cost-consequence analysis

For every nine (NSW ambulance) to fourteen (Virtual Hub) patients seen via rED, there was freeing up of one space in the emergency room for a day.

Willingness to pay analysis

If decision-makers are willing to pay $150 (NSW Ambulance) or $250 (Virtual Hub) to reduce the occupancy of the emergency department by one person for one hour, then rED would be the preferred option.

Methodology: The benefits of the patients seen in each of the models of rED were estimated compared to seen and discharged patients of the same triage category. This was initially calculated as ED minutes and ambulance time and then converted in dollar amounts using the data in the Appendix. For the extended basecase only the difference in time within the emergency department was used.

Limitations

The results were sensitive to assumptions around the resources savings per attendance and the proportion of substitutability. If the costs avoided were higher than used in the analysis (for example, the virtual care prevented patients from subsequently being admitted to hospital), the cost-benefit would be more favourable.

These estimates do not include the dynamic benefits of improving flow through emergency departments. For example, reducing the number of patients in the emergency department may speed up the transfer of patients from ramped ambulances to the emergency department care. It also assumes that all patients seen and treated by the virtual services would have been discharged. From that perspective, the results of this evaluation may be regarded as conservative.

Considerations for the future

As the evidence shows, different models within rED intervening at different points between care being sought and patients being discharged result in different costs and benefits for patients and the health system. The assumption made in the analysis is that, without the presence of virtual care, patients would be seen in the emergency department. This assumption will be tested as the volume of virtual services grow and if virtual urgent care services are introduced and offered to the public without involvement of another healthcare provider.

The number of virtual urgent care services provided in 2023 was relatively limited and this is reflected in a high cost per service provided. It is assumed that increasing volume in the virtual emergency department will be at a lower marginal cost. The marginal cost is the cost of providing an additional service. Service volumes would need to increase by 70% (for NSW Ambulance Referral and Virtual Hub models) to become cost neutral, assuming that there is no increase in resources to accommodate the increased volume. At the growth rates seen in virtual emergency care (65%), this may take a year to accomplish.

While increasing the volume of activity without increasing resources may be possible in the short term (while there is spare capacity), it is unlikely to be possible in the longer-term. Different marginal costs of services have been estimated from the activity-based cost data of **rpa**virtual, specifically the lowest cost of provision of an individual emergency department substitution service in 2023 or the lowest average monthly cost of provision of emergency department services over 2023. A tripling of activity from 2023 would be required if the marginal cost of virtual urgent care is approximately $400.

The activity in rED has already increased in 2024 and may increase significantly in the future with the expansion of virtual urgent care services announced by NSW Health (NSW Health, 2024). This expansion is likely to lower the average cost associated with rED.

When virtual services are delivered in volume they may substitute for non-emergency department attendance, for example, urgent or non-urgent usage of general practitioner services. The demand for an urgent service without user charges will increase as the waiting time to access those services decreases (Strobel, 2024). In Canada, Strobel estimated that the impacts would be relatively small for emergency departments – 2% increase for a 30 minute decrease in waiting time but higher for lower resourced urgent care centres where 15% increase occurred (Strobel, 2024). The changes were in less acute patients. If this occurs the substitutability of the virtual care services for in-person ED services will decrease.

A comprehensive evaluation of virtual urgent care services would ideally include both the impact on in-person emergency services as well as the impact on urgent care services provided by primary care physicians.

Appendix – assumptions, data sources and sensitivity analysis

The modelling of the impact of the rED is based on a series of empirical data sources and assumptions. These are detailed below as is the impact of the use of plausible alternatives in the sensitivity analysis.

The economic evaluation is a cost-minimisation exercise, with the assumption that patient outcomes are similar between the alternatives. This underestimates the benefits of improved performance that would be associated with reduced overcrowding for patients who have not had rED care. The sensitivity analysis is a series of one-way analysis conducted by altering specific parameters.

The monetary figures have been adjusted to represent the full year of 2023. Analysis was conducted in Stata 18.5 before modelling and sensitivity analyses were conducted in Excel.

Distance and time

The value of time is based on 40% of the wage rate for non-business travel, consistent with the NSW for Transport guidelines (Transport for NSW, 2016). This is less than the figure used in the Productivity Commission analysis of the benefits of digital technology in healthcare which used the higher figure of the participation rate of the labour force to adjust the average wage (Productivity Commission, 2024). Distance and travel time were calculated using the latitude and longitude of the address of the patient and RPA emergency department using the "georoute" command in Stata, unless otherwise noted.

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Full time adult earning – ordinary time	$1863.45	Average of seasonally adjusted figure for May-2023 ($1838.10) and Nov-2023 (1888.80) (ABS, 2023)	
Nil			
Ordinary hours of work	38	Fair Work Ombudsman (Fair Work Ombudsman)	Nil
Average hour earning	$49.04	Ordinary earnings divided by ordinary hours of work	Nil
Participation rate	66.64%	Average of monthly seasonally adjusted participation rate (ABS, 2024)	Nil
Value of the time not spent waiting by individuals	$19.62	40% of the average hourly wage	The full wage and the full range multiplied by the participation rate.
Distance avoided from travelling in ambulance	14.62	Twice average travel distance from Sydney LHD residents for all **rpa**virtual patients	Use of minimum and maximum distances (1.052 and 53.034km)
Distance avoided by ambulance travelling from RPA to base	4.8 km	Distance between Haberfield Ambulance Superstation – SAMIS (45 Parramatta Road (60 Sloane Street)) and RPA hospital emergency department (using google maps) (NSW Ambulance, 2023)	

Increasing the assumed benefit associated with reducing time seeking and receiving healthcare had the predictable impact of increasing the value for patients. For the Virtual Hub, the benefits for patients of the increased time is $83 per patient seen. For those patients assisted as part of the Sydney District Nursing model, the benefit is $112 per patient seen.

