Demand and capacity growth for Tier 2 services in the New Zealand health system and the impacts of reduced variation

29 January 2021

Aim: to document expected changes in Tier 2 demand, based on population growth and ageing, and define the implications of reduced variation across Tier 2 delivery.

Activity data

Data was extracted from the National Minimum Dataset (NMDS) for the financial year 2018/19.[1] This data was then classified into key groupings of activity – important for understanding the split of how activity is funded and to support quantification of the impacts on future costs of Tier 2 service delivery. The following table provides the split of NMDS by key group, including estimated costs based on WIES and national prices in 2018/19.

Table 1: 2018/19 NMDS activity and cost based on National Price by group

Group	Discharges	Bed-days	WIES	Cost based on National Price[2]
Publicly funded casemix-included	959,469	2,156,630	891,908.4	$4,520M
Publicly funded casemix-excluded[3]	27,950	413,127	69,836.8	$354M
Publicly funded purchase unit funded[4]	112,413	381,023	93,234.9	$417M
ACC funded	11,334	115,703	20,543.4	$104M
Overseas ineligible	1,311	349	556.1	$3M
Total	1,112,477	3,066,832	1,076,079.5	$5,398M

Population data

To estimate the trajectory of demand, and therefore, capacity and estimated costs under current models of care, we use the demographic projections provided to the Ministry of Health by Statistics New Zealand on an annual basis. These projections are on an age and ethnicity (Prioritised Level 1 Ethnicity) basis and project the population of each DHB's domiciled population by calendar and financial year out to 2042/43.

The projections used are based on the 2020 update of the population projections provided via email by the Ministry of Health on the 15th of December 2020. Importantly this incorporates results from the 2018 Census which has led to some significant changes in both current, and projected, population size and mix by DHB and nationally. There are some factors that contribute to these projections which will be watched with interest by Statistics New Zealand over the coming months / years, e.g., effects of COVID-19 on net migration. However, these estimates form the basis for PBFF[5] and so are used widely in service and capacity planning across the sector – and are appropriate for use in this analysis.

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[1] This avoids the impacts of COVID-19 on care patterns and delivery.

[2] $5068.12 per WIES in 2018/19. It is noted that in 2020/21 a significant uplift in price occurred with a further uplift planned for 2021/22. These uplifts are intended to align pricing with efficient service delivery costs as per the National Pricing Programme's technical working group advice.

[3] Costs for casemix-excluded activity are estimated based on the National Price per WIES.

[4] Costs for purchase unit funded activity are a mixture of casemix-excluded activity where there is a National Price on a per event basis, and estimated costs based on the National Price per WIES for activity such as Solid Organ Transplantation which does have a purchase unit but is not funded on a per event basis.

[5] Population based funding formula.

Projecting demand in a baseline scenario

To project demand, age and ethnicity specific rates are calculated based on 2018/19 activity and population by DHB. The projected population is then applied to the calculated rates to project the number of events, bed-days and WIES under the assumption that current per capita rates do not change. This accounts for population growth and ageing. Bed-days are projected to grow faster than events due to population ageing.

