Supporting Information

Supplementary material

This appendix was part of the submitted manuscript and has been peer reviewed.

It is posted as supplied by the authors.

Appendix to: Von Huben A, Thompson A, Wilson A, et al. An economic evaluation of the Virtual Rural Generalist Service versus usual care in Western New South Wales Local Health District. *Med J Aust* 2024; doi: 10.5694/mja2.52530.

THE UNIVERSITY OF SYDNEY

Virtual Rural Generalist Service (VRGS) Evaluation

An observational study using routinely collected administrative data to evaluate if the Virtual Rural Generalist Service (VRGS) is a COVID-resilient and transferable model that provides equivalent health outcomes to usual medical care.

ECONOMIC EVALUATION PLAN

Prepared by: *Amy Von Huben, Kirsten Howard*

Date: 11 October 2022

Using protocol version: 1.3 Dated: 23 Feb 2022

Signed & dated:

Principal Investigator(s):

Dr Shannon Nott

Prof Andrew Wilson

Appendix 1: Economic analysis plan

Abbreviations 5
Economic evaluation design 6
Intervention model of care 6
Traditional model of care 7
Economic analysis objectives 7
Schedule of data collection 7
Patient population 8
Inclusion criterion 8
Exclusion criterion 8
Analysis 8
Methods and analysis 8
Costs 9
Cost to NSW Health 9
Hospital expenditure – Clinical costing 10
Presentation of costs and outcomes 11
Sensitivity analysis 16
Subgroup analysis 16
Appendix A – Resources, units of measure, unit costs and data sources 17
Appendix B – Clinical costing model components and definitions 23
Appendix C – In-scope sites and funding methodology 25
Appendix D – Wallie list 26
Appendix E – VRGS shift rates 27
Appendix F – GP VMO expenditure 28
Glossary 29

Table 1 Schedule of data collection 7
Table 2 Total costs and outcomes in each cohort 11
Table 3 Incremental analysis of costs and outcomes need 14
Table 4 Health service cost 17
Table 5 Medical costs for all face-to-face shifts in in-scope sites 17

Table 6 VRGS intervention costs – IT and equipment 18
Table 7 Estimates of locum/face-to-face VRGS costs 20
Table 8 VRGS intervention costs – Salary and wages from VRGS cost centre (note excludes F2F cost) 21
Table 9 VRGS other expenses 22
Table 10 Components of clinical costing and definitions (source: NSW ABM portal) 23
Table 11 In-scope sites and funding methodology 25

Figure 1 Cost-effectiveness plane 16

Abbreviations

CI	Confidence Interval
eMEDs	Electronic medication management (part of the Cerner eMR)
eMR	Electronic medical record (including Cerner Millennium PowerChart and FirstNet)
FWLHD	Far West NSW Local Health District
GP VMO	General Practitioner Visiting Medical Officer
GWHREC	Greater Western Human Research Ethics Committee
HIU	Health Intelligence Unit, WNSWLHD
ICER	Incremental Cost-Effectiveness Ratio
IQR	Interquartile range
LHDs	Local Health Districts
MDT	Multidisciplinary team
MPS	Multipurpose services
n	Number in that cell
N_C	Number in the control group
N_T	Number in the treatment group
NWAU	Net Weighted Activity Unit
OOS	Occasions of service
SD	Standard Deviation
SEP	State Efficient Price
VRGS	Virtual Rural Generalist Service
WNSWLHD	Western NSW Local Health District

Economic evaluation design

This economic evaluation is a cost-consequence study to evaluate the costs and benefits, including health outcomes, of the Virtual Rural Generalist Service (VRGS) compared to usual care from the perspective of the New South Wales (NSW) healthcare system.

Briefly, the VRGS is a comprehensive, contemporary model supporting rural communities in WNSWLHD without a regular doctor (GP/VMO) and where local doctors require additional support. This evaluation study aims to determine whether VRGS is an agile and COVID-resilient workforce model to support the needs of rural communities where there is either no local doctor or where the local doctors require additional support.

Intervention model of care

VRGS uses Rural Generalists who undertake onboarding to understand the needs of Aboriginal and rural patients. The pre-COVID intention was a minimum of 25% in face-to-face shifts. VRGS leverages WNSWLHD's comprehensive telehealth infrastructure to provide best-practice care for patients presenting to emergency departments or admitted in rural facilities, including residential aged care (RAC) patients in Multipurpose Services. High-definition, wireless telehealth carts and the NSW Health eMR/eMeds platforms enable ward rounds, consultations and multidisciplinary team/family conferences.
When required, VRGS provides the following to all rural facilities in WNSWLHD alongside on-site clinicians:

- Video consultations to emergency department (ED) patients
- Medical management of acute inpatients
- Virtual ward rounds for inpatients
- Clinical support for residential aged care (RAC) residents in rural MPSs where the local general practitioner (GP) is not available

VRGS supports:

- Hospital staff in communities where permanent GP VMOs have retired or relocated (including while recruitment efforts take place)
- Fatigue management of GP VMOs in towns with only one or two VMOs locally
- Gaps in rosters in towns where hospitals would otherwise be without medical coverage

A patient "encounter" in the context of this study and aligned to the NSW Health definition is an emergency department presentation or an admitted patient episode of care.
There are two cohorts for the intervention:

- VRGS only: Defined as a patient encounter with VRGS clinician only
- Hybrid: Defined as a patient encounter with mixture of VRGS and non-VRGS clinicians

Note that seeing a VRGS clinician may mean seeing them face to face.

Traditional model of care

Traditional care is what is available if there is no VRGS service, i.e., a GP VMO with short term locum placements for fatigue relief or no medical coverage (travel to nearest hospital).

The traditional care cohort is termed "Non-VRGS".

Economic analysis objectives

The main objective of the economic evaluation is to conduct a cost-consequence analysis at in-scope sites (see Appendix C) of VRGS, with results reported as disaggregated incremental costs and outcomes. Comparisons of total costs and disaggregated outcomes (specified in the VRGS Quantitative Evaluation Data Analysis Plan) will be conducted for the following specific comparisons:

1. Analysis 1:
    a. Intervention: Post-VRGS implementation - 1 July 2021 to 30 June 2022
    b. Comparator: Pre-VRGS implementation - 1 February 2019 to 31 January 2020
2. Analysis 2:
    a. VRGS model of care (VRGS only, hybrid VRGS) - 1 July 2021 to 30 June 2022
    b. Traditional care (No VRGS cohort) - 1 July 2021 to 30 June 2022

Schedule of data collection

The data elements required for the economic evaluation and their time of collection are listed in Table 1.

Table 1 Schedule of data collection

	Pre-VRGS implementation*	Post-VRGS implementation**
Emergency department presentations (EDDC) & Admitted patient episodes (APDC) for all in-scope sites: • Health outcomes • NWAUs (version 21) • Clinical costings (will differ by financial year – inflate to FY21/22 using price weight adjustors)	X	X
Directly allocatable expenses to VRGS model of care		
- IT and Equipment		X
- Other expenses; e.g., VRGS staff training, travel, postage from VRGS cost centre expenses		X
- VRGS Administration salaries		X
- VRGS clinician wages from VRGS cost centre **(note does not cover VRGS face-to-face hours)**		X
- VRGS clinician wages from face-to-face shifts		X
- VRGS clinician wages from vCare hours		X
Directly allocatable expenses to traditional model of care		

	Pre-VRGS implementation*	Post-VRGS implementation**
• Salary and wages by site minus face-to-face VRGS shifts		X

*Pre-VRGS implementation: 1 February 2019 to 31 January 2020
**Post-VRGS implementation: 1 July 2021 to 30 June 2022

Patient population

Patients of any age who present to an emergency department (presentations) or are inpatients in a hospital (episodes) at the sites where VRGS is operating (i.e., in-scope sites) from:

- 1 February 2019 to 31 January 2020
- 1 July 2021 to 30 June 2022

Inclusion criterion

For in-scope sites see VRGS Quantitative Evaluation Data Analysis Plan.

Exclusion criterion

- Patients who are residential aged care residents who are not type-changed to either inpatient or emergency department presentation
- Outpatients
- Patients being cared for as part of "Hospital in the Home"
- Walk-in health centres
- Patients undergoing haemodialysis without any other presenting problem

Analysis

Methods and analysis

Patient-level data on costs and outcomes will be aggregated and presented in total and average for all cohorts. Incremental costs and incremental benefits for the comparisons specified above will be calculated as the difference in means and presented with a 95% Confidence Interval (CI).

If appropriate, incremental cost-effectiveness ratios (ICERs) will be calculated. Using a bootstrap procedure to estimate uncertainty, a 95% CI for the incremental cost-effectiveness ratio (ICER) will be calculated, and estimates will be plotted on a cost-effectiveness plane.

The economic evaluation report will follow the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement.

Costs

All costs will be valued in 2022 dollars. No discounting will be applied as costs are measured over 12 months only. The discount rate for amortisation is 5% as per NSW Treasury guidelines.

Note telehealth provided in the in-scope sites cannot currently be claimed under the Medicare Benefits Scheme, but this may be a future consideration reducing the cost of the VRGS service to NSW Health.

Cost to NSW Health

Given the perspective of this analysis is from the New South Wales (NSW) healthcare system, the price paid (or cost) of an emergency department presentation or hospital admission episode to NSW health is the **national activity weighted units (NWAUs)** for the encounter multiplied by the corresponding **State Efficient Price**.

A NWAU is the unit for counting healthcare service activity, based on the clinical complexity of patients and legitimate variations in costs:

- The NWAU can be described as a single 'currency' that expresses relative resource use for healthcare across all settings
- The 'average' health service is equivalent to one NWAU
- More intensive and expensive activities are funded by multiple NWAUs, and simpler and less expensive activities are funded by fractions of an NWAU
- NWAUs are calculated based on Australian refined diagnosis related groups (AR-DRG) which reflect the care provided and the complexity, length of stay, and adjustments for paediatric, Indigenous and remote patients, treatment remoteness, radiotherapy and dialysis services, hours in ICU, and private patient adjustments

The **State Efficient Price** is the amount that NSW Health determines is the price paid to Districts and Networks for the delivery of each National Weighted Activity Unit (NWAU) across the NSW Health system:

- This is the price for which activity from Districts and Networks is purchased
- The State Efficient Price is calculated for each financial year using the clinical costing data from District and Network Return (DNR)

We will use NWAU version 21 applied to every patient encounter. The corresponding state efficient price is $4,931 per NWAU21. (Source: NSW ABM Compendium 2021-22 Online)

Note that all in-scope sites (see Appendix C) are funded under the small rural hospitals funding methodology (SRHFM) in NSW. This methodology is almost exactly the same as for activity-based funding except that the same fixed cost is added to the funding cost for every site; i.e., Funding for under SRFHM for FY21/22 equals:

> Variable cost (currently State Efficient Price $4,931) x NWAU + Fixed cost (currently $0.9 million)

Note that no in-scope sites are currently block funded.

This means we can treat all in-scope sites as activity-based funded because the fixed cost is the same for every site.

Hospital expenditure – Clinical costing

The limitation to the costing approach described in the 'Cost to NSW Health' section (page 9), termed a "case-mix group" approach, is that it is insensitive to costs that are directly allocatable to the VRGS model of care and the traditional model of care such as:

- For the VRGS model of care:
  - Cost of additional equipment to facilitate the virtual visits
  - Training of VRGS clinicians
  - The salaries of the VRGS clinicians
  - The cost of salaries for those performing the administration of planning and resourcing the VRGS clinicians

  These are costs that have not yet been allocated in the case-mix group approach above nor the clinical costing that informs these costs.

- For the traditional model of care:
  - The higher costs per encounter when locums are providing the service

Another method of costing from which the NWAU is derived through price weights is "Clinical costing". This is the allocation of healthcare-related costs to patient activity. A healthcare facility combines financial data (expense) with patient activity and utilisation data (e.g., diagnostics, pharmacy) to calculate the cost of care at an individual patient encounter level. See Appendix B for the components of these costs and their definitions. Clinical costing data from 2018-19 (i.e., the National Hospital Cost Data Collection (NHCDC) 2018-19) has been used to determine the national price weights for the NWAU21 calculation.

A way to make these costs more sensitive to the model of care is (Drummond et al., 2015, p238):

1. Identify hospital costs unambiguously related to the models of care, termed "directly allocatable costs" (i.e., Equipment and IT, medical salaries (VRGS/non-VRGS), administrator salaries, and other VRGS expenses such as training of VRGS staff and travel)
2. Deduct from total hospital costs operating expenses, the cost of departments already allocated above (Medical salaries only, but note VRGS face to face not in directly allocatable costs)
3. Add back the net hospital costs already allocated to the encounters determined from 2
4. Perform sensitivity analysis

Presentation of costs and outcomes

The economic analysis will be presented as disaggregated costs and outcomes for the comparisons specified in the 'Cost to NSW Health' section (page 9). Table 2 presents total costs and outcomes in each cohort, Table 3 presents the incremental analysis of costs and outcomes, and Figure 1 shows the presentation of a cost-effectiveness plane.