Triage category and time

It is assumed that the triage categories for the Ambulance Referral model and the Sydney District Nursing services are the same as the Virtual Hub model.

Parameter	Parameter value	Reference	Variation considered in sensitivity analysis
Proportion of patients seen by Virtual Hub with a triage category of 3	11%	Primary Evaluation of Virtual Hub Pilot (June 2024)	6.5% to 15.5%
Proportion of patients seen by Virtual Hub with a triage category of 4	63%	Primary Evaluation of Virtual Hub Pilot (June 2024)	56.0% to 70.0%
Proportion of patients seen by Virtual Hub with a triage category of 5	26%	Primary Evaluation of Virtual Hub Pilot (June 2024)	19.7% to 32.3%
Proportion of patients seen by the Broken Hill Base Hospital ED referral model with a triage category of 1	1%	Primary Evaluation of Virtual Hub Pilot (June 2024)	Nil
Proportion of patients seen by the Broken Hill Base Hospital ED referral model with a triage category of 2	13%	Primary Evaluation of Virtual Hub Pilot (June 2024)	Nil
Proportion of patients seen by the Broken Hill Base Hospital ED referral model with a triage category of 3	55%	Primary Evaluation of Virtual Hub Pilot (June 2024)	Nil
Proportion of patients seen by the Broken Hill Base Hospital ED referral model with a triage category of 4	26%	Primary Evaluation of Virtual Hub Pilot (June 2024)	Nil
Proportion of patients seen by the Broken Hill Base Hospital ED referral model with a triage category of 5	5%	Primary Evaluation of Virtual Hub Pilot (June 2024)	Nil

Increasing the proportion of triage category 3 patients increases the value of rED.

Assumed health services resources usage

The derivation of the average length of time from the reporting of the Bureau of Health Information (BHI) was based on assuming a consistent rate of performance between each of the measures. It also assumed that the 90% percentile represented the maximum length of time a person spent in the emergency department.

Parameter	Parameter value	Reference	Variation considered in sensitivity analysis
Length of time in the ED for treated and discharged patients	207 minutes	BHI (derived from median, performance and 90% percentile) averaged over the 4 quarters of 2023 for Sydney LHD	90% percentile – 342 minutes
Length of time for ambulance ramping	16 minutes	BHI (derived from median, performance and 90% percentile) averaged over the 4 quarters of 2023 for Sydney LHD	90% percentile – 34 minutes
Length of time in the ED for treated and discharged patients within rED	105 minutes	Primary Evaluation of Virtual Hub Pilot (June 2024)	

Assumed substitutability of services

Parameter	Parameter value	Reference	Variation considered in sensitivity analysis
Substitutability of Virtual Hub service	100%	Assumption	Assumption because attended and registered in the ED
Substitutability of ambulance service for ED service	80%	Primary Evaluation of Virtual Hub Pilot (June 2024)	70% and 90%
Substitutability of Sydney District Nursing Referral pathway to ED	66.6%	Primary Evaluation of Virtual Hub Pilot (June 2024)	56.6%% and 76.6%
Base number of services	440	**rpa**virtual data – number of services attributed to emergency department substitution activities with cost data recorded	
Growth in services	65% per annum	Kelly et al. (Kelly et al., 2024)	
55% and 75%			
Portion of virtual urgent care services that are Virtual Hub	79%	Data from **rpa**virtual	
Portion of virtual urgent care services that are ambulance services	15%	Data from **rpa**virtual	
Portion of virtual urgent care services that are Sydney District Nursing services	6%	Data from **rpa**virtual	

Assumed health services costs

Parameter	Parameter value	Reference	Variation considered in sensitivity analysis
Cost of avoided category 3 patient at the RPA	$794	Sydney LHD data for seen and discharged patients from RPA emergency department.	Admitted and discharged patients using IHACPA portal ($592) and increasing by 5.2% for the first year and then 6% per annum. Only including URG050 and URG 056 ($423) and increasing by 5.2% for the first year and then 6% per annum
Cost of avoided category 4 patient at RPA	$534	Sydney LHD data for seen and discharged patients from RPA emergency department.	Admitted and discharged patients using IHACPA portal ($592) and increasing by 5.2% for the first year and then 6% per annum. Only including URG083 and URG 058 ($423) and increasing by 5.2% for the first year and then 6% per annum
Cost of avoided category 5 patient at RPA	$400	SLHD data for seen and discharged patients from RPA emergency department.	Admitted and discharged patients using IHACPA portal ($592) and increasing by 5.2% for the first year and then 6% per annum. Only including URG083 and URG 058 ($423) and increasing by 5.2% for the first year and then 6% per annum
Ambulance call out cost	$840	https://www.ambulance.nsw.gov.au/our-services/accounts-and-fees	Assumed that the vast majority of those with a callout have a valid concession card. Sensitivity analysis is to divide between the public and the government on the 49%/51%
Ambulance cost per km	$7.58 per km	https://www.ambulance.nsw.gov.au/our-services/accounts-and-fees	Assumed that the vast majority of those with a callout have a valid concession card
Ambulance cost per minute	$7.58 per minute		Assumption at one minute was equivalent to one kilometre
Virtual cost of ED services	$1014.49	SLHD data for virtual services based on the costing NSW Costing Methodology from 1/1/2023 to 31/12/2024. Included urgent care and COVID-19 response in the analyses.	The highest and lowest average monthly cost over 2023 – $398.19 and $1,977.44. The lowest individual cost recorded in 2023 was $92.81.