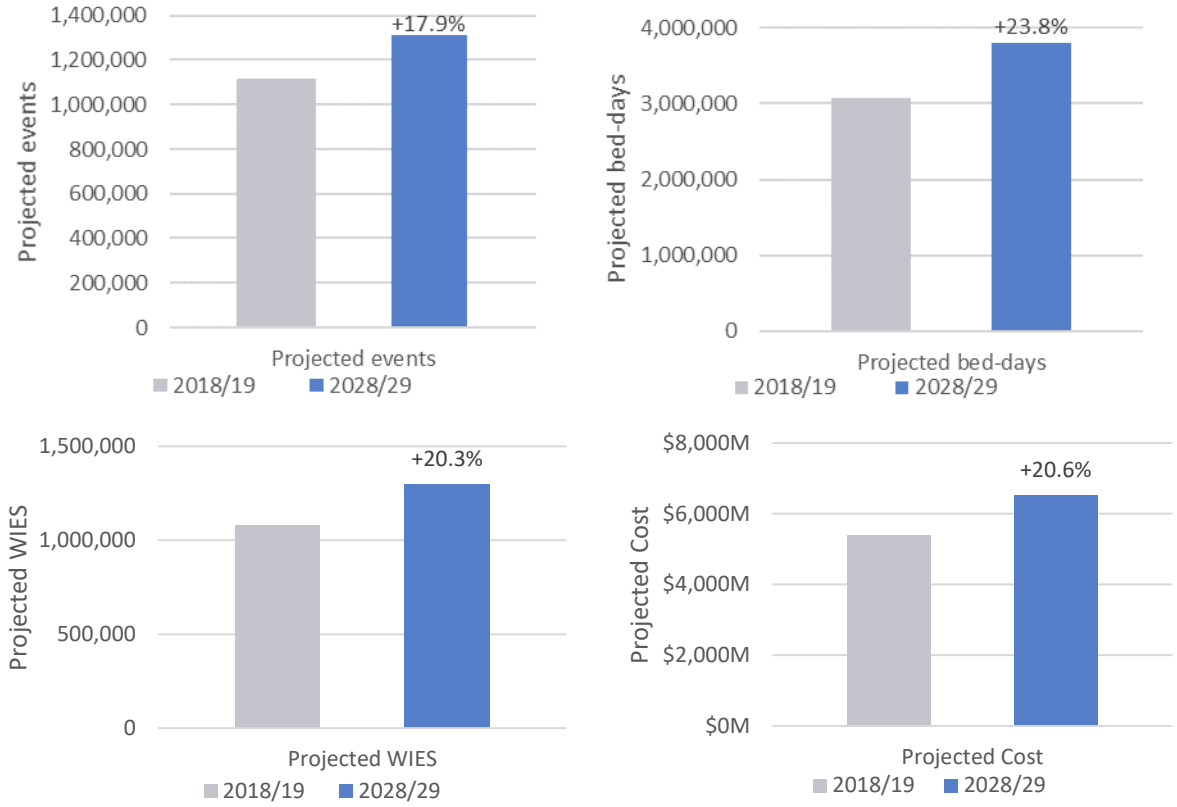

Figure 1: Demand projections in a baseline scenario to 2028/29

Table 2: Baseline demand projection to 2028/29

	2018/19	2028/29	% change
Events	1,112,477	1,311,829	+17.9
Bed-days	3,066,832	3,795,357	+23.8%
WIES	1,076,080	1,294,434	+20.3
Cost	$5,398M	$6,510M[6]	+20.6%

[6] Unadjusted for cost inflation. Based on historic price increases from 2008/09 through to 2018/19, the cost could be expected to be as much as ~32% higher by 2028/29, for reference, $6,510M multiplied by 1.32 equates to $8,293M, which is $2,083M higher than the projected cost based on 2018/19 National Pricing.
[7] For reference, accrued FTE at year end was 67,878 (excluding outsourced).

A common metric used to assess how many beds a facility requires is the utilisation metric – usually set at 85%. This inflates the number of bed-days before dividing by 365 (number of days in year) to translate bed-days into bed-years (i.e., beds). The purpose of the inflation is to account for variability in activity over time, so services can respond to fluctuations in demand with the same bed base.

Applying this metric to 2018/19 bed-days, at 85% utilisation, gives 9,885 beds. Applying this to the projected 2028/29 bed-days gives 12,233 beds, an increase of 2,348 beds.

Projecting workforce in a baseline scenario

Alongside significant growth in demand, workforce resources will also need to keep pace.
In 2018/19, expenditure on only medical and nursing staff (insourced and outsourced) amounted to $4,913M.[7] If this were to grow in step with demand, then assuming a 25% increase, this would amount to $6,141M, an increase of $1,228M. This excludes any changes to pay and leave entitlements.

The impacts of reducing variation across Tier 2 services

Purpose

The Health and Disability Review Transition Unit aims to transform the health system to become more equitable and sustainable. One aspect of this involves continuous improvement of inpatient care, an expensive part of the health system. Demand for inpatient care is projected to grow considerably in the future due to the ageing population, thus becoming increasingly expensive to potentially unsustainable levels. If appropriate models of care are put in place to reduce demand through fewer readmissions, unplanned discharges, and a shorter length of stay, the trajectory of growth can be lowered to more sustainable levels. The following analysis looks at the impact of changes to the above on the number of events, bed-days, case-weighted discharges and cost. This quantifies the potential savings in terms of demand, bed-days and thus capacity, and complexity to understand cost savings which could be achieved.