Table 2 Total costs and outcomes in each cohort

Analysis	**Analysis 1**				**Analysis 2**					
Cohorts	**Pre-VRGS implementation**		**Post-VRGS implementation**		**No VRGS**		**VRGS only**		**Hybrid VRGS**	
Costs	**Total**	**Avg /Enc**	**Total**	**Avg /Enc**	**Total**	**Avg /Enc**	**Total**	**Avg /Enc**	**Total**	**Avg /Enc**
Case-mix group approach										
NWAU cost										
Clinical costing approach										
Equipment and IT (VRGS only)										
Medical salaries										
Admin. Salaries (VRGS only)										
Other VRGS expenses (VRGS only)										
Not directly allocatable costs										

Analysis	**Analysis 1**				**Analysis 2**					
Cohorts	**Pre-VRGS implementation**		**Post-VRGS implementation**		**No VRGS**		**VRGS only**		**Hybrid VRGS**	
Total clinical cost										
Outcomes	**n**	**n/N (%)**	**n**	**n/N (%)**	**n**	**n/N (%)**	**n**	**n/N (%)**	**n**	**n/N (%)**
ED presentations	**N_{ED}**		**N_{ED}**		**N_{ED}**		**N_{ED}**		**N_{ED}**	
Time from triage to completion (Total time, Avg./Enc.)										
Arrival to departure greater than 4 hours										
Care completed										
Admitted										
Transferred to other hospital										
Did not wait (incl left at own risk)										
Died in ED										
Unplanned re-presentation within 48 hrs. Same facility or different facility in WNSWLHD										
Hospital admissions	**N_{AD}**		**N_{AD}**		**N_{AD}**		**N_{AD}**		**N_{AD}**	
Long stay outliers										

Analysis	**Analysis 1**				**Analysis 2**					
Cohorts	**Pre-VRGS implementation**		**Post-VRGS implementation**		**No VRGS**		**VRGS only**		**Hybrid VRGS**	
Discharged										
Transferred to other hospital or RAC										
Discharged at own risk										
Died										
Hospital acquired complications (HACs) (Y/N)										
Unplanned readmissions within 28 days. Same facility or different facility in WNSWLHD										

Avg/Enc = Average per Encounter
*Other VRGS expenses include training, travel, and printing and postage from VRGS cost centre expenses

Other outcome measures to be considered could be the number of medication reconciliations, VTE prophylaxis form, and discharge summary completion.

Table 3 Incremental analysis of costs and outcomes need

Analysis	**Analysis 1**	**Analysis 2**	
	Post-VRGS relative to Pre-VRGS	**VRGS only relative to No VRGS**	**Hybrid VRGS relative to No VRGS**
Incremental costs	**Mean difference (95% CI)**	**Mean difference (95% CI)**	**Mean difference (95% CI)**
Case-mix group approach			
NWAU cost			
Clinical costing approach			
Equipment and IT (VRGS only)			
Medical salaries			
Admin. Salaries (VRGS only)			
Other VRGS expenses (VRGS only)			
Not directly allocatable costs			
Total clinical cost			
Incremental outcomes	***Risk/mean difference (95% CI)**	***Risk/mean difference (95% CI)**	***Risk/mean difference (95% CI)**
ED presentations			
Time from triage to completion (Total time, Avg./Enc.)			
Arrival to departure greater than 4 hours			
Care completed			
Admitted			
Transferred to other hospital			
Transferred to other clinical location			
Did not wait (incl left at own risk)			
Died in ED			

Unplanned re-presentation within 48 hrs. Same facility or different facility in WNSWLHD			
Hospital admissions			
Long stay outliers			
Discharged			
Transferred to other hospital or RAC			
Discharged at own risk			
Died			
Hospital acquired complications (HACs) (Y/N)			
Unplanned readmissions within 28 days. Same facility or different facility in WNSWLHD			

95% CI, 95% Confidence Interval. *Adjusted by confounders if required for imbalances in confounders and robust errors to account for correlated outcomes by site. Example confounders: Age, sex, Indigenous status, source of referral, rurality (patient, treatment), For ED: ED visit type, Triage category, mode of arrival, re-presentation within 48 hrs, Admissions: Transferred from another facility, source of referral, Emergency status (planned/unplanned), potentially preventable hospitalisation, readmission, and clinical complexity.

If it is feasible to calculate an ICER, bootstrapped analysis will be explored, then results will be presented on a cost effectiveness plane.

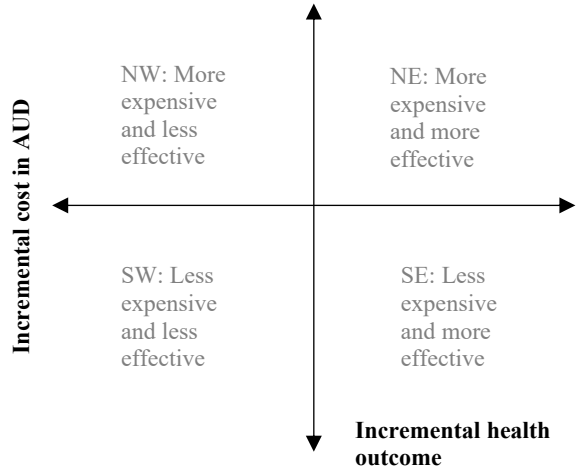


Figure 1 Cost-effectiveness plane

Sensitivity analysis

Sensitivity analyses on cost-effectiveness of VRGS intervention will consider plausible variation in allocatable costs.

Subgroup analysis

Subgroup analyses were specified in the quantitative data analysis plan based on:

- Patients ≥65 years
- Remoteness of patient based on MMM
- Remoteness of site based on MMM
- Indigenous patients

[Update as at 9 October, 2024] The quantitative data analysis plan was changed to only look at subgroups of vulnerable populations. These vulnerable subgroups were deemed to be:

- Indigenous patients
- Older versus younger patients, where older people were defined as being:
    - 65 years or older if they were non-Indigenous, or
    - 50 years or older if they were Indigenous

Note, due to the delay in AHMRC ethics approval for the evaluation of VRGS in Indigenous communities both subgroup analyses will only be presented in a future subsequent publication covering all the analysis conducted evaluating VRGS in Indigenous communities.

Appendix A – Resources, units of measure, unit costs and data sources

Summaries of resources, units of measure, unit costs, and their data sources are provided in Table 4 to Table 9.

Table 4 Health service cost

Item of resource use	Unit	Unit costs	Source of data	Values
Encounter	NWAU	Allocatable cost per NWAU	***Health Intelligence Unit (HIU)*** ***Encounters & NWAU:*** APDC and EDDC **Costs:** Allocatable costs as detailed in tables below	**$x** per encounter

NWAU = National Weighted Activity Unit is the 'currency' that expresses relative resource payment for services funded on an activity basis. NWAUs provide a way of comparing and valuing each public hospital service, whether it is an admission, emergency department presentation or outpatient episode

State Efficient Price = The cost of providing activity-based services by NSW Local Health Districts and Specialty Networks. See NSW ABM Compendium for 2020-21 for State Efficient Price methodology. The 2020-21 State Efficient Price is $4,931.

Total clinical cost = Total cost of service for the financial year (excludes Actuarial Adjustment, PPP Interest, Depreciation)

Costs allocatable to model of care are detailed in Table 5 to Table 9

Table 5 Medical costs for all face-to-face shifts in in-scope sites

Item of resource use	Unit	Unit costs	Source of data
*Medical salary and wages for face-to-face shifts in-scope sites	Site	Actual medical salary and wages expenditure for the period	Business Manager, Rural Sectors, WNSWLHD

*Includes medical staff costs for all face-to-face shifts for GP VMOs, Locums, and VRGS

Table 6 VRGS intervention costs – IT and equipment

Item of resource use	Units	Unit costs	Source of data	Useful life in yrs (manufacturer recommendation)	List Other Users	Estimated % use by VRGS
Equipment purchase						
Wallie	1 per site; i.e., per Wallie	$ ProEX Hub procured	WNSWLHD Telehealth Manager, Health ICT	5	VRGS has priority although growing number of users: vCare, Virtual Clinical Pharmacy Service (VCPS), patient specialist and allied health appointments Virtual Allied Health Service (VAHS)	~100% given priority is VRGS
ProEX Hub with Otoscope kit and GEIS (handheld camera) These are mounted to the tray of the cart known as the Wallie	1 per site	$ per Overbed camera procured		5	CNC for wounds or burns	99%
Overbed cameras	1 per site	$ per Desktop video unit procured		5	vCare	10-15%
Desktop video unit (purely a VC	1 per site	$ per Desktop video unit procured	WNSWLHD Telehealth Manager, Health ICT	5	Mainly for MEC (mental health virtual consults)	5-10%

Item of resource use	Units	Unit costs	Source of data	Useful life in yrs (manufacturer recommendation)	List Other Users	Estimated % use by VRGS
system not a computer)						
VRGS Dr kit						
LHD Laptop and dock HDMI cable	25 (includes 2 more kits for emergencies)	WNSWLHD ICT standard costs for orders via SARA portal	Rural Health Innovation Lead, Rural Sectors, Operations	5	None	100%
Web camera	25 (includes 2 more kits for emergencies)	WNSWLHD ICT standard costs for orders via SARA portal	WNSWLHD Telehealth Manager, Health ICT	5	None	100%
Equipment maintenance						
Wallie	1 per site (41 currently, see site list Appendix D)	25 (includes 2 more kits for emergencies)	WNSWLHD Telehealth Manager, Health ICT	NA	VRGS has priority although growing number of users: vCare, Virtual Clinical Pharmacy Service (VCPS), patient specialist and allied health appointments Virtual Allied Health Service (VAHS)	100%
ProEx Hub	1 per site (37 currently)	Annual fee		NA	CNC for wounds or burns	99%

Item of resource use	Units	Unit costs	Source of data	Useful life in yrs (manufacturer recommendation)	List Other Users	Estimated % use by VRGS
Overbed cameras	1 per site	Annual fee		NA	vCare	10-15%
Desktop video unit	1 per site (25 in ED)	Annual fee		NA	Mainly for MEC (mental health virtual consults)	5-10%
Software						
Plexsum integration engine software	# accounts = 4-5	Annual fee	WNSWLHD Telehealth Manager, Health ICT	NA	NA	100%
Data usage/connectivity costs						
Data usage fees	Year	None – Doctors have to have reliable connection of reasonable speed. No claims from doctors as yet, but could potentially claim on their contracts.				
Significant costs for LHD for technical analysis, e.g., upgrade for bandwidth and technical enablers occurred before our analysis period – for noting only						

Table 7 Estimates of locum/face-to-face VRGS costs

Item of resource use	Unit	Unit costs	Source of data
Locum and VRGS face-to-face salary and wages	Per shift day	Average daily rate	For locum rates, Medical Workforce – Litmus Coordinator For VRGS rates, Rural Health Innovation Lead, Rural Sectors, Operations
Travel flights, meal, and accommodation			
Flights	Return flight per two weeks	Flight cost City Dubbo return: SYD $300, BRS $350, ADEL $450, PERTH $700, DAR $1400: Average $500	Flight centre
Ground transport	Two weeks car hire +2 days (small SUV) plus two petrol tanks	Care hire rate $1,252.80	Avis Dubbo Airport

Item of resource use	Unit	Unit costs	Source of data
Locum and VRGS face-to-face salary and wages	Per shift day	Average daily rate	For locum rates, Medical Workforce – Litmus Coordinator For VRGS rates, Rural Health Innovation Lead, Rural Sectors, Operations
		Cost petrol per L ($2) x tank size (63L)	Fuel watch website for Dubbo
Meal	Two weeks + two days meals	breakfast 37.50 lunch 53.10 dinner 74.30	Taxation determination TD2021/6: Statutory meal allowance for Employee's annual salary – $230,051 and above
Accommodation	Two weeks + two days House or motel, Note that on-site accommodation usually occupied by nursing staff	$150 mid ($120-$200)	Business Manager, Rural Sector, WNSWLHD and Taxation determination TD2021/6 $195 (none higher in Table 4; e.g., Cobar $144 per night)

Table 8 VRGS intervention costs – Salary and wages from VRGS cost centre (note excludes F2F cost)

Item of resource use	Unit	Unit costs	Source of data
Total VRGS S&W (net of F2F time)			
*Administration staff	FTE x Estimated % of time working on VRGS per annum	Salary per annum	VRGS Financial Data - FY19 - FY22.xlsx, "Administration Expenses", cost centre VRGS
- Admin Officer Level 6	0.84 FTE x 100%		
- Health Manager Level 3	1 FTE x 30%		
- Medical Superintendent	0.5 FTE x 20%		
**Medical staff	Total Salaries and Wages	Cost per annum	VRGS Financial Data - FY19 - FY22.xlsx, S&W Med

*Administration Expenses: The VRGS cost centre (CC804158 WLHD Virtual Rural Generalist Service) has incurred costs for various Admin positions that do not directly work on VRGS-related tasks, so the Admin cost component is based on proportion FTE as provided by the Business Manager, Rural Sector, WNSWLHD

**Medical S&W for VRGS face-to-face days are not allocated to this cost centre (source: Business Manager, Rural Sector, WNSWLHD)

Table 9 VRGS other expenses

Item of resource use	Unit	Unit costs	Source of data
Total VRGS other expenses			
Goods & Services			
Contract Catering	Various	Cost per annum	VRGS Financial Data – FY19 – FY22.xlsx, CC804158 WLHD Virtual Rural Generalist Service
Consult OP Org Rev			
Functions			
Postal/print & Stat other			
*Travel Dom Accommodation			
*Travel Dom Airflights			
Travel Dom Mot Vehs			
Travel Dom Per Diem Allow & Other			
VRGS staff training costs			
Orientation and Onboarding - Salaries and Wages. Assumes 30 hours required to onboard every new staff member - covering 2-day Orientation Programs, hours required to complete mandatory training, system testing sessions, and 2 half buddy shifts each. Assumes 4 new staff will be onboarded per annum	Hrs (30hrs) x # average hires per year (~4)	$150	Rural Health Innovation Lead, Rural Sectors, Operations
Twice Annual Training Days - Salaries and Wages Assumes 20 doctors attend for the Training days of 3 days each (8hr days @$150/hr), two times each year	2 x Hrs (24 hrs) x # VRGS Drs (20)	$150	Rural Health Innovation Lead, Rural Sectors, Operations

*Note there are no international travel costs for VRGS

Appendix B – Clinical costing model components and definitions

Clinical costing is the allocation of healthcare-related costs to patient activity. A healthcare facility combines financial data (expense) with patient activity and utilisation data (e.g., diagnostics, pharmacy) to calculate the cost of care **at an individual patient encounter level**. The components of the cost of care with their definitions from the NSW ABM portal are listed in Table 10.