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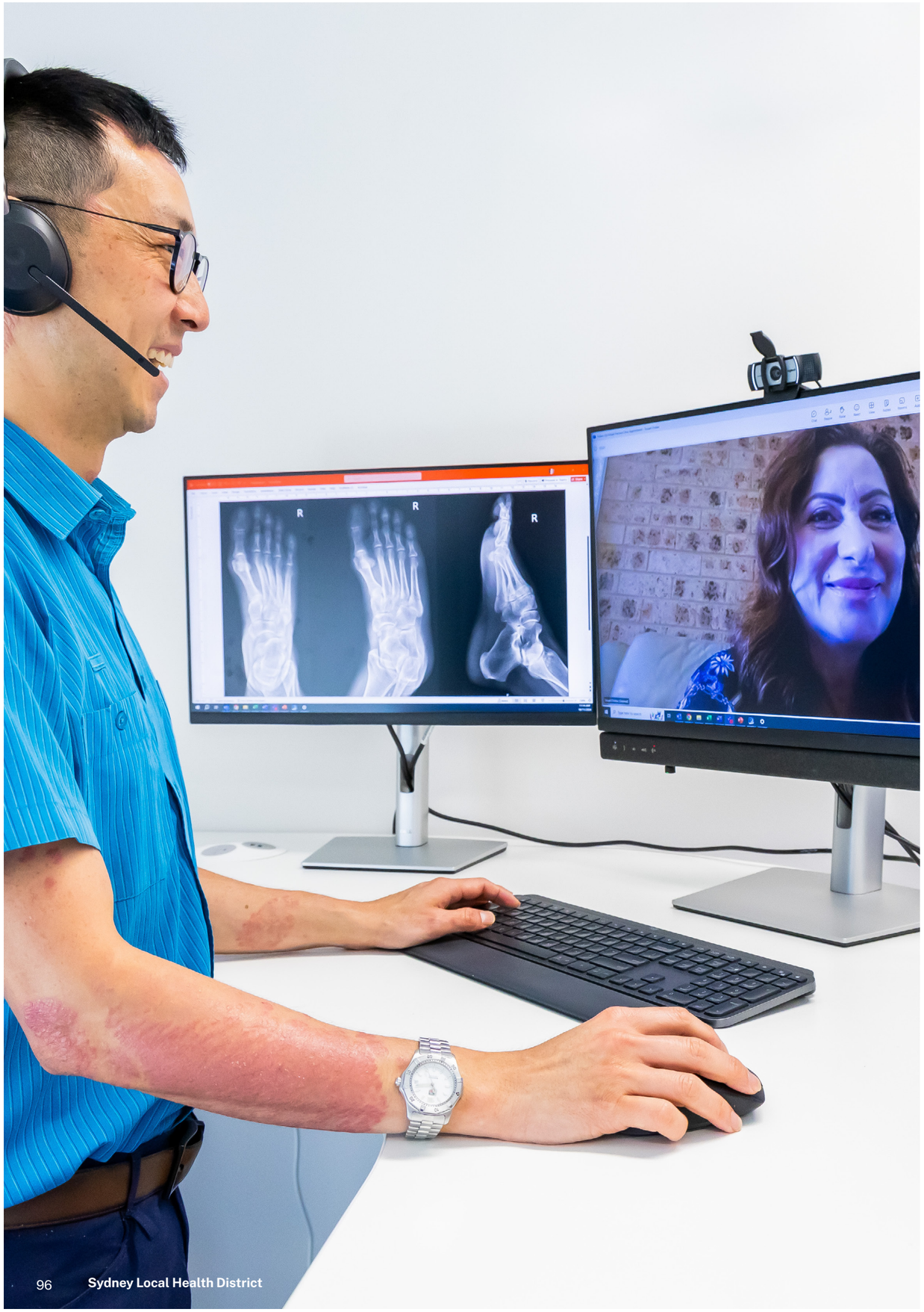

Chapter 6 - Virtual Fracture

Summary

Virtual outpatient services can deliver care that is valued by patients and removes inequities in geographical access that would otherwise occur. New models of care, such as virtual facture clinics, can deliver care at a similar or lower cost than the delivery of in-person services.

This evaluation found that the benefits of **rpa**virtual's Virtual Fracture service exceeded its costs. These benefits include reduced travel time and costs. The virtual substitution of fracture care is also equity enhancing. This care can be provided at a lesser cost than alternatives and more services can be delivered for the same quantum of funding.

The cost of delivering care virtually is uninfluenced by geography. The **rpa**virtual's Virtual Fracture service generated more pronounced benefits for patients that used the services in the Far West Local Health District (LHD). This is because the provision of in-person care to the Far West LHD is more costly than in-person care in a metropolitan context and patients travel further.

The **rpa**virtual's Virtual Fracture service has data limitations and hence this has constrained the knowledge and insights that formed part of this evaluation. These limitations may be resolved soon with the completion of a randomised controlled trial initiated by **rpa**virtual in collaboration with the Institute for Musculoskeletal Health.