Adjusting for reducing rates of readmissions

Readmissions can be considered additional work that may have been avoidable. Here readmissions are based on unplanned readmissions within 28 days (excluding readmissions on the same day of discharge – this removes activity for services such as AT&R where patients are routinely discharged from inpatient medical / surgical care and admitted into AT&R). The following graph highlights the variation in readmission rates across DHBs (based on DHB of Domicile).

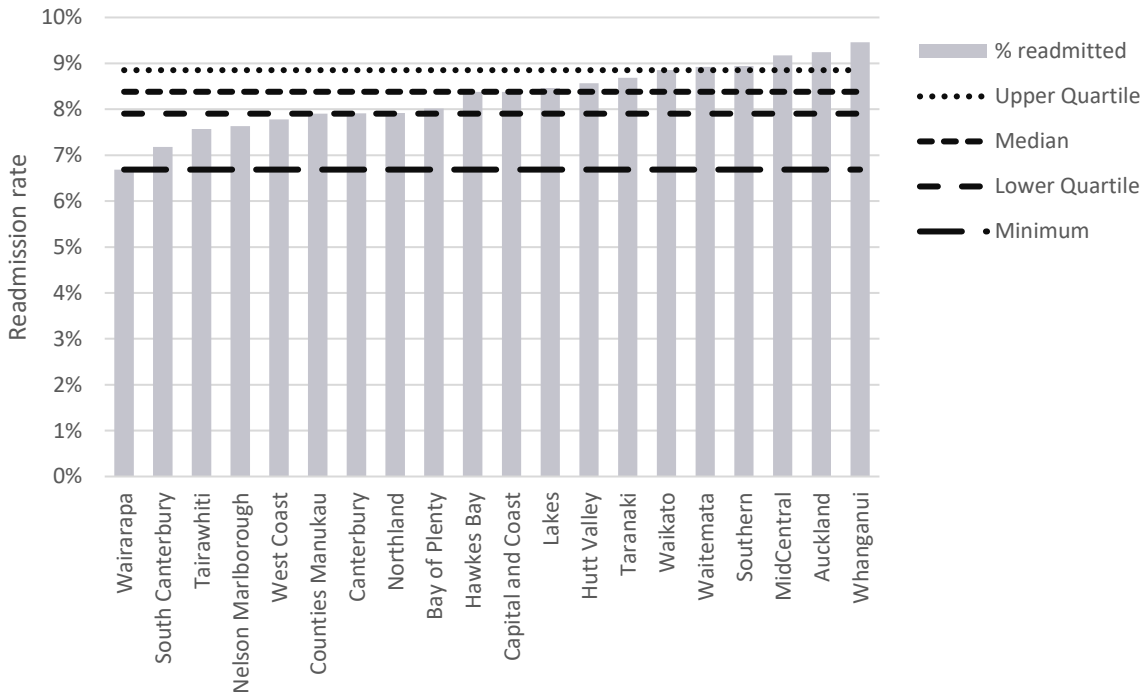

Figure 2: Unplanned readmission rate within 28 days by DHB of Domicile

To estimate the impact of reduced variation in readmission rates, readmissions were reduced to the rate of the lower quartile over a 5-year period with an increasing reduction each year. This was a reduction of 0.5% from 8.4% in the 2018/19 baseline down to 7.9% by 2022/23.

Table 3: Yearly reductions in events, bed-days, and WIES and cost savings from reduced unplanned readmissions

	2018/19	2019/20	2020/21	2021/22	2022/23
Cumulative % reduction	0.11%	0.21%	0.32%	0.43%	0.53%

Yearly reduction in events	1,186	1,199	1,210	1,215	1,221
Yearly reduction in bed-days	3,878	3,922	3,955	3,972	3,991
Yearly reduction in WIES	1,078	1,090	1,100	1,104	1,110
Yearly cost saving	$5.5M	$5.5M	$5.6M	$5.6M	$5.6M

Adjusting for reducing rates of unplanned hospitalisation

DHBs continue to work on reducing unplanned hospitalisation rates, given they are such a significant driver of demand for care, and impact on their ability to deliver other, more proactive, types of care in a timely manner. Here unplanned hospitalisation rates are age and ethnicity standardised (i.e., adjusting for the impacts of differing age and ethnic structures which correlate with or can drive demand for care). The following graph highlights the variation in unplanned hospitalisation rates across DHBs (based on DHB of Domicile).