Table 10 Components of clinical costing and definitions (source: NSW ABM portal)

Components of clinical costing	**Definition**	**Directly Allocatable Cost to VRGS or traditional models of care (Y/N)**
Allied	Average Cost of all Good & Services (Excluding Pathology, Imaging, Pharmaceuticals and Prosthesis) and Salary and Wages for Allied Health Cost centres. Included is average Cost of Allied Health Salary and Wages costs that occurred in Clinical Service Cost centres.	N
Med	Average cost of all Medical Salary and Wages and VMO Payments in Clinical Service or Ward cost centres	Y
Nurse	Average cost of all Nursing Salary and Wages in Clinical Service or Ward cost centres	N
Critical Care	Average cost of all Goods & Services (excluding prosthesis), Salary and Wages and VMO Payments for Critical Care cost centres including ICU, HDU, CTICU, PSICU, NICU, PICU and CCU	N
Imag	Average cost of all Imaging Goods & Service costs except for those in Critical Care, SPS, Operating Suite or Emergency cost centres and average cost of all Goods & Services (excluding Prosthesis), Salary and Wages and VMO Payments for Imaging cost centres	N
OR	Average cost of all Goods & Services (excluding Prosthesis), Salary and Wages and VMO Payments for Operating Theatre cost centres	N
Path	Average cost of all Pathology Goods & Service costs except for those in Critical Care, SPS, Operating Suite or Emergency Cost centres and Average cost of all Goods & Services (excluding Blood & Prosthesis), Salary and Wages and VMO Payments for pathology cost centres	N
Pharm	Average cost of all Pharmacy Goods & Service costs except for those in Critical Care, SPS, Operating Suite or Emergency Cost centres and Average cost of all Goods & Services (excluding Prosthesis), Salary and Wages and VMO Payments for Pharmacy cost centres	N
Pros	Average cost of all Prosthesis costs in all cost centres	N
SPS	Average Cost of all Good & Services (excluding Prosthesis), Salary and Wages and VMO Payments for Specialist Procedures Suites (SPS)	N
Ward & ED Supplies	Average cost of all Goods & Services (excluding Pathology, Imaging, Pharmacy and Prosthesis) for Clinical Service or Ward cost centres	N
On Cost	The average amount of on costs. These costs include Superannuation and Workers Compensation premium payments.	N
Non-clinical	The average amount of non-clinical costs including hotel and administrative costs, non-clinical salaries and wages	N
Exclude	The average amount of costs that are excluded from the NSW State Efficient Price such as blood, redundancy payments, long service and annual leave actuarial adjustments and professional indemnity premium payments	N

Patient Transport	Average cost of all Patient Transport costs in all cost centres	N
***Total Cost**	**Total cost of service for financial year. Excludes Actuarial Adjustment, PPP Interest, Depreciation.**	**NA**

*****We have termed Total Cost as “Total Clinical Cost” to distinguish it from generic total costs

Appendix C – In-scope sites and funding methodology

All in-scope sites are funded through the small rural hospital funding methodology for 2021-22.

Table 11 In-scope sites and funding methodology

#	**In-scope site**	**Methodology 2021-22**
1	Baradine Multi-Purpose Service	SRHFM
2	Blayney Multi-Purpose Service	SRHFM
3	Bourke Multi-Purpose Service	SRHFM
4	Brewarrina Multi-Purpose Service	SRHFM
5	Canowindra Soldiers' Memorial Hospital	SRHFM
6	Cobar District Hospital	SRHFM
7	Collarenebri Multi-Purpose Service	SRHFM
8	Condobolin Health Service	SRHFM
9	Coolah Multi-Purpose Service	SRHFM
10	Coonabarabran District Hospital	SRHFM
11	Coonamble Multi-Purpose Service	SRHFM
12	Dunedoo War Memorial Multi-Purpose Service	SRHFM
13	Gilgandra Multi-Purpose Service	SRHFM
14	Grenfell Multi-Purpose Service	SRHFM
15	Gulgong Multi-Purpose Service	SRHFM
16	Lightning Ridge Multi-Purpose Service	SRHFM
17	Molong Multi-Purpose Service	SRHFM
18	Narromine District Hospital	SRHFM
19	Nyngan Multi-Purpose Service	SRHFM
20	Oberon Multi-Purpose Service	SRHFM
21	Peak Hill Multi-Purpose Service	SRHFM
22	Rylstone Multi-Purpose Service	SRHFM
23	Tottenham Multi-Purpose Service	SRHFM
24	Trangie Multi-Purpose Service	SRHFM
25	Trundle Multi-Purpose Service	SRHFM
26	Tullamore Multi-Purpose Service	SRHFM
27	Walgett Multi-Purpose Service	SRHFM
28	Warren Multi-Purpose Service	SRHFM
29	Wellington District Hospital	SRHFM

SRHFM = Small Rural Hospitals Funding Methodology

Appendix D – Wallie list

Under normal circumstances there would be a total of 42 Wallies - some sites have additional equipment for the District's COVID response. Two of these have maintained their "old" Wallie as they were designated COVID Facilities. Other COVID designated facilities have Cisco DX80 - the desktop systems on a trolley in the actual COVID ward. These do NOT leave the ward.

Appendix E – VRGS shift rates

Shifts	On Call	Daily Rate
Day **0800 - 1800 hours**	on-call until 2000hrs	Mon-Fri: $1,500.00 Sat & Sun: $1,800.00 Public holiday: $2,250.00
Ward **0800 - 1800 hours**	on-call until 2000hrs	As for day
Bridge **1200 - 2200 hours**	on-call until 2400hrs	As for day
Evening **1400 - 2400 hours**	on-call until 0200hrs	As for day
Night **2000 - 0800 hours**	N/A	Mon-Fri: $2,200.00 Sat & Sun: $2,640.00 Public holiday: $3,300.00
On site (face-to-face shifts)	24 hours	$2,000.00
vCare shifts	1900-0700hrs	$1,467.00

Appendix F – GP VMO expenditure

Medical salaries and wages for FY21/22 are shown below. Locum days for travel expenses are also shown below.

Facility name	**Medical cost (AUD)**	**Locum days**
Total	$x	X days

Glossary

Term	Definition
ABM Portal	The NSW ABM Portal is an online tool that provides comparative clinical costing data on healthcare services and patient characteristics. The tool can be accessed at *http://internal.health.nsw.gov.au/abf_taskforce/abm_portal/main.html*
Activity-Based Funding (ABF)	ABF is a way of funding hospitals for the number and mix of patients they treat. ABF takes into account that some patients are more complex and resource intensive to treat than others. • Under ABF in NSW Health services are funded at a unit price (weighted activity unit) based on activity agreed in Service Agreements with the Secretary, NSW Health.
Activity-Based Management (ABM)	ABM is an evidence-based management approach. It uses patient level costing data to inform strategic and operational decision making.
Australian Refined Diagnosis Related Groups (AR-DRGs) Classification *often referred to as DRGs Classification.*	The national classification that is used to classify acute admitted patient episodes into clinically meaningful categories of similar levels of complexity (outputs) that consume similar amounts of resources (inputs).
Australian Emergency Care Classification (AECC)	AECC is the emergency care classification system developed primarily for activity-based funding of emergency care. • In NSW, the AECC replaces Urgency Related Groups and Urgency Disposition Groups from 1 July 2021 in emergency care settings. • The classification provides more accurate and clinically meaningful data on emergency care services; particularly the allocation of resources to reflect the complexity of patient care.
Average Length of Stay (ALOS)	The average duration of a hospital episode of care excluding leave days. The measure is either days for admitted patient episodes or hours for emergency patient presentations.
Avoidable Readmission IHPA has developed a risk adjustment model for avoidable hospital readmissions. • NSW Health is not factoring avoidable hospital readmissions into its funding/pricing model or into purchasing methodology in 2021-22.	A readmission occurs when a patient who has been admitted and discharged from hospital (index admission) is admitted again within a certain time interval, and this readmission: - is clinically related to the index admission, and - has the potential to be avoided through improved clinical management and/or appropriate discharge planning in the index admission.

Term	Definition
Block Funding	In NSW, block funding applies to facilities/services which are not under Small Rural Hospitals Funding Methodology or Activity-Based Funding. • Block funding is based on the latest full financial year clinical costing data submission (District and Network Return), plus escalation.
Bounds *see also 'Inliers', 'Outliers',* *'Low3 High3' and* *'Low1.5 High1.5'*	Bounds of each class reflect the admitted episode length of stay (LOS) range within that class: - Inlier bounds represent episodes where the LOS is within the statistical upper and lower boundary points for a particular class within a classification - Those episodes that do not fit within this typical range of LOS are described as either short or long-stay outliers (also referred to as upper and lower bounds). • The bounds are calculated using either the L3H3 or L1.5H1.5 methodology.
Casemix/Casemix Classification	Casemix is a general term that describes any system which aggregates information about patients and associated procedures into groups based on the type and mix of the patients treated by a hospital or other healthcare facility *(Health Information Management Association of Australia).* • The groupings enable a clinically meaningful way of relating the number and type of patients treated in a hospital (hospital casemix) to the resources required by the hospital or other healthcare facility.
Class *in the context of casemix classifications see also 'Error Class'*	• A class is an integral structural element of each casemix classification. • A class represents a grouping (with a unique code and description) of patient encounters with similar characteristics into a meaningful category. • Examples of classes are: - Tier 2 (for non-admitted patients) – *20.33 Dermatology* - AR-DRG (for acute admitted) – *F23Z Heart Transplant* - AN-SNAP (for sub and non-acute) – *4J01 Adult Same-Day Rehabilitation* - AECC (for emergency presentations) – *E0430B Asthma Complexity level B.*

Term	Definition
Clinical Coding	The process of translating disease and procedure information that has been documented by a clinician in a health record into ICD-10-AM (for diagnoses) or ACHI (for procedures/interventions) codes for the purpose of describing the patients admitted journey of care and in preparation to be grouped. • A software application (grouper) with a special algorithm uses the clinical codes to allocate the AR-DRGs within the AR-DRG Classification to an admitted care episode.
Clinical Costing *see also 'District and Network Return (DNR)'*	Clinical costing is the allocation of healthcare-related costs to patient activity. A healthcare facility combines financial data (expense) with patient activity data, and the cost is allocated to individual patient activity. • Within NSW, clinical costing is undertaken to prepare the District and Network Return (DNR) which is a condition of subsidy. Costing data is published in the ABM Portal and allows clinicians and managers to analyse cost variation relating to patient complexity or service delivery.
Complexity Split *in the context of casemix classifications*	Each classification is split into classes that represent different levels of patient complexity, known as complexity split. • Complexity reflects differences in patient characteristics, levels of care and resource consumption.
Complication *see also 'Hospital Acquired Complication' and 'Condition Onset Flag (COF)'*	• A condition that affects the patient's treatment/management and/or length of stay in hospital. Complications can be present prior to a hospital admission or develop during the hospital stay. • A condition onset flag (COF) defines complications that arise during the hospital stay and were not present on admission (COF 1) and those that were known on admission (COF 2). • The complications that develop during a hospital admission are referred to as Hospital Acquired Complications.
Condition onset flag (COF) *see also 'Complication' and 'Hospital Acquired Complication (HAC)'*	A qualifier for each coded diagnosis to indicate the onset of the condition relative to the beginning of an admitted patient episode of care, as represented by a code.
Cost-Price Adjustment *see also 'Projected Average Cost' and 'State Efficient Price'*	The cost-price adjustment relates to the difference between the District or Network Projected Average Cost (PAC) and the State Efficient Price. • This adjustment is an interim measure being provided where applicable. The rules for funding growth activity from the cost-price adjustment have been applied.