Substitution of in-person outpatient services, such as fracture care

Hospital outpatient services offer access to specialist care from physicians, allied health and nurses. They include consultations, tests and procedures. These services occur without an admission to hospital.

Outpatient services play an important role in access to care and over time they have substituted for hospital inpatient services. Specialist outpatient services may help reduce the burden on emergency services if primary care practitioners can refer patients to them directly, rather than using the emergency department.

However, there is an increasing demand on outpatient services. In 2022-23, the Australian Institute of Health and Welfare reported 41.1 million non-admitted services, increasing from 39 million in 2018-2019 (Australian Institute of Health and Welfare, 2024).

The benefits of virtual outpatient care

Virtual care has some distinct advantages for the substitution of outpatient services. First, it eliminates the requirement for travel and waiting by the patient. Second, it reduces the requirement for the physician, allied health practitioner or nurse to travel, potentially increasing their efficiency. Third, it reduces the demand for physical outpatient rooms or cubicles.

The **rpa**virtual model of care for specialist outpatient services

The Virtual Fracture service is one model of specialist outpatient care delivered by **rpa**virtual. This model is based around a team approach to treatment and appropriate substitution of in-person care with virtual care. After receiving information that one of their patients has an appropriate fracture, a General Practitioner may refer a patient directly to Virtual Fracture, rather than sending this person to the emergency department to be accessed and treated.

The Virtual Fracture model of care uses physiotherapy and orthopaedic specialist skills. After referral, the case and radiology scans are reviewed by a physiotherapist and an orthopaedic surgeon. Then a series of thirty-minute consultations take place.

Assessing the benefits of Virtual Fracture

As with all virtual models, there are a wide range of choices to be made in providing Virtual Fracture care. These include the use of telephone versus video, physiotherapist directed treatment versus self-guidance, and triage mechanisms.

The **rpa**virtual's Virtual Fracture model delivers care for suitable patients that have a simple fracture that may involve management using removable orthoses, but not those patients who need a cast or surgery for their fracture(s). The average cost of an in-person fracture clinic may involve these patients alongside more complicated patients. Accordingly, using the costs derived from the average patient may overestimate the resources saved by virtual care.

In this evaluation, the relative effectiveness of virtual and in-person attendance for fracture assessment and treatment is assumed to be equal. Absent data, this evaluation cannot account for any difference in the follow-on requirements for medical care, such as re-presentations at the emergency department. Most patients managed by virtual fracture clinics are managed safely, with no increase in re-presentations. However, in some studies, it has been suggested that specific injuries, such as distal radius and ankle fractures, may have a higher rate of re-presentation after virtual care than would be the case with in-person care (Dey et al., 2023).

It has also been assumed in this evaluation that there are longer attendances in virtual fracture care, compared to in-person fracture care.

The release of the capacity constraint associated with in-person fracture care may result in an increased number of attendances in virtual care that would not have occurred in an in-person context. In this situation, the comparison would be between a lesser number of in-person attendances with a greater number of virtual services, with a potential increase in effectiveness.

Improved patient experiences

There was substantial agreement that the services offered by Virtual Fracture improved patient experiences, as discussed in Chapter 1. The benefits articulated by patients include a reduced requirement to travel for treatment.

Equitable health outcomes

Virtual Fracture increased the availability of services to those in the Far West LHD. During 2023, **rpa**virtual delivered 37 occasions of service, which was an increase of 25% on the number of tier 2 orthopaedic clinics reported in 2020-2021 or 5% over the number reported in 2023.

Methodology: The number of attendances in 2023 recorded in the cost database of **rpa**virtual corresponding to the **rpa**virtual fracture clinic for the Far West LHD were compared to the number of tier 2 clinics for orthopaedics (40.44) recorded in the Independent Hospital and Aged Care Pricing Authority (IHACPA) benchmarking portal and the activity-based costing for the Far West LHD. See the Appendix for detail.

Sustainable management of the health systems

The replacement cost associated with delivering fracture care in-person is comparable to the costs of delivering Virtual Fracture services in 2023. Depending on the assumptions, it might be slightly less costly or slightly more costly.

Basecase

In the basecase, the cost of providing virtual fracture care was $161 per attendance and the cost of an in-person attendance at Royal Prince Alfred was $296.88. The benefit-cost ratio (BCR) using these figures was 1.2 in the Sydney LHD. That is, for every dollar spent in virtual care, the cost of providing an in-person service in the Sydney LHD would require a dollar and twenty cents.

The cost of providing Virtual Fracture care in the Far West LHD is similar to the cost of providing such care within the Sydney LHD ($113). However, the hypothetical delivery of in-person fracture care in the Far West LHD has been estimated as substantially more costly – between $240 and $448 per attendance based on the cost of providing orthopaedic services. Consequently, the BCR for Virtual Fracture care provided to the Far West LHD can be higher, up to 3.3. That is, for every dollar spent in virtual fracture care in the Far West LHD, the cost of providing an in-person fracture service would require three dollars and thirty cents. The comparison of the average Virtual Fracture clinic time to the 2023 cost gave a BCR of 1.5.

Sensitivity analysis

The provision of **rpa**virtual's Virtual Fracture services to the Far West LHD was always assessed as being less expensive than the in-person alternatives of providing orthopaedic care. Assuming, however, three virtual consultations substituted for two in-person consultations, the BCR remained above 1 for those who would have been treated in-person at the Far West LHD but fell below 1 for those who would have been treated for in-person at the Sydney LHD.