Term	Definition
Discharge Summary	• A clinical report prepared by a clinician at the end of an admitted patient's episode of care outlining information such as diagnosis, procedure, medical investigation findings, progress and recommendations on discharge.
District and Network Return (DNR)	The mandatory clinical costing data submission from each District/Network to the NSW Ministry of Health. DNR includes patient activity and utilisation data, along with general ledger expenses to calculate hospital costs in a fully absorbed costing model. • DNR is audited by local internal audit teams and used to inform the State Efficient Price, the National Efficient Price and several national data submissions, such as National Hospital Cost Data Collection, Public Hospital Establishment and Health Expenditure. • DNR costing data is also published in the NSW ABM Portal and enables clinical variation analysis.
Emergency Care Categories (ECC) *see also 'Australian Emergency Care Classification' and 'Emergency Care Diagnosis Groupings'*	ECC's are higher level groupings of Emergency Care Diagnosis Groups (ECDGs) and are used mainly for navigating ECDGs. • Examples are: - E01 – Nervous system and neurological - E02 – Eye - E03 – Ear, nose, mouth and throat.
Emergency Care Diagnosis Groups (ECDGs) *see also 'Australian Emergency Care Classification' and* *'Emergency Care Category'*	Clinically meaningful groupings of emergency care short list diagnoses reflecting care pathways. The ECDG subcategories are used in the complexity splits where more complex diagnoses within an ECDG reflect differences in the cost of the subcategories. • Examples of ECDGs in the *ECC E01 Nervous System and Neurological* are: - E0110 Dementia and other chronic brain syndromes - E0120 Delirium - E0130 Stroke and other cerebrovascular disorders.
Emergency Department Stay *in the context of emergency care setting*	Emergency department stay refers to a presentation date which is the date on which the patient/client presents for the delivery of an emergency service, expressed as DDMMYYYY. *METeOR: 651867.*
Encounter *see also 'Episode of Care', 'Presentation', 'Occasion of*	An encounter is an interaction between a patient and healthcare provider/s. It is used to recognise patient activity associated with healthcare service(s) or the health status of a patient. All funded healthcare contacts are identified as an 'encounter'.

Term	Definition
Service' and 'Service Event'	• As activity data element concept an encounter is described as follows: - in the admitted patient context, an encounter must represent at least an episode of care, and cover the period of the formal or statistical admission to the discharge. - in a non-admitted patient context, an encounter may represent an individual service event or bundled occasions of service that group to one service event or encounter for the month.
Episode Clinical Complexity (ECC) Model *see also 'Diagnosis Complexity Level',* *'Complexity Split and 'Episode Clinical Complexity Score (ECCS)'*	ECC is a model which forms the basis of the AR-DRG Classification. ECC allows for cost variation within adjacent ADRGs. • ECC is used to split an adjacent diagnosis related group (ADRG) into DRG classes reflecting clinical complexity levels based on resource homogeneity.
Episode Clinical Complexity Score (ECCS) *see also 'Episode Clinical Complexity (ECC)'*	The ECCS is a measure of the cumulative effect of diagnosis complexity levels (DCLs) for a specific acute care episode. • An ECCS is expressed as a value between 0 and 31.25. *Australian Consortium for Classification Development, 2014.*
Episode of Care *admitted patient care* *see also 'Admission'* *and 'Separation'*	The period of care between the admission (formal or statistical) of a patient to a healthcare facility for treatment and the patient's separation (formal or statistical) characterised by one care type. • Each admission is comprised of one or more episodes of care which represent a period of care with a common clinical focus as reflected by the "care type". However, one episode of care is characterised by one care type.
Funding calculation – emergency presentations under ABF	The emergency presentation funding formula: {Price Weight x (1 + Indigenous Patient Adjustment + Patient Residential Remoteness Adjustment) x (1 + Patient Treatment Remoteness Adjustment)} x State Efficient Price.
Funding Calculation – admitted acute under ABF	An admitted acute episode funding formula: {[Price Weight x Paediatric A x (1 + Specialist Psychiatric Age A + Indigenous Patient A + Patient Residential Remoteness Area A + Radiotherapy A + Dialysis A) x (1 + Patient Treatment Remoteness Area A) + (ICU A x ICU hours)] – [(Price Weight + ICU A x ICU hours) x Private Patient Service A + Length of Stay x Private Patient Accommodation A]} x State Efficient Price. *where A=adjustment*

Term	Definition
Healthcare Facility	An organisation such as a hospital, a community health service, Multipurpose Service or an integrated health service.
Hospital Acquired Complication (HAC) *see also 'Complication'* NSW purchasing methodology risk adjusted for HACs is applied for fifteen HACs as per the *NSW Purchasing Framework*	A HAC refers to a patient complication for which clinical risk mitigation strategies may reduce (but not necessarily eliminate) the risk of that complication occurring. • A HAC is a condition that develops during an admission and affects the patient's treatment/management and/or length of stay in a hospital. *Refer to Appendix E for the list of HACs.*
Hospital In The Home (HITH)	HITH is a clinical model that provides admitted acute/sub-acute care in the patient's home or the community as a substitute for in-hospital care. Instead of receiving care and hospital accommodation, patients receive hospital level care whilst being accommodated in their own home. *NSW Hospital in the Home Guideline, GL2018_020.*
Hospital Stay *see also 'Episode of Care'*	The period of admitted patient care between a formal admission and a formal discharge which comprises one or more episodes of care. *NSW Policy Directive PD2016_039, Care Type Policy for Acute, Sub-Acute and Non-Acute and Mental Health Admitted Patient Care.*
Independent Hospital Pricing Authority (IHPA)	A typical episode of care, such as one with an average length of stay or consuming an average amount of resources. In these episodes the length of stay is between the statistical upper and lower boundary points for most cases within the particular casemix class.
Index Admission *see also 'Avoidable Readmission'*	The first admission in a series of admissions within a specified time frame.
Length of Stay (LOS) *in the context of hospital stay* *See also 'Leave Days'*	The length of stay of an admitted patient in hospital, excluding leave days, measured in days. - a same-day patient should be allocated a length of stay of one patient day. - the length of stay of an overnight stay patient is calculated by subtracting the date the patient is admitted from the date of separation and deducting total leave days. *METeOR 269422.*
Low 1.5 High 1.5 (L1.5H1.5) *see also 'Bounds'*	The method used to set the length of stay inlier bounds for: - sub-acute and non-acute patient admitted episodes

Term	Definition
	- acute admitted mental health episodes coded to Major Diagnostic Categories MDCs 19 and 20 - high-cost long-stay AR-DRGs. • The upper bound is set at 1.5 times the average length of stay (ALOS) and the lower bound is set at two thirds of the ALOS.
Low 3 High 3 (L3H3) *see also 'Bounds'*	The method used for calculating the length of stay inlier bounds and outliers (short and long stay) for all acute admitted patient care episodes, except those where L1.5H1.5 is applied: - sub-acute and non-acute patient admitted episodes - acute admitted mental health episodes coded to Major Diagnostic Categories (MDCs) 19 and 20 - high-cost long-stay AR-DRGs. • The upper bound is set at three times the average length of stay (ALOS) and the lower bound is set at one third of the ALOS.
Major Diagnostic Category (MDC) *see also 'Pre-MDC'*	MDCs are mutually exclusive categories into which principal diagnoses fall. Each MDC is generally based on a single body system *(e.g., Respiratory)* or corresponds to a clinical specialty *(e.g., Ear, Nose, Mouth and Throat)* providing care. Each category is partitioned according to whether a general intervention was performed or not. • This preliminary partitioning into MDCs occurs before an AR-DRG is assigned. In AR-DRG version 10.0 there are 23 MDCs and 1 Pre-MDC (MDC 00). *AR-DRG v10.0 Definitions Manual Volume 1, IHPA 2019.*
Medical Benefits Schedule (MBS)	A listing of the Medicare services subsidised by the Australian Government.
National Efficient Cost (NEC)	The cost set by IHPA for public hospitals or services that do not meet ABF criteria, such as small rural hospitals. • NEC determines the Commonwealth funding contribution to States and Territories for block funded hospitals.
National Efficient Price (NEP)	The price, set by IHPA, that determines the Commonwealth Government's share of funding to States and Territories for public hospital services funded on an activity basis (ABF).
National Weighted Activity Unit (NWAU)	A NWAU is the unit for counting healthcare service activity, based on the clinical complexity of patients and legitimate variations in costs.

Term	Definition
	• The NWAU can be described as a single 'currency' that expresses relative resource use for healthcare across all settings. • The 'average' health service is equivalent to one NWAU. More intensive and expensive activities are funded by multiple NWAUs, and simpler and less expensive activities are funded by fractions of an NWAU.
Non-ABF methodology *see also 'Small Rural Hospitals Funding Methodology' and 'Block Funding'*	Non-ABF methodology refers to the method of funding facilities/services which are not under ABF. Non-ABF methodology is split into two types: - Small Rural Hospitals Funding Methodology (SRHFM) - applicable to facilities which are neither ABF nor block funded. - block funding - applicable to facilities/services not under ABF or SRHFM.
Outlier *see also 'Bounds'* *and 'Inlier'*	Outlier is a length of hospital stay outside of inlier bounds.
Overnight Admission	An overnight admission is where the admission date and separation date occur on different calendar days. *NSW Health Policy Directive PD2017_015, NSW Health Admission Policy.*
Paediatric Intensive Care Unit (PICU)	Must be capable of providing complex, multisystem life support for an indefinite period; be a tertiary referral centre for children needing intensive care; and have extensive backup laboratory and clinical service facilities to support this tertiary role. • Must be capable of providing mechanical ventilation, extracorporeal renal support services and invasive cardiovascular monitoring for an indefinite period to infants and children less than 16 years of age, or care of a similar nature. *METeOR 327234.*
Pre-ECDG *Australian Emergency Care Classification.* *see also 'Emergency Care Diagnosis Groups'*	The AECC has three Pre-ECDG classes (first step in the AECC grouper processing logic). These classes represent episodes for which a diagnosis is not available or not relevant. • The Pre-ECDG's are: - planned return visit - not attended by a healthcare professional - dead on arrival

Term	Definition
	• Following the Pre-ECDG processing for all remaining emergency presentations the grouper checks whether a valid principal diagnosis short list code has been assigned
Pre-MDC *see also Major Diagnostic* *Categories (MDCs)*	Prior to allocation to an MDC, Pre-MDC assignment occurs, which: - Identifies very high-cost episodes (e.g., ventilation ≥336 hours) and - Is driven by a specific intervention code that overrides the outcome of the principal diagnosis-based MDC assignment. *AR-DRG v10.0 Definitions Manual Volume 1, IHPA 2019.*
Price Weight	Price weight is the term used to describe the price of activity-based funded (ABF) healthcare activity weighted to account for patient complexity. • Adjustments may be applied to a price weight to account for legitimate and unavoidable variations in the cost of health service delivery.
Sentinel Event Any public patient healthcare encounter that includes a sentinel event is not funded. This applies to all patient encounters across all the facilities irrespective of the funding methodology they have.	Sentinel events are a subset of hospital adverse events that result in death or serious harm to a patient.
Small Rural Hospitals Funding Methodology (SRHFM)	The SRHFM is used to allocate the budget for NSW small rural hospitals which do not meet the criteria for ABF or block funding. • The SRHFM is based on activity and fixed and variable operating costs of small public hospitals. It aims to better harmonise funding and activity flow between small hospitals and ABF hospitals in rural settings • Facilities eligible for funding by SRHFM are: - rural facilities which deliver activity of ≤3,500 total NWAU per annum - major city (metropolitan area) hospitals with activity 1,800 admitted patient NWAU per annum.
Specified Intensive Care Units	Specified intensive care units are intensive care units that are eligible for the intensive care unit adjustment
State Efficient Price *see also 'State Price'*	The amount that NSW Health determines is the price paid to Districts and Networks for the delivery of each National Weighted Activity Unit (NWAU) across the NSW Health system.

Term	Definition
	• This is the price for which activity from Districts and Networks is purchased. • The State Efficient Price is calculated for each financial year using the clinical costing data from District and Network Return (DNR).

Sourced from NSW ABM Compendium 2021-22 online

Appendix 2: Supplementary methods and results

Acceptability analysis of VRGS from interviews with local doctors and district/executive-level managers 40
Data flowcharts for cohort and pre-post analyses 43
Patient characteristics 44
Cohort analysis 44
Pre-post analysis 47
Scenario analysis for price per activity unit for VRGS versus non-VRGS 52
Cost-effectiveness planes for emergency department presentations 53
Pre-post analysis 53
References 55

Supplementary Table 1 Acceptability analysis of VRGS with local doctors/managers 40
Supplementary Table 2 Characteristics of emergency department presentations by cohort (FY21/22) 44
Supplementary Table 3 Characteristics of hospital admissions by cohort 46
Supplementary Table 4 Characteristics of emergency department presentations by period 48
Supplementary Table 5 Characteristics of hospital admissions by period 49
Supplementary Table 6 Prices per activity per model of care by scenario 52

Supplementary Figure 1 Cohort analysis data flowchart 43
Supplementary Figure 2 Pre-post data analysis flowchart 43
Supplementary Figure 3 Cost-effectiveness planes for Post versus Pre: Incremental cost A per minute saved in ED arrival to departure time, B per ED presentation within 4 hours (arrival to departure time) 53
Supplementary Figure 4 Cost-effectiveness planes for Post versus Pre: Incremental cost A per admission, B for avoiding a patient departing for another clinical location, C for avoiding a patient not waiting, D for avoiding an unplanned re-presentation within 48 hours 54

Acceptability analysis of VRGS from interviews with local doctors and district/executive-level managers

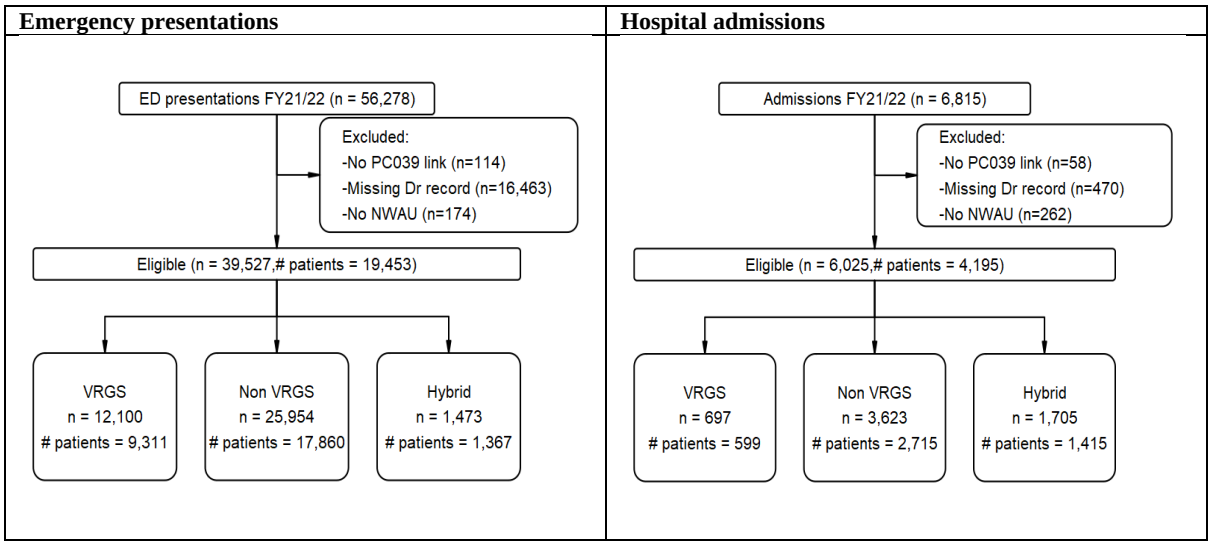
Supplementary Table 1 Acceptability analysis of VRGS with local doctors/managers

Objective	To evaluate the extent to which local doctors and district/executive-level managers see VRGS as acceptable.
Methods	
Study design	Semi-structured interviews and focus groups were conducted. Interview questions were designed to incorporate constructs from the Theoretical Framework of Acceptability (TFA) (1), the Consolidated Framework for Implementation Research (CFIR) (2), and the NSW Health Virtual Care Strategy Monitoring and Evaluation Plan (3). Responses were analysed using a deductive thematic approach aligned to the CFIR.
Participant recruitment and selection	Invitations to participate in interviews or focus groups were distributed by email for the acceptability analysis. Participation was voluntary. Staff had the option of participating by phone or online.
Analysis	Transcripts were coded manually and analysed using a deductive thematic approach aligning with the CFIR (2).
Outcome measures	The most frequently cited data points were identified as themes for that group of stakeholders, i.e., local doctors or managers.
Results	
Local doctor interviews	
Local doctor participation	All local doctors who volunteered to participate were interviewed, with two exceptions: one who did not know what VRGS was and another who was unavailable in the evaluation timeframe. Nine local doctors and two locums were interviewed individually, online, or by phone.
Themes	
Clinical capacity and workforce configuration	Local doctors were grateful for the fatigue relief provided by VRGS, and several said their positions would be untenable without this support, making rural positions more attractive and supporting longevity in the role.
Quality of care	Local doctors appeared to have more divergent views of VRGS than managers. All but two said that VRGS provides good quality care most of the time, within the limitations of virtual care, and is necessary to provide medical coverage in the region with the current workforce shortages. The two local doctors who expressed more negative views about VRGS appeared to conflate VRGS with a different virtual care model in operation, vCare. Their views were inconsistent with those of the other local doctors and site staff interviewed.
Access to medical care	The local doctors generally saw VRGS increasing access to medical care in rural sites, thus improving the overall quality of healthcare available to people across the LHD. They saw the VRGS doctor group as generally highly skilled clinicians who provide good quality care. They saw no

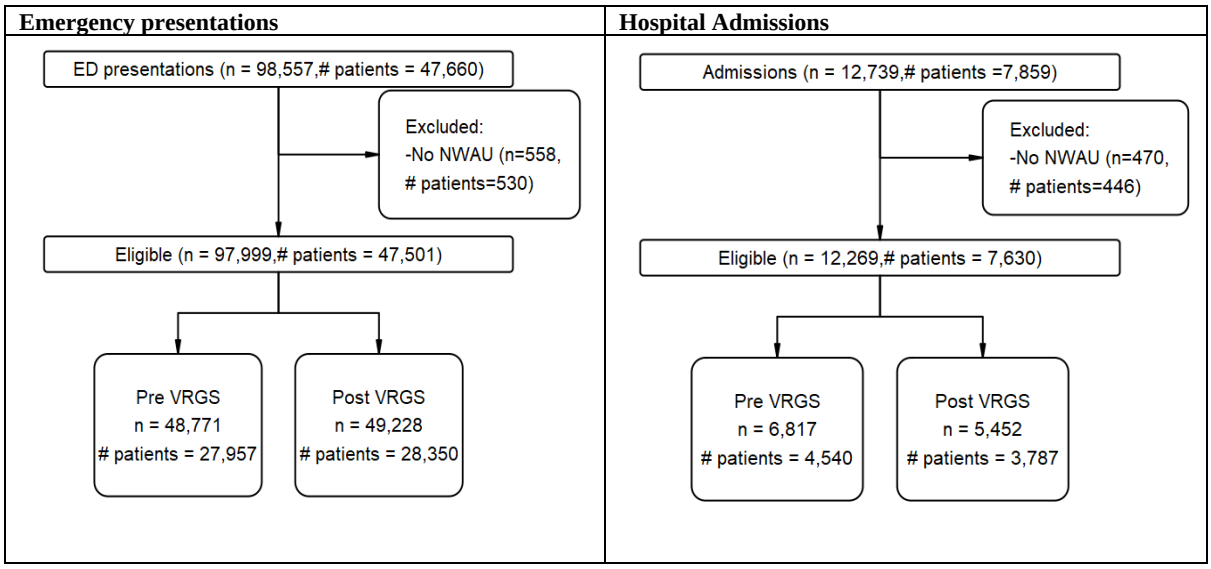
	significant difference in the quality of care provided virtually by VRGS compared to traditional face-to-face care, where virtual care is adequate (i.e., in most cases).
Number of transfers	Some local doctors saw VRGS as reducing the need for patients to be transferred, but others said without a doctor on site, most transfers would have been required whether or not VRGS was available.
Continuity of care	They commented that using VRGS could negatively affect the continuity of care for admitted patients. However, the reported impact of this was inefficiency for staff rather than a detrimental impact on patient outcomes.
Comparison to other virtual models of care	VRGS was seen as providing significantly better quality of care than the previous phone-based service (RMCS) because the doctor can see and directly communicate with the patient rather than rely on nurse-mediated communication.
District and executive-level managers interviews	
Manager participation	All staff who volunteered to participate were interviewed. There were 11 district-level and three executive-level managers interviewed, the executive in a focus group and district-level individually. All interviews were conducted online or by phone. The participant sample was considered representative of the primary Executive Directors and managers who oversee VRGS and related services.
Themes	
Clinical capacity and workforce configuration	VRGS was seen as an asset in navigating medical workforce shortages and fluctuations due to the agility and scalability of the model. Managers reported that while they continued to try to fill every vacancy with a doctor on the ground, a national shortage of locums made this impossible. VRGS enabled medical coverage at any site when local doctors or locum positions were not filled. The service could be scaled up or down to boost clinical capacity. However, they noted that the extra demands of VRGS on nursing staff have not been factored into staffing ratios. There was a potential need for an additional non-clinical role of 'virtual navigator' or 'clinical support officer' to practically and administratively support virtual services, e.g., booking appointments and moving and maintaining the technology.
Access to medical care	VRGS was seen by managers as "an essential service" to provide medical coverage to smaller communities in the district, increasing access to good quality medical care, working alongside other services including vCare, the Virtual Clinical Pharmacy Service (VCPS), and local staff. Virtual care was now part of a patient's total care journey and was not seen as replacing face-to-face care.
Functionality and Reliability	Managers were of the view that VRGS was better than the locum model, with the following advantages: Easily scalable when required; VRGS doctors are more skilled, accountable, invested, used to working with other virtual services like telepharmacy, provide staff education when on site, and have a better understanding of health provision in the rural context; lower cost; and the team environment fosters quality improvement and innovation.

Integration with health service	VRGS is considered one of the district's many virtual services that have quickly appeared in recent years without an overarching vision or structure for these services. As a result, VRGS and other virtual services are seen as 'siloed' and poorly integrated. Structural change is necessary to integrate virtual services within the broader health system. The administration acknowledges a public relations problem around VRGS and that there needs to be more community and staff engagement during the implementation. In addition, as mentioned in workforce configuration, the extra demands on nursing staff have not been factored into staffing ratios, and there is a need for additional non-clinical virtual support roles.
Discussion	Local doctors and managers support the model because of its flexibility to scale up and down according to need, ability to complement and support existing medical capacity, providing there is a core support capacity (which is currently mainly provided by local nursing staff). However, managers add that the service could be improved by recognition of additional nursing or technical staff support and skills development among local clinical staff to support virtual care.
Limitations of analysis	Because VRGS is part of a system, it was sometimes difficult or artificial to isolate views about VRGS from other virtual services, especially its sister service vCare. In particular, some local doctors (including those most negative about virtual services) conflated their feedback about vCare and VRGS; thus the data provided in these cases do not exclusively refer to VRGS. Another possible gap in the data is the lack of sampling of medical specialists who have interacted with VRGS and may have views about the service.
Conclusion	With additional investment in nursing and technical staff to support the service, VRGS has promise as a scalable service to increase access and sustain quality medical care in rural and remote communities.

Data flowcharts for cohort and pre-post analyses



Supplementary Figure 1 Cohort analysis data flowchart



Supplementary Figure 2 Pre-post data analysis flowchart

Patient characteristics

Cohort analysis

Emergency department presentations

Characteristics of emergency department (ED) presentations are summarised in Supplementary Table 2. Activity, as measured by National Weighted Activity Units (NWAU), is calculated based on facility remoteness, patient remoteness, Indigenous status, and the clinical complexity of the encounter as measured by AECC (Australian Emergency Care Classification 1.0).

The Non-VRGS cohort included more than twice the encounters and just under twice the number of patients as VRGS over FY21/22. The mean and median NWAU per encounter were very similar between VRGS and Non-VRGS cohorts suggesting both cohorts dealt with ED presentations requiring the same level of activity. VRGS dealt with proportionately more patients in outer regional and remote facilities, which offset a slight reduction in the clinical complexity of the encounters they treated compared to Non-VRGS (Supplementary Table 2). In addition, the higher activity in the Combined cohort resulted from encounters with higher clinical complexity, as would be expected of this cohort, as it is defined by a patient being treated by two or more doctors.