Extended basecase

The inclusion of reduced costs and time of travel for Sydney LHD residents increases the benefits of Virtual Fracture. If the number of attendances were equal across in-person and Virtual Fracture care, then virtual care has a benefit greater than its cost. The BCR was 1.4. The improvement was greater for the services provided to the Far West LHD, and the BCR increased to 1.92.

If only two in-person attendances replace three virtual attendances, then the BCR for treating patients in the Sydney LHD is just less than one (0.95). That is, the two alternatives are approximately equal.

Cost-consequence analysis

During 2023, there were over 1,800 Virtual Fracture attendances associated with the Sydney LHD. As noted above, 37 attendances were associated with the Far West LHD.

This would have required over 600 hours of clinic time, if held in-person or alternatively it freed-up 151 x 4-hour cubicle slots. Assuming a 6-cubicle outpatient clinic, this reduced the number of required clinics by 25 over 2023.

Methodology: The assessment was based on the costs associated with delivering care for non-admitted services. The comparison was between services delivered by virtual services and in-person alternative. The number of attendances per person was assumed to be three and equal between in-person and virtual services. The **rpa**virtual's costing data for 2023 was used for the number of attendances and the cost of delivery. The costs of the in-person alternative were sourced from the IHACPA benchmarking portal for tier 2 orthopaedic clinics (40.44). A series of one-way sensitivity analyses were undertaken as detailed in the Appendix, as are the additional assumptions that were made.

Limitations

This evaluation assumes that the clinical outcomes are equal between the virtual and in-person alternatives. Re-presentations and longer-term outcomes have not been considered in this evaluation. A recent publication, which included Australian patients, found that the cost of outpatient care (including fracture clinic appointments) was a relatively small component of the total cost of care (Talevski et al., 2022).

Considerations for the future

The total activity in **rpa**virtual's Virtual Fracture service was relatively low in 2023, compared to the initial two years of activity. This has the impact of spreading the fixed costs associated with **rpa**virtual over a smaller pool and increasing the cost per unit of activity. Increasing activity within Virtual Fracture may reduce the average cost of delivering care virtually, even if the number of people seen in the service does not alter.

A key limitation in evaluating a range of virtual models of care, including Virtual Fracture, is a lack of confidence in the relative clinical benefits of virtual care versus in-person care. An ongoing randomised controlled trial (RECITAL) will offer future evidence about this for Virtual Fracture (Teng et al., 2024).

During 2023, there were over 1,800 Virtual Fracture clinic admissions

Appendix: Assumptions

Alternatives and main features of the analysis

The alternative courses of action are:

1. Treatment of simple fractures in-person at the Royal Prince Alfred Hospital.
2. Treatment of simple fractures by Virtual Fracture at **rpa**virtual.

Initially it is assumed that the same number of attendances would occur both in-person and virtually. As the attendances are occurring over a short period of time, the time horizon of the analysis is twelve weeks and no discounting has been undertaken.

Costs

Table 1: Costs

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Cost of providing a fracture attendance in Far West LHD	$240.47	Activity-based costs of NSW using the July to December 2023 figures	Physiotherapy tier 2 clinics (40.09) for Far West LHD using the IHACPA portal ($236) and increasing by 5.2% for the first year and then 6% per annum ($278.96).
Orthopaedic tier 2 clinics (40.44) for Far West LHD using the IHACPA portal ($379) and increasing by 5.2% for the first year and then 6% per annum ($447).			
Cost of providing an in-person fracture attendance at Royal Prince Alfred	$196.88	Activity-based costs of NSW using the July to December 2023 figures	Physiotherapy tier 2 clinics (40.09) for Royal Prince Alfred hospital using the IHACPA portal ($144) and increasing by 5.2% for the first year and then 6% per annum ($170.21).
Orthopaedic tier 2 clinics (40.44) for Royal Prince Alfred hospital using the IHACPA portal ($179) and increasing by 5.2% for the first year and then 6% per annum. ($211.58).			
Cost of providing a Virtual Fracture attendance at **rpa**virtual	$160.80	Use of cost data from **rpa**virtual including both the Sydney and Far West LHD components	The 95% confidence interval around the data was from $155.58 to $166.01. The lowest monthly average cost was $118.54.
Cost of providing a Virtual Fracture attendance at **rpa**virtual for the Far West LHD	$113.36	Use of cost data from **rpa**virtual for the Far West LHD components	
Cost of providing a Virtual Fracture attendance at **rpa**virtual for the Sydney LHD	$161.77	Use of cost data from **rpa**virtual for the Sydney LHD components	

Resource usage

Table 1: Changes in resource usage

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Number of orthopaedic tier 2 attendances in the Far West LHD in 2020-2021	149	Highest of the number of orthopaedic tier 2 attendances (40.44) recorded in the 2019-20 (32) or 2020-21 (149) years in the IHACPA data portal	Highest of the number of physiotherapy tier 2 clinics (40.09) recorded in 2019-20 or 2020-21: 2,562 for 2019-20 and 1,824 for 2020-21.
Number of Virtual Fracture attendances associated with Far West LHD in 2023	37	Number of unique attendances in the costing data	
Number of orthopaedic tier 2 attendances in the Far West LHD in 2023	740	Activity based costs of NSW using the July to December 2023 figures multiplied by two	
Number of Virtual Fracture attendances associated with Sydney LHD in 2023	1,812	Number of unique attendances in the costing data	
Virtual Fracture clinic time usage	30 minutes	Teng et al. (Teng et al., 2024)	
In person fracture clinic time usage	20 minutes	Teng et al. (Teng et al., 2024)	
Number of clinic spots for one cubicle	12	Three per hour for four hours	
Number of cubicles in an outpatient clinic	6	Assumption	
Substitution of Virtual Fracture for in-person clinic usage	100%	Assumption	66% - two appointments compared to three (Teng et al., 2024).