Supplementary Table 2 Characteristics of emergency department presentations by cohort (FY21/22)

	Cohort			
	VRGS N = 12,100 Patients = 9,311	**Non-VRGS N = 25,954 Patients = 17,860**	**Combined N = 1,473 Patients = 1,367**	**Total N = 39,527**
Age Mean (SD)	39.0 (±26.3)	42.9 (±26.2)	50.2 (±24.6)	42.0 (±26.3)
Age Median (IQR)	35.0 (17.0 - 60.0)	43.0 (20.0 - 65.0)	53.0 (30.0 - 71.0)	41.0 (20.0 - 64.0)
Age Group				
<1	305 (2.5%)	569 (2.2%)	23 (1.6%)	897 (2.3%)
1-5	1,129 (9.3%)	1,896 (7.3%)	43 (2.9%)	3,068 (7.8%)
6-11	777 (6.4%)	1,501 (5.8%)	33 (2.2%)	2,311 (5.8%)
12-18	1,019 (8.4%)	1,867 (7.2%)	93 (6.3%)	2,979 (7.5%)
19-35	2,850 (23.6%)	5,212 (20.1%)	272 (18.5%)	8,334 (21.1%)
36-50	1,774 (14.7%)	3,931 (15.1%)	223 (15.1%)	5,928 (15.0%)
51-65	1,748 (14.4%)	4,592 (17.7%)	305 (20.7%)	6,645 (16.8%)
66-80	1,603 (13.2%)	4,315 (16.6%)	328 (22.3%)	6,246 (15.8%)
>80	895 (7.4%)	2,071 (8.0%)	153 (10.4%)	3,119 (7.9%)
Sex				
1-Male	5,783 (47.8%)	13,268 (51.1%)	741 (50.3%)	19,792 (50.1%)
2-Female	6,315 (52.2%)	12,685 (48.9%)	732 (49.7%)	19,732 (49.9%)
Missing	*2 (0.0%)*	*1 (0.0%)*	*0 (0.0%)*	*3 (0.0%)*
[a]Socio-economic disadvantage (quintile)				
1 - Most disadvantaged	5,766 (47.7%)	16,507 (63.6%)	736 (50.0%)	23,009 (58.2%)
2	4,610 (38.1%)	6,596 (25.4%)	526 (35.7%)	11,732 (29.7%)
3	1,334 (11.0%)	1,883 (7.3%)	172 (11.7%)	3,389 (8.6%)
4	96 (0.8%)	333 (1.3%)	16 (1.1%)	445 (1.1%)
5 - Least disadvantaged	93 (0.8%)	225 (0.9%)	7 (0.5%)	325 (0.8%)
Missing	*201 (1.7%)*	*410 (1.6%)*	*16 (1.1%)*	*627 (1.6%)*
[b]Facility remoteness				
Inner Regional Australia	1,241 (10.3%)	3,329 (12.8%)	185 (12.6%)	4,755 (12.0%)

	Cohort			
	VRGS N = 12,100 Patients = 9,311	**Non-VRGS N = 25,954 Patients = 17,860**	**Combined N = 1,473 Patients = 1,367**	**Total N = 39,527**
Outer Regional Australia	6,496 (53.7%)	15,421 (59.4%)	723 (49.1%)	22,640 (57.3%)
Remote Australia	3,851 (31.8%)	6,290 (24.2%)	486 (33.0%)	10,627 (26.9%)
Very Remote Australia	512 (4.2%)	914 (3.5%)	79 (5.4%)	1,505 (3.8%)
[c]Patient remoteness				
Major Cities of Australia	233 (1.9%)	584 (2.3%)	31 (2.1%)	848 (2.1%)
Inner Regional Australia	1,764 (14.6%)	4,349 (16.8%)	235 (16.0%)	6,348 (16.1%)
Outer Regional Australia	6,150 (50.8%)	14,307 (55.1%)	703 (47.7%)	21,160 (53.5%)
Remote Australia	3,494 (28.9%)	5,922 (22.8%)	435 (29.5%)	9,851 (24.9%)
Very Remote Australia	259 (2.1%)	383 (1.5%)	53 (3.6%)	695 (1.8%)
Missing	*200 (1.7%)*	*409 (1.6%)*	*16 (1.1%)*	*625 (1.6%)*
[d]Patient Indigenous Status				
Aboriginal and/or Torres Strait Islander	4,024 (33.3%)	7,361 (28.4%)	454 (30.8%)	11,839 (30.0%)
Neither Aboriginal nor Torres Strait Islander	7,821 (64.6%)	18,024 (69.4%)	999 (67.8%)	26,844 (67.9%)
Missing	*255 (2.1%)*	*569 (2.2%)*	*20 (1.4%)*	*844 (2.1%)*
[e]Australian Emergency Care Classification (AECC)				
Not attended by health prof.	229 (1.9%)	233 (0.9%)	27 (1.8%)	489 (1.2%)
Planned return visit	29 (0.2%)	430 (1.7%)	3 (0.2%)	462 (1.2%)
Dead on Arrival	2 (0.0%)	9 (0.0%)	0 (0.0%)	11 (0.0%)
Complexity Level A - highest	921 (7.6%)	2,931 (11.3%)	449 (30.5%)	4,301 (10.9%)
Complexity Level B	4,144 (34.2%)	8,934 (34.4%)	630 (42.8%)	13,708 (34.7%)
Complexity Level C - lowest	5,181 (42.8%)	9,654 (37.2%)	263 (17.9%)	15,098 (38.2%)
Complexity Level Z	1,594 (13.2%)	3,763 (14.5%)	101 (6.9%)	5,458 (13.8%)
Triage category				
Non-urgent	1,672 (13.8%)	4,350 (16.8%)	37 (2.5%)	6,059 (15.3%)
Semi-urgent	5,159 (42.6%)	10,039 (38.7%)	284 (19.3%)	15,482 (39.2%)
Urgent	4,674 (38.6%)	7,377 (28.4%)	821 (55.7%)	12,872 (32.6%)
Emergency	593 (4.9%)	4,061 (15.6%)	321 (21.8%)	4,975 (12.6%)
Resuscitation	2 (0.0%)	125 (0.5%)	10 (0.7%)	137 (0.3%)
Missing	*0 (0.0%)*	*2 (0.0%)*	*0 (0.0%)*	*2 (0.0%)*
[f]NWAU Mean (SD)	0.13 (±0.05)	0.14 (±0.06)	0.19 (±0.07)	0.14 (±0.06)
[f]NWAU Median (IQR)	0.11 (0.09 - 0.16)	0.12 (0.09 - 0.17)	0.18 (0.14 - 0.23)	0.12 (0.09 - 0.17)

VRGS=Virtual Rural Generalist Service, SD=Standard deviation, IQR=Interquartile range
[a]Socio-economic indices Australia, 2016, by patient's postal area (NSW Deciles), IRSD - Index of Relative Socio-economic Disadvantage
[b]The remoteness of the establishment providing care, based on the road distance to the nearest urban centre and its population size. Presentations in remote and very remote facilities receive an NWAU adjustment of 5%
[c]Australian Bureau of Statistics 2016 Remoteness Area Category Names mapped by patient postcode. Presentations for patients who reside in remote and very remote areas receive an NWAU adjustment of 29%
[d]Presentations for patients who identify as Aboriginal and/or Torres Strait Islander receive an NWAU adjustment of 4%
[e]AECC=Australian Emergency Care Classification 1.0 - A patient classification scheme which provides a means of relating the number and types of patients treated in an emergency department, as represented by a code. There are three Pre-Emergency Care Diagnosis Group (Pre-ECDG) codes - Not attended by a healthcare professional, Planned return visit and Dead on arrival. All other emergency presentations are classified into ECDG with a level of complexity represented by a single alphabetic character (A, B, C, and Z). A represents the highest complexity level within the ECDG, and each subsequent letter represents the next complexity level, up to D. Z indicates that there was no complexity split for the ECDG. (source: IHACPA nwau21_calculator_for_ed_activity_aecc.xlsx)
[f]NWAU=National weighted activity units Financial Year (FY) 21/22

Hospital admissions

Baseline demographics for hospital admissions are summarised in Supplementary Table 3. NWAU differences between cohorts for hospital admissions for the in-scope sites are primarily driven by facility remoteness, patient remoteness, patient Indigenous status, and clinical complexity measured by AR-DRG (Australian Refined Diagnosis Related Groups) and length of stay.

The Non-VRGS cohort treated approximately five times the number of hospital admissions and inpatients as the VRGS cohort (Supplementary Table 3). Higher mean and median activity (NWAU) per encounter for the Non-VRGS and Combined cohorts resulted from higher clinical complexity hospital admissions than seen by VRGS (Supplementary Table 3).

Supplementary Table 3 Characteristics of hospital admissions by cohort

	Cohort			
	VRGS N = 697 Patients = 568	**Non-VRGS N = 3,623 Patients = 2,751**	**Combined N = 1,705 Patients = 1,468**	**Total N = 6,025**
Age Mean (SD)	65.1 (±19.9)	66.1 (±19.3)	67.1 (±19.6)	66.3 (±19.4)
Age Median (IQR)	70.0 (53.0 - 81.0)	70.0 (55.0 - 81.0)	73.0 (55.0 - 82.0)	71.0 (55.0 - 81.0)
Age Group				
<1	0 (0.0%)	3 (0.1%)	0 (0.0%)	3 (0.0%)
1-5	1 (0.1%)	4 (0.1%)	1 (0.1%)	6 (0.1%)
6-11	0 (0.0%)	5 (0.1%)	0 (0.0%)	5 (0.1%)
12-18	9 (1.3%)	48 (1.3%)	23 (1.3%)	80 (1.3%)
19-35	67 (9.6%)	294 (8.1%)	138 (8.1%)	499 (8.3%)
36-50	76 (10.9%)	337 (9.3%)	178 (10.4%)	591 (9.8%)
51-65	147 (21.1%)	792 (21.9%)	296 (17.4%)	1,235 (20.5%)
66-80	221 (31.7%)	1,202 (33.2%)	575 (33.7%)	1,998 (33.2%)
>80	176 (25.3%)	938 (25.9%)	494 (29.0%)	1,608 (26.7%)
Sex				
1-Male	340 (48.8%)	1,749 (48.3%)	781 (45.8%)	2,870 (47.6%)
2-Female	357 (51.2%)	1,874 (51.7%)	924 (54.2%)	3,155 (52.4%)
[a]Socio-economic disadvantage (quintile)				
1 - Most disadvantaged	308 (44.2%)	2,238 (61.8%)	804 (47.2%)	3,350 (55.6%)
2	297 (42.6%)	968 (26.7%)	643 (37.7%)	1,908 (31.7%)
3	80 (11.5%)	341 (9.4%)	235 (13.8%)	656 (10.9%)
4	7 (1.0%)	35 (1.0%)	8 (0.5%)	50 (0.8%)
5 - Least disadvantaged	2 (0.3%)	24 (0.7%)	10 (0.6%)	36 (0.6%)
Missing	*3 (0.4%)*	*17 (0.5%)*	*5 (0.3%)*	*25 (0.4%)*
[b]Facility remoteness				
Inner Regional Australia	26 (3.7%)	700 (19.3%)	189 (11.1%)	915 (15.2%)
Outer Regional Australia	450 (64.6%)	1,597 (44.1%)	967 (56.7%)	3,014 (50.0%)
Remote Australia	205 (29.4%)	1,045 (28.8%)	475 (27.9%)	1,725 (28.6%)
Very Remote Australia	16 (2.3%)	281 (7.8%)	74 (4.3%)	371 (6.2%)
[c]Patient remoteness				
Major Cities of Australia	8 (1.1%)	41 (1.1%)	22 (1.3%)	71 (1.2%)
Inner Regional Australia	67 (9.6%)	840 (23.2%)	297 (17.4%)	1,204 (20.0%)
Outer Regional Australia	423 (60.7%)	1,489 (41.1%)	886 (52.0%)	2,798 (46.4%)
Remote Australia	194 (27.8%)	1,118 (30.9%)	459 (26.9%)	1,771 (29.4%)
Very Remote Australia	2 (0.3%)	118 (3.3%)	36 (2.1%)	156 (2.6%)

	Cohort			
	VRGS N = 697 Patients = 568	**Non-VRGS N = 3,623 Patients = 2,751**	**Combined N = 1,705 Patients = 1,468**	**Total N = 6,025**
Missing	*3 (0.4%)*	*17 (0.5%)*	*5 (0.3%)*	*25 (0.4%)*
[d]Patient Indigenous Status				
Aboriginal and/or Torres Straight Islander	152 (21.8%)	918 (25.3%)	376 (22.1%)	1,446 (24.0%)
Neither Aboriginal nor Torres Straight Islander	545 (78.2%)	2,690 (74.2%)	1,325 (77.7%)	4,560 (75.7%)
Missing	*0 (0.0%)*	*15 (0.4%)*	*4 (0.2%)*	*19 (0.3%)*
[e]Australian Refined Diagnosis Related Groups				
Complexity Level A - highest	139 (19.9%)	847 (23.4%)	546 (32.0%)	1,532 (25.4%)
Complexity Level B	495 (71.0%)	2,415 (66.7%)	1,036 (60.8%)	3,946 (65.5%)
Complexity Level C	61 (8.8%)	313 (8.6%)	116 (6.8%)	490 (8.1%)
Complexity Level D - lowest	0 (0.0%)	3 (0.1%)	3 (0.2%)	6 (0.1%)
Complexity Level Z	2 (0.3%)	45 (1.2%)	4 (0.2%)	51 (0.8%)
Emergency status				
1-Unplanned Admissions	545 (78.2%)	2,744 (75.7%)	1,379 (80.9%)	4,668 (77.5%)
2-Planned Admissions	85 (12.2%)	545 (15.0%)	179 (10.5%)	809 (13.4%)
3-Other Admissions	53 (7.6%)	304 (8.4%)	145 (8.5%)	502 (8.3%)
4-Maternity/Newborn	0 (0.0%)	1 (0.0%)	0 (0.0%)	1 (0.0%)
5-Regular Same Day Planned Admission	9 (1.3%)	25 (0.7%)	1 (0.1%)	35 (0.6%)
Invalid	*5 (0.7%)*	*4 (0.1%)*	*1 (0.1%)*	*10 (0.2%)*
Total bed days Mean (SD)	2.9 (±4.3)	4.5 (±8.0)	7.9 (±15.6)	5.2 (±10.6)
Total bed days Median (IQR)	1.0 (1.0 - 3.0)	2.0 (1.0 - 4.5)	3.0 (1.0 - 8.0)	2.0 (1.0 - 5.0)
[f]NWAU Mean (SD)	0.68 (±0.73)	0.95 (±1.34)	1.35 (±2.53)	1.03 (±1.73)
[f]NWAU Median (IQR)	0.51 (0.27- 0.86)	0.70 (0.32 - 1.09)	0.77 (0.34 - 1.45)	0.70 (0.31 - 1.13)