In 2023, a 66% substitution of virtual fracture care for in-person fracture care reduces the number of clinic time replaced in 2023 to 400 hours, the number of 4-hour cubicle slots to 100, and the number of 6-cubicle outpatient clinics to 16.

Societal benefits

Table 1: Monetary value of benefits to the patients

Parameter	Parameter value	Reference or method of calculation	Variation considered in sensitivity analysis
Value of time per attendance for Virtual Fracture attendances	$18.06	As discussed in Chapter 1	Use of average cost in the Chapter 1 analysis of travel time and cost per patient ($39.13)
Cost of travel for Virtual Fracture attendances	$5.05	As discussed in Chapter 1	Use of average cost in the Chapter 1 analysis of travel time and cost per patient ($29.31)
Value of time per attendance for Far West LHD Virtual Fracture attendances	$39.13	As discussed in Chapter 1	Use of average cost for the Far West LHD in the Chapter 1 analysis of travel time and cost per patient ($201.92)
Cost of travel for Far West LHD Virtual Fracture attendances	$29.31	As discussed in Chapter 1	Use of average cost for the Far West LHD in the Chapter 1 analysis of travel time and cost per patient ($218)

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Chapter 7: Financing RPA Virtual Hospital

Summary

The financing of **rpa**virtual has been based on block funding provided by the NSW Ministry of Health and the Sydney Local Health District while **rpa**virtual is evaluated.

Block funding allows the virtual hospital model of care to mature while alternative models of funding, such as activity based funding, can be assessed.

Ideally, a funding model would:

- be sustainable (Huxtable, 2023);
- incentivise the delivery of the goals of the health care system, such as effectiveness, efficiency, equity and integration (Huxtable, 2023; Wise et al., 2022); and
- respond appropriately during times of crisis and stress to allow services to change capacity in response to new needs (OECD, 2023).

The demand volatility associated with COVID-19 has been substantial in the context of **rpa**virtual's overall block funded budget. It has had significant repercussions on the way **rpa**virtual has operated, including by constraining the development of sustainable models of care at the same time as managing COVID-19 in NSW.

Key issues

Funding models: activity based, block funding, or outcomes based?

A variety of funding models could be used to fund virtual care. It is unlikely that one single model of funding is appropriate for all virtual care because of the variation in services, patients, and facilities. Virtual hospitals may require different funding schemes compared to virtual primary care. The relationship between demand for health care and availability of a health service and actual service levels is complex. An appropriate funding model should allow for appropriate expansion and incentivise use of virtual services where it is a cost-effective alternative to conventional care but not incentivise low value care on top of existing services.

Public hospital services in Australia are primarily funded on an activity basis or via block funding. Activity Based Funding (ABF) rewards local hospital networks based upon the outputs they produce. These outputs are measured by National Weighted Activity Units (NWAUs) that account for the number and complexity of services delivered by public hospitals.

Block funding is reserved for activities where ABF is deemed impractical or inappropriate (Clause A3 of the 2020-25 NHRA Addendum). Examples of block funding include remote and rural hospitals where economies of scale do not exist, or in circumstances where activity cannot be easily counted, such as research.

Outcomes based funding or value based funding is rare at present, but encouraged as a future priority for the health care system (Huxtable, 2023). Examples include funding based on the clinical benefit received by patients or on how care reduces the burden on patients and their carers.

rpavirtual: block funding restricted use of other funding models

The use of block funding grants for **rpa**virtual means that several other income streams were not accessed to ensure its services are only paid for once. For example, the Virtual Trauma service, Virtual Rehabilitation service and Virtual Fracture service are eligible to receive monies from the compulsory third party (green slip) scheme, but do not do so. Similarly, the activities of the Virtual Care Centre and the Sydney District Nursing service are kept separate to ensure that there is no use of the **rpa**virtual block grant for services paid for via other means.

Can **rpa**virtual be funded on an activity basis?

There are several classification systems used for hospital activities: admitted acute care, emergency care, sub-acute and non-acute care, non-admitted care and recently, mental health care. Additionally, there is a classification scheme around teaching, training, and research. These are used for the reporting of health care activity outputs by the Independent Health and Aged Care Pricing Authority (IHACPA).

rpavirtual reports its activity using the non-admitted classification scheme over the 2022-2023 and 2023-2024 financial years. The non-admitted classification is referred to as Tier 2 Clinics.

Classification systems for funding use different types of data

The classifications are approached differently for inpatient and non-admitted activity by IHACPA.

For inpatients, the activity is based on the clinical condition of the patient and the services provided. An enormous amount of information is used, including patient data to allocate the Diagnostic Related Group (AR-DRG) and the subsequent allocation of a price-weight that determines the NWAU assigned to any particular activity.

More complex episodes, such as a patient with an elective hip replacement, receive a different AR-DRG and a higher price-weight than less-complex episodes, such as an elderly patient with a finger fracture who was admitted overnight for observation.

In the non-admitted care Tier 2 Clinics classification system, the services are provided without a formal admission process and the patients do not occupy a hospital bed. The classification system is based upon the nature of the service and the nature of the provider of the service. Little information about the patient is used to determine the price weight.

The details of the non-admitted classification system

Irrespective of whether the patient is seen jointly or separately by multiple providers, only one non-admitted patient service event may be counted for a patient at a clinic on a given calendar day. Continuing the above example, after they are discharged from their admitted episode and start attending a non-admitted clinic for follow-up care, the patient with the hip replacement and the patient with the finger fracture will both be counted similarly.

When three or more providers see a patient within a clinic a multiple provider flag is triggered, and a greater cost weight can be inferred. Patients attending multiple clinics will have multiple attendances recorded. Additional weights are added based on the Indigenous status of the patient, the remoteness of the patient (and treatment facility), and the age of the patient.

There are telehealth items in the non-admitted care classification that discuss the receipt of care attending one hospital for a consultation from another hospital. In this case there is the counting of two non-admitted services: one where the patient attends and one where the service is provided.

Currently, there are activities in the non-admitted care classification system that do not require the patient to be present. These are for multi-disciplinary case conferences. For example, Tier 2 Clinic "20.56 Multidisciplinary case conference – patient not present" is a meeting where the care of a patient is coordinated. When most health care providers are allied health or nurse professionals, then Tier 2 Clinic item 40.62 can be used. If the case conference does not meet the criteria of the multi-disciplinary meeting (for example, the outcomes were not recorded) then this is not counted as a separate multi-disciplinary case conference. These can be delivered virtually provided all criteria are adhered to. There are also activities that occur in a patient's home without a healthcare provider being present. For example, item 10.16 is renal dialysis that is home delivered by the patient without a health care provider present.

The sophistication of the non-admitted services classification is limited by the data availability. Improved data availability would allow more emphasis on the patient's complexity.

Virtual care in the current non-admitted classification scheme

In general, the consultations delivered virtually that satisfy the criteria of a consultation can be counted as a consultation within the current classification system. These consultations are counted as they would have been in the absence of the use of information technology. The compendium for Tier 2/non-admitted services outlines these considerations (Independent Health and Aged Care Pricing Authority, 2023b).

The direct quotes from the compendium (section 2.5) are, with emphasis added: "Consultations delivered via information and communication technology (ICT) (including but not limited to telehealth and where the patient is participating via a video conferencing platform) must be equivalent to a face to face consultation to be counted as a non-admitted patient service event. That is, **the event must be necessary and if the event were not delivered via ICT then the patient would have been required to receive that service in a face to face consultation**."

The counting rules that are to be applied are outlined below.

- Consultations delivered via ICT must involve an interaction between at least one healthcare provider and the patient. Hence, the presence of the patient is required at one location. The interaction must be the equivalent of a face to face consultation. That is, both healthcare provider and patient interacting in a mutually responsive manner within a short timeframe.
- Consultations delivered via ICT **must be a substitute for a face to face consultation to be counted as a non-admitted patient service event**. That is, the consultation must contain therapeutic/clinical content and be equivalent in content in the sense that if the consultation could not be provided via ICT, a face to face consultation would have occurred.
- Administrative phone calls, such as booking or rescheduling appointments, must not be counted as non-admitted patient service events.
- Consultations delivered via ICT may be counted by the public hospital service providing the consultation service (provider end), and by the public hospital service where the patient is present (receiver end).

Advantages and disadvantages of using the non-admitted care classification system to measure virtual care activity

In the case of substitution of service, the above counting rules are relatively straightforward, i.e., the same codes and activity will be used. In these circumstances, there is a direct substitution of activity. The use of the same activity incentivises the modality which is more technically efficient to deploy.

However, in several circumstances, this assumption of complete substitution will not hold.

- Virtual care may not be a one-for-one direct substitution, either more or less virtual services may be delivered for each in-person consultation.
- Virtual care may allow care delivery structures that are transformative and do not have an obvious current in-person equivalent. For example, some versions of wearable technology may fall into this category.
- Virtual care may allow necessary care to be delivered in a situation where it would not have been provided face to face. That is the provision of necessary care that was previously not provided. Examples would be greater access to care for regional and remote patients or those who have difficulty attending a consultation, or a more holistic approach with integrated care.
- Virtual care may allow lower value care to be provided but this may still be of value to the patient, carer, provider, or system and is considered cost-effective.

Perverse or unhelpful incentives may be generated under the current system, which rewards activity in the non-admitted sector on a per occasion of service basis. For example, virtual care may make it easier to have additional services provided by a practitioner or splitting the services provided within a multi-disciplinary service to increase activity.

Services that are ultimately beneficial, such as a hospital substitution program that is effective and cost-effective but relies on activity that is not counted (such as a non-patient interaction that is not a case conference), will not be incentivised under the current arrangements. This will result in a less than societally optimal level of treatment.

Alternatively, the restriction to an equivalent in-person activity limits the potential for the proliferation of low value care interactions which would not have occurred in the in-person setting.

A lack of concordance between the non-admitted care classification system and **rpa**virtual

There is a lack of concordance between how **rpa**virtual organises its activities and its data and the non-admitted classification system. Five examples follow below.