VRGS=Virtual Rural Generalist Service, SD=Standard deviation, IQR=Interquartile range
[a]Socio-economic indices Australia, 2016, by patient's postal area (NSW Deciles), IRSD - Index of Relative Socio-economic Disadvantage
[b]The remoteness of the establishment providing care, based on the road distance to the nearest urban centre and its population size. Admissions in remote and very remote facilities receive an NWAU adjustment of 7% and 19% respectively
[c]ABS 2016 Remoteness Area Category Names mapped by patient postcode. Admissions for patients who reside in remote and very remote areas receive an NWAU adjustment of 27% and 31% respectively
[d]Admissions for patients who identify as Aboriginal and/or Torres Strait Islander receive an NWAU adjustment of 4%
[e]Australian Refined Diagnosis Related Groups Version 10 (AR-DRG v10.0) - A patient classification scheme which provides a means of relating the number and types of patients treated in a hospital to the resources. Hospital admissions are classified into AR-DRG with a level of complexity represented by a single alphabetic character (A, B, C, and Z). A represents the highest complexity level within the AR-DRG, and each subsequent letter represents the next complexity level, up to D. Z indicates that there was no complexity split for the AR-DRG. (source: IHACPA NWAU21 calculator for acute activity.xlsx)
[f]NWAU=National weighted activity units Financial Year (FY) 21/22

Pre-post analysis

Emergency department

Baseline demographics and characteristics of emergency department (ED) presentations pre and post-VRGS are summarised in Supplementary Table 4. The post-VRGS period saw a decrease in planned return visits and an increase in the complexity of ED presentations as measured by AECC. There were increases in outer regional and very remote facility encounters but a decrease in remote facility encounters. Despite these changes, mean and median activity (NWAU) per encounter was very similar in the pre and post-VRGS periods for the emergency department (Supplementary Table 4). Although not a direct factor in NWAU calculations, the proportion and absolute number of presentations triaged

as emergency increased significantly in the post period with a corresponding decrease in semi urgent presentations.

Supplementary Table 4 Characteristics of emergency department presentations by period

	Period		
	Pre-VRGS N = 48,771	**Post-VRGS N = 49,228**	**Total N = 97,999**
Age Mean (SD)	40.1 (±26.5)	41.5 (±25.8)	40.8 (±26.2)
Age Median (IQR)	38.0 (18.0 - 62.0)	40.0 (20.0 - 63.0)	39.0 (19.0 - 63.0)
Age Group			
<1	1,318 (2.7%)	1,047 (2.1%)	2,365 (2.4%)
1-5	4,525 (9.3%)	3,714 (7.5%)	8,239 (8.4%)
6-11	3,342 (6.9%)	2,788 (5.7%)	6,130 (6.3%)
12-18	3,647 (7.5%)	3,785 (7.7%)	7,432 (7.6%)
19-35	10,179 (20.9%)	10,878 (22.1%)	21,057 (21.5%)
36-50	7,479 (15.3%)	7,732 (15.7%)	15,211 (15.5%)
51-65	7,514 (15.4%)	8,317 (16.9%)	15,831 (16.2%)
66-80	7,271 (14.9%)	7,391 (15.0%)	14,662 (15.0%)
>80	3,493 (7.2%)	3,576 (7.3%)	7,069 (7.2%)
Missing	*3 (0.0%)*	*0 (0.0%)*	*3 (0.0%)*
Sex			
1-Male	25,042 (51.3%)	24,740 (50.3%)	49,782 (50.8%)
2-Female	23,725 (48.6%)	24,482 (49.7%)	48,207 (49.2%)
Missing	*4 (0.0%)*	*6 (0.0%)*	*10 (0.0%)*
[a]**Socio-economic disadvantage (quintile)**			
1 - Most disadvantaged	27,571 (56.5%)	28,600 (58.1%)	56,171 (57.3%)
2	14,690 (30.1%)	14,342 (29.1%)	29,032 (29.6%)
3	4,802 (9.8%)	4,464 (9.1%)	9,266 (9.5%)
4	550 (1.1%)	525 (1.1%)	1,075 (1.1%)
5 - Least disadvantaged	438 (0.9%)	440 (0.9%)	878 (0.9%)
Missing	*720 (1.5%)*	*857 (1.7%)*	*1,577 (1.6%)*
[b]**Facility remoteness**			
Inner Regional Australia	4,143 (8.5%)	4,197 (8.5%)	8,340 (8.5%)
Outer Regional Australia	25,241 (51.8%)	26,216 (53.3%)	51,457 (52.5%)
Remote Australia	17,102 (35.1%)	15,999 (32.5%)	33,101 (33.8%)
Very Remote Australia	2,285 (4.7%)	2,816 (5.7%)	5,101 (5.2%)
[c]**Patient remoteness**			
Major Cities of Australia	1,210 (2.5%)	1,114 (2.3%)	2,324 (2.4%)
Inner Regional Australia	7,037 (14.4%)	7,145 (14.5%)	14,182 (14.5%)
Outer Regional Australia	23,100 (47.4%)	24,112 (49.0%)	47,212 (48.2%)
Remote Australia	15,551 (31.9%)	14,700 (29.9%)	30,251 (30.9%)
Very Remote Australia	1,153 (2.4%)	1,303 (2.6%)	2,456 (2.5%)
Missing	*720 (1.5%)*	*854 (1.7%)*	*1,574 (1.6%)*
[d]**Patient Indigenous Status**			
Aboriginal and/or Torres Strait Islander	15,929 (32.7%)	15,961 (32.4%)	31,890 (32.5%)
Neither Aboriginal nor Torres Strait Islander	32,024 (65.7%)	32,193 (65.4%)	64,217 (65.5%)
Missing	*818 (1.7%)*	*1,074 (2.2%)*	*1,892 (1.9%)*

[e]**Australian Emergency Care Classification (AECC)**

	Period		
	Pre-VRGS N = 48,771	**Post-VRGS N = 49,228**	**Total N = 97,999**
Not attended by health prof.	1,231 (2.5%)	1,208 (2.5%)	2,439 (2.5%)
Planned return visit	1,574 (3.2%)	695 (1.4%)	2,269 (2.3%)
Dead on Arrival	33 (0.1%)	39 (0.1%)	72 (0.1%)
Complexity Level A - highest	4,291 (8.8%)	4,752 (9.7%)	9,043 (9.2%)
Complexity Level B	14,275 (29.3%)	16,293 (33.1%)	30,568 (31.2%)
Complexity Level C - lowest	19,363 (39.7%)	19,799 (40.2%)	39,162 (40.0%)
Complexity Level Z	8,004 (16.4%)	6,442 (13.1%)	14,446 (14.7%)
Triage category			
Non-urgent	11,059 (22.7%)	10,962 (22.3%)	22,021 (22.5%)
Semi-urgent	18,999 (39.0%)	17,991 (36.5%)	36,990 (37.7%)
Urgent	13,881 (28.5%)	14,630 (29.7%)	28,511 (29.1%)
Emergency	4,588 (9.4%)	5,484 (11.1%)	10,072 (10.3%)
Resuscitation	162 (0.3%)	147 (0.3%)	309 (0.3%)
Missing	*82 (0.2%)*	*14 (0.0%)*	*96 (0.1%)*
[f]NWAU Mean (SD)	0.13 (±0.06)	0.13 (±0.06)	0.13 (±0.06)
[f]NWAU Median (IQR)	0.11 (0.09 - 0.16)	0.11 (0.09 - 0.16)	0.11 (0.09 - 0.16)

VRGS=Virtual Rural Generalist Service, SD=Standard deviation, IQR=Interquartile range
[a]Socio-economic indices Australia, 2016, by patient's postal area (NSW Deciles), IRSD - Index of Relative Socio-economic Disadvantage
[b]The remoteness of the establishment providing care, based on the road distance to the nearest urban centre and its population size. Presentations in remote and very remote facilities receive an NWAU adjustment of 5%
[c]Australian Bureau of Statistics 2016 Remoteness Area Category Names mapped by patient postcode. Presentations for patients who reside in remote and very remote areas receive an NWAU adjustment of 29%
[d]Presentations for patients who identify as Aboriginal and/or Torres Strait Islander receive an NWAU adjustment of 4%
[e]AECC=Australian Emergency Care Classification 1.0 - A patient classification scheme which provides a means of relating the number and types of patients treated in an emergency department, as represented by a code. There are three Pre-Emergency Care Diagnosis Group (Pre-ECDG) codes - Not attended by a healthcare professional, Planned return visit and Dead on arrival. All other emergency presentations are classified into ECDG with a level of complexity represented by a single alphabetic character (A, B, C, and Z). A represents the highest complexity level within the ECDG, and each subsequent letter represents the next complexity level, up to D. Z indicates that there was no complexity split for the ECDG. (source: IHACPA nwau21_calculator_for_ed_activity_aecc.xlsx)
[f]NWAU = National weighted activity units Financial Year (FY) 21/22

Hospital admissions

Baseline demographics and characteristics of hospital admissions by period are summarised in Supplementary Table 5. The post-VRGS period saw an increase in the complexity of hospital admissions as measured by Australian Refined Diagnosis Related Groups (AR-DRG), leading to an increase in the mean and median NWAU per hospital admission in the post period. Although not a direct factor in the NWAU calculation, emergency status reporting shows reductions in "other admissions" significantly reduced in proportion and absolute number in the post period. Both planned and unplanned admissions increase as a proportion and planned admissions increase in absolute number in the post period.

Supplementary Table 5 Characteristics of hospital admissions by period

	Period		
	Pre-VRGS N = 6,817	**Post-VRGS N = 5,452**	**Total N = 12,269**
Age Mean (SD)	63.8 (±20.6)	65.8 (±19.5)	64.7 (±20.2)
Age Median (IQR)	68.0 (50.0 - 80.0)	71.0 (55.0 - 81.0)	69.0 (52.0 - 80.0)
Age Group			
<1	15 (0.2%)	2 (0.0%)	17 (0.1%)
1-5	31 (0.5%)	4 (0.1%)	35 (0.3%)
6-11	15 (0.2%)	5 (0.1%)	20 (0.2%)
12-18	129 (1.9%)	71 (1.3%)	200 (1.6%)

	Period		
	Pre-VRGS N = 6,817	**Post-VRGS N = 5,452**	**Total N = 12,269**
19-35	646 (9.5%)	478 (8.8%)	1,124 (9.2%)
36-50	881 (12.9%)	563 (10.3%)	1,444 (11.8%)
51-65	1,263 (18.5%)	1,096 (20.1%)	2,359 (19.2%)
66-80	2,259 (33.1%)	1,837 (33.7%)	4,096 (33.4%)
>80	1,576 (23.1%)	1,396 (25.6%)	2,972 (24.2%)
Missing	*2 (0.0%)*	*0 (0.0%)*	*2 (0.0%)*
Sex			
1-Male	3,307 (48.5%)	2,588 (47.5%)	5,895 (48.0%)
2-Female	3,510 (51.5%)	2,864 (52.5%)	6,374 (52.0%)
[a]Socio-economic disadvantage (quintile)			
1 - Most disadvantaged	3,992 (58.6%)	3,059 (56.1%)	7,051 (57.5%)
2	2,031 (29.8%)	1,687 (30.9%)	3,718 (30.3%)
3	663 (9.7%)	622 (11.4%)	1,285 (10.5%)
4	60 (0.9%)	35 (0.6%)	95 (0.8%)
5 - Least disadvantaged	40 (0.6%)	27 (0.5%)	67 (0.5%)
Missing	*31 (0.5%)*	*22 (0.4%)*	*53 (0.4%)*
[b]Facility remoteness			
Inner Regional Australia	602 (8.8%)	586 (10.7%)	1,188 (9.7%)
Outer Regional Australia	2,935 (43.1%)	2,546 (46.7%)	5,481 (44.7%)
Remote Australia	2,478 (36.4%)	1,847 (33.9%)	4,325 (35.3%)
Very Remote Australia	802 (11.8%)	473 (8.7%)	1,275 (10.4%)
[c]Patient remoteness			
Major Cities of Australia	114 (1.7%)	61 (1.1%)	175 (1.4%)
Inner Regional Australia	1,037 (15.2%)	945 (17.3%)	1,982 (16.2%)
Outer Regional Australia	2,660 (39.0%)	2,306 (42.3%)	4,966 (40.5%)
Remote Australia	2,781 (40.8%)	1,952 (35.8%)	4,733 (38.6%)
Very Remote Australia	194 (2.8%)	166 (3.0%)	360 (2.9%)
Missing	*31 (0.5%)*	*22 (0.4%)*	*53 (0.4%)*
[d]Patient Indigenous Status			
Aboriginal and/or Torres Straight Islander	1,944 (28.5%)	1,434 (26.3%)	3,378 (27.5%)
Neither Aboriginal nor Torres Straight Islander	4,869 (71.4%)	4,003 (73.4%)	8,872 (72.3%)
Missing	*4 (0.1%)*	*15 (0.3%)*	*19 (0.2%)*
[e]Australian Refined Diagnosis Related Groups			
Complexity Level A - highest	1,200 (17.6%)	1,378 (25.3%)	2,578 (21.0%)
Complexity Level B	4,845 (71.1%)	3,520 (64.6%)	8,365 (68.2%)
Complexity Level C	609 (8.9%)	426 (7.8%)	1,035 (8.4%)
Complexity Level D - lowest	10 (0.1%)	6 (0.1%)	16 (0.1%)
Complexity Level Z	153 (2.2%)	122 (2.2%)	275 (2.2%)
Emergency status			
1-Unplanned Admissions	4,871 (71.5%)	4,104 (75.3%)	8,975 (73.2%)
2-Planned Admissions	575 (8.4%)	727 (13.3%)	1,302 (10.6%)
3-Other Admissions	1,173 (17.2%)	475 (8.7%)	1,648 (13.4%)
4-Maternity/Newborn	10 (0.1%)	1 (0.0%)	11 (0.1%)
5-Regular Same Day Planned Admission	188 (2.8%)	138 (2.5%)	326 (2.7%)