- **rpa**virtual organises its activities around models of care that are patient focused, rather than provider focused. A multi-disciplinary, team-based approach is used but not all team members interact with the patient on each occasion of service. The models of care span multiple attendances over time and these are interlinked.
- There is an interaction and intersection with other types of care, for example, hospital admissions, sub-acute care, and emergency care. The use of **rpa**virtual models of care is not distinct from these other types of care. For example, Virtual Care and Emergency Department (rED) uses specialist emergency doctors making decisions about patients that would otherwise be physically present in a 'bricks and mortar' emergency department.
- The use of activities that are poorly captured in the current non-admitted classification scheme, for example, wearable devices.
- The level of effort in some activities is not consistent with the non-admitted classification scheme. For example, the ED to Community model of care involves a high degree of coordination and integration that is not in the presence of the patient. It also involves many brief interactions, none of which would be appropriate for a non-admitted occasion of service but collectively require substantial resources. Multiple interactions per day may be provided from a variety of different staff for services that are more analogous to inpatient care than clinic care.
- Capturing the public good nature of the innovation that is occurring. **rpa**virtual generates the evidence for new models of care. This is a time intensive process that does not formally fit into a definition of research, as it has not been approved by a research governance or ethics body and it is central (not secondary) to patient care (Paxton Partners, 2014). It does, however, have elements of research, in that there is application beyond the health service and the novel elements of virtual care mean more innovation and stakeholder engagement is potentially required. These models of care can be adapted to new environments and may result in higher costs for the innovators than the subsequent adopters.

Considerations relevant to adapting activity-based classification schemes for virtual care

A lack of clinical content in the classification system results in an input-based approach rather than an output-based approach. This is more prevalent in the non-admitted classification scheme than the other classification schemes. So, the incentives are to be efficient in the production of the inputs - attendance - rather than the output of comprehensive care.

For these reasons, it may be appropriate to investigate alternatives to the current arrangements. These alternatives will rely on a greater amount of data being available for classification. These alternatives could apply to both virtual and non-virtual settings. Some of these alternatives are outlined below.

1. Increasing the number of clinical classifications to include virtual specific models of care.
2. Linking the patient activity into an appropriate bundle of care
    a. Include a clinical diagnosis, clinical information and/or the purpose of treatment in the classification scheme, for example, analogous to the sub-acute classifications.
    b. Bundle multiple activities over multiple days as one activity if it is related to the same clinical issue. For example, rather than multiple fracture clinic appointments and activity, there is one activity for treating the fracture.
    c. Bundle with other classification systems to create a larger bundle. For example, consider the management of a patient over multiple classification systems, such as inpatient and virtual care to be one episode of care with one activity weight.
3. Including value-based elements in the classification
    a. Without outcomes, or activities that can correctly proxy an outcome, information about the value of care will be missing. Standardised outcome measures for specific high volume virtual care may align funding with incentives.
    b. Discounting or overweighting activity on the relative burden experienced by the patient and their family would align incentives between health system and society.

Currently, IHACPA continues to use Tier 2 clinics to cost the activity for non-admitted services while a new non-admitted care classification system is being developed (Independent Health and Aged Care Pricing Authority, 2023a). This reform is expected to better account for service transitions and include information from electronic health records.

The appropriateness of the size and activity risk associated with **rpa**virtual

Activity within **rpa**virtual depends on the demand for virtual services. Demand was very high during 2020 to 2022 and driven by the COVID-19 pandemic. More recently, the demand for virtual services has decreased and this is reflected in the declining activity of **rpa**virtual. The activity in 2022-23 and 2023-24 is lower than the preceding two years.

Table 1: Annual occasions of service (OOS) 2019-2023

Financial Year	2019-2020	2020-2021	2021-2022	2022-2023
Non-COVID activity (OOS)	2,141	11,583	19,904	21,184
COVID activity (OOS)	14,555	94,461	149,289	20,456
Total	**16,696**	**106,044**	**169,193**	**42,113**

This association between the volume of services provided by **rpa**virtual as a whole and the calculated cost, and therefore cost-effectiveness can be seen in the evaluation of models of care.

Currently, there are two financing issues to consider with **rpa**virtual: the volume of services and an appropriate pricing of the services.

In general, current **rpa**virtual activity would not be consistent with sustainable funding on an activity basis, using the current non-admitted classification scheme (which simply transfers the current outpatient funding rules to virtual care). The move to an activity-based funding model may result in an incentive for gaming of activity. Even with a greater level of activity, the application of current outpatient funding rules could result in inefficiencies and mis-pricing.

It is likely that this will remain an issue until reorganisation of the non-admitted patient classification becomes less provider focused and more patient and value focused.

A hybrid funding model for **rpa**virtual?

The current size and variation in activity of **rpa**virtual may mean that it is appropriate to consider a hybrid model of funding, that is, a fixed and variable component until a certain size and consistency in activity level is reached.

Three elements stand out as a rationale for a fixed component to the funding. The first should be limited in time and the second two elements suggest a special position of **rpa**virtual compared to other providers of virtual care services.

1. The level of activity and funding is volatile, with the impact of the COVID-19 pandemic having set back the development and maturity of the non-COVID models of care in **rpa**virtual's first three years of operation, meaning the initial logic of block funding until stability and predictability remains.
2. The contribution of **rpa**virtual to a resilient health system suggests that the presence of a Virtual Care Centre may be required, and a minimum funding guarantee should be considered, even without sufficient activity to ensure financial sustainability.
3. The public good element of generation of innovative models of virtual care may require additional funding above that usually returned.

A decision to have a fixed and variable component should be justified and transparency applied (Huxtable, 2023). The rationale for block funding should dissipate with the further embedding of virtual care into the healthcare system.

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Notes

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