	Period		
	Pre-VRGS N = 6,817	**Post-VRGS N = 5,452**	**Total N = 12,269**
Invalid	*0 (0.0%)*	*7 (0.1%)*	*7 (0.1%)*
[f]NWAU Mean (SD)	0.94 (±1.41)	1.04 (±1.74)	0.98 (±1.57)
[f]NWAU Median (IQR)	0.67 (0.29 - 1.06)	0.70 (0.31 - 1.13)	0.69 (0.30 - 1.09)

VRGS=Virtual Rural Generalist Service, SD=Standard deviation, IQR=Interquartile range
[a]Socio-economic indices Australia, 2016, by patient's postal area (NSW Deciles), IRSD - Index of Relative Socio-economic Disadvantage
[b]The remoteness of the establishment providing care, based on the road distance to the nearest urban centre and its population size. Admissions in remote and very remote facilities receive an NWAU adjustment of 7% and 19% respectively
[c]ABS 2016 Remoteness Area Category Names mapped by patient postcode. Admissions for patients who reside in remote and very remote areas receive an NWAU adjustment of 27% and 31% respectively
[d]Admissions for patients who identify as Aboriginal and/or Torres Strait Islander receive an NWAU adjustment of 4%
[e]Australian Refined Diagnosis Related Groups Version 10. (AR-DRG v10.0) - A patient classification scheme which provides a means of relating the number and types of patients treated in a hospital to the resources. Hospital admissions are classified into AR-DRG with a level of complexity represented by a single alphabetic character (A, B, C, and Z). A represents the highest complexity level within the AR-DRG, and each subsequent letter represents the next complexity level, up to D. Z indicates that there was no complexity split for the AR-DRG. (source: IHACPA NWAU21 calculator for acute activity.xlsx)
[f]NWAU = National weighted activity units Financial Year (FY) 21/22

Scenario analysis for price per activity unit for VRGS versus non-VRGS

A price per activity unit (NWAU) was calculated for VRGS and Non-VRGS models of care by dividing total expenditure allocatable to the model of care by total activity units for that model of care. "Combined" activity was allocated evenly to VRGS and Non-VRGS cohorts given this is the definition of the Combined cohort. Scenario analysis was conducted to understand the impact on price per activity unit under different allocations of activity in the "No Dr recorded" cohort. Four allocation scenarios were created:

Scenario 1 - No allocation of "No Dr recorded" NWAU

Scenario 2 - 100% allocation of "No Dr recorded" NWAU to VRGS

Scenario 3 - 100% allocation of "No Dr recorded" NWAU to Non-VRGS

Scenario 4 - 50% allocation of "No Dr recorded" NWAU to VRGS and 50% to Non-VRGS

In all scenarios, VRGS resulted in a lower price per activity unit than the Non-VRGS model of care. Prices per activity per model of care by scenario are shown in Supplementary Table 6. The base case was equal allocation as extensive investigation found no relationship between model of care and no doctor recorded encounters.

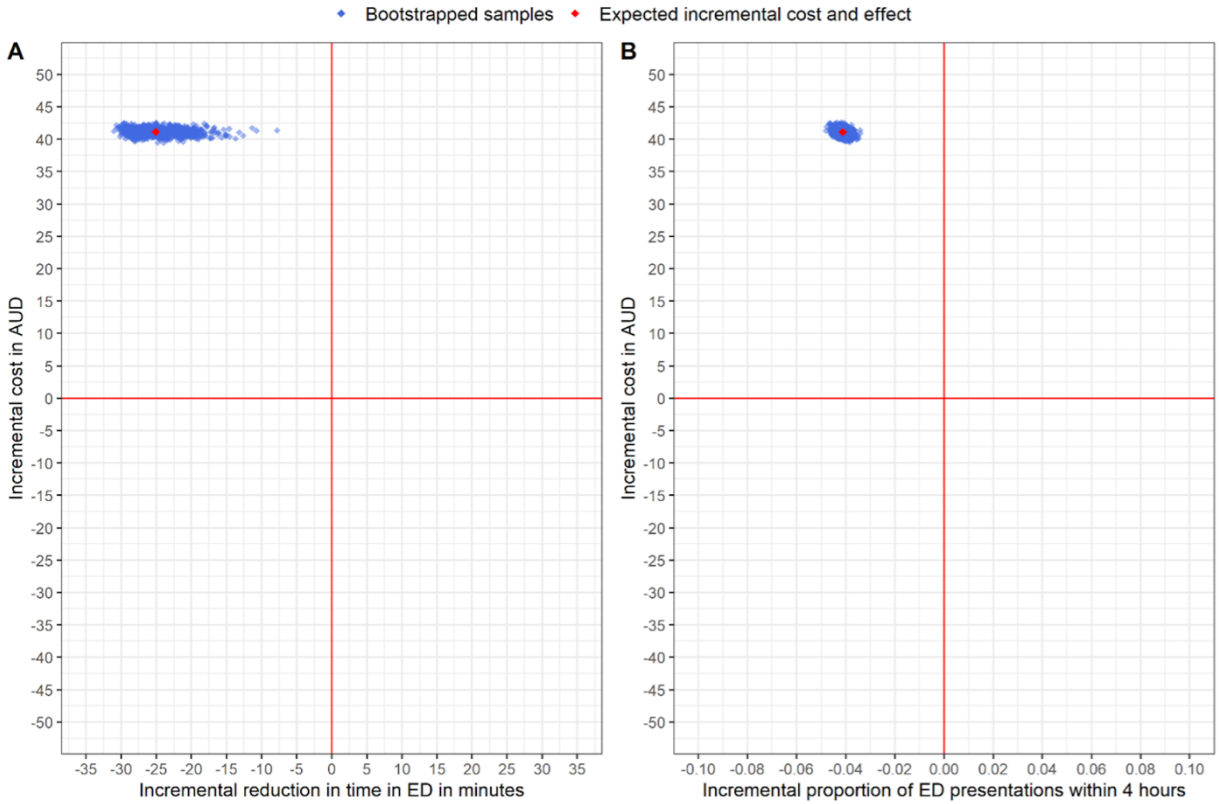
Supplementary Table 6 Prices per activity per model of care by scenario

Model of care	Total Expenditure (Australian dollars, 2022)[a]	Total NWAU[b]	Price per NWAU (Australian dollars, 2022)
Scenario 1			
VRGS	4,582,781	3,324	1,379
Non-VRGS	16,415,687	8,312	1,975
Scenario 2			
VRGS + 100% unallocated	4,582,781	5,433	844
Non-VRGS	16,415,687	8,312	1,975
Scenario 3			
VRGS	4,582,781	3,324	1,379
Non-VRGS + 100% unallocated	16,415,687	10,422	1,575
Scenario 4			
VRGS + 50% unallocated	4,582,781	4,378	1,047
Non-VRGS + 50% unallocated	16,415,687	9,367	1,753

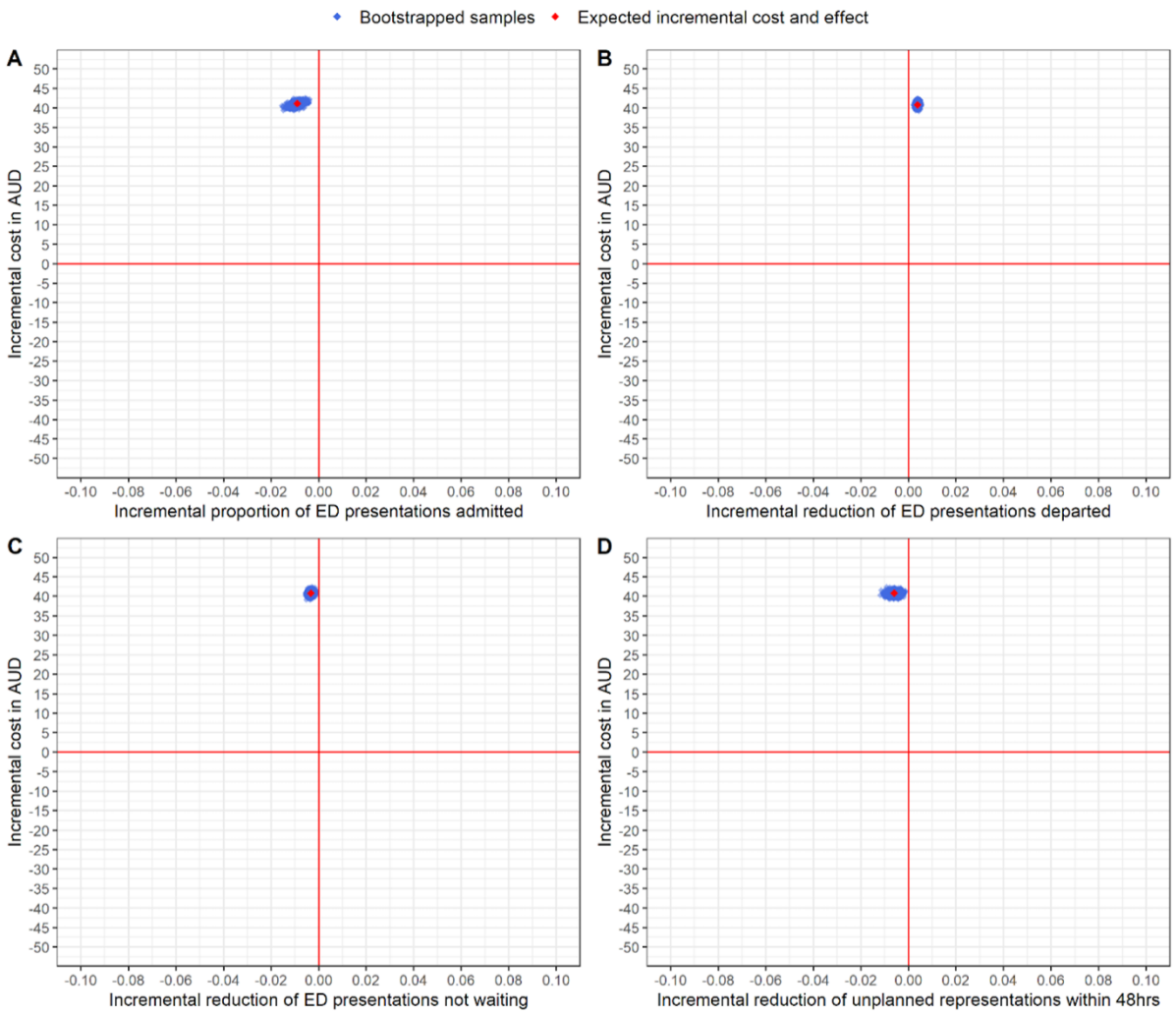
[a]Base total expenditure FY21/22 in Australian dollars, 2022
[b]Combined activity is split evenly between VRGS and Non-VRGS models of care for all scenarios
NWAU = National weighted activity units

Cost-effectiveness planes for emergency department presentations

Pre-post analysis



*Supplementary Figure 3 Cost-effectiveness planes for Post versus Pre: Incremental cost **A** per minute saved in ED arrival to departure time, **B** per ED presentation within 4 hours (arrival to departure time)*



*Supplementary Figure 4 Cost-effectiveness planes for Post versus Pre: Incremental cost **A** per admission, **B** for avoiding a patient departing for another clinical location, **C** for avoiding a patient not waiting, **D** for avoiding an unplanned re-presentation within 48 hours*

References

1. Sekhon M, Cartwright M, Francis JJ. Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. BMC Health Serv Res. 2017;17(1):88-88.
2. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implementation science : IS. 2009;4(1):50-50.
3. New South Wales Ministry of Health. NSW Health Virtual Care Strategy Monitoring and Evaluation Plan. In: Health Mo, editor. Sydney (AU)2020.