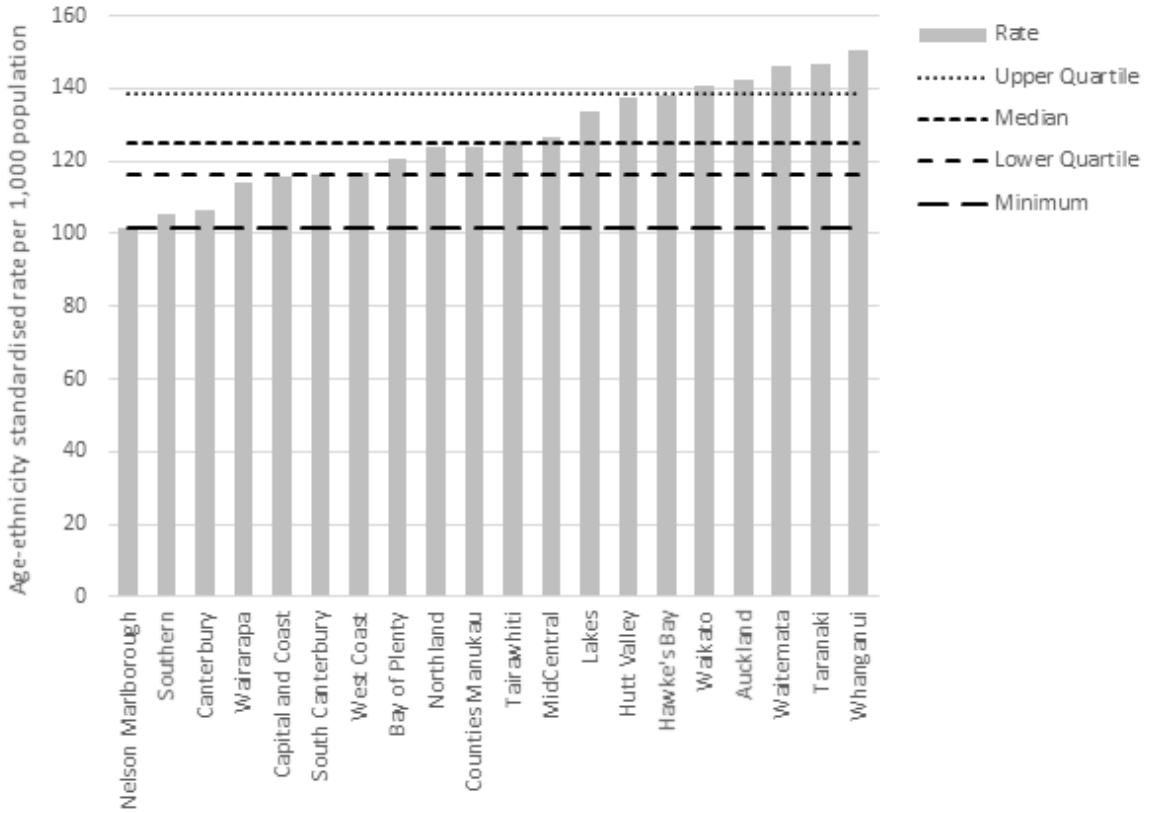

Figure 3: Unplanned hospitalisation rates standardised for age and ethnicity by DHB of Domicile

To estimate the impact of reduced variation in unplanned discharges, rates were reduced to the lower quartile, a 9.3% decrease over a 5-year period. Also note that this was only applied to unplanned hospitalisations less readmissions.

Table 4: Yearly reductions in events, bed-days, and WIES and cost savings from reduced unplanned admissions

	2018/19	2019/20	2020/21	2021/22	2022/23
Cumulative % reduction	1.9%	3.7%	5.6%	7.4%	9.3%
Yearly reduction in events	10,758	10,870	10,959	11,009	11,068
Yearly reduction in bed-days	30,892	31,216	31,471	31,615	31,784
Yearly reduction in WIES	9,586	9,687	9,766	9,811	9,863
Yearly cost saving	$49M	$49M	$50M	$50M	$50M

Adjusting for reducing hospital length of stay

Similar to rates of unplanned hospitalisation, DHBs continue to work on reducing length of stay. Here length of stay is explored based on the actual and expected length of stay at a facility level (only includes publicly funded casemix activity) – this accounts for a particular facility's casemix, patient complexity and aspects of patient flow. The following graphs highlight the variation in actual and expected planned and unplanned lengths of stay across facilities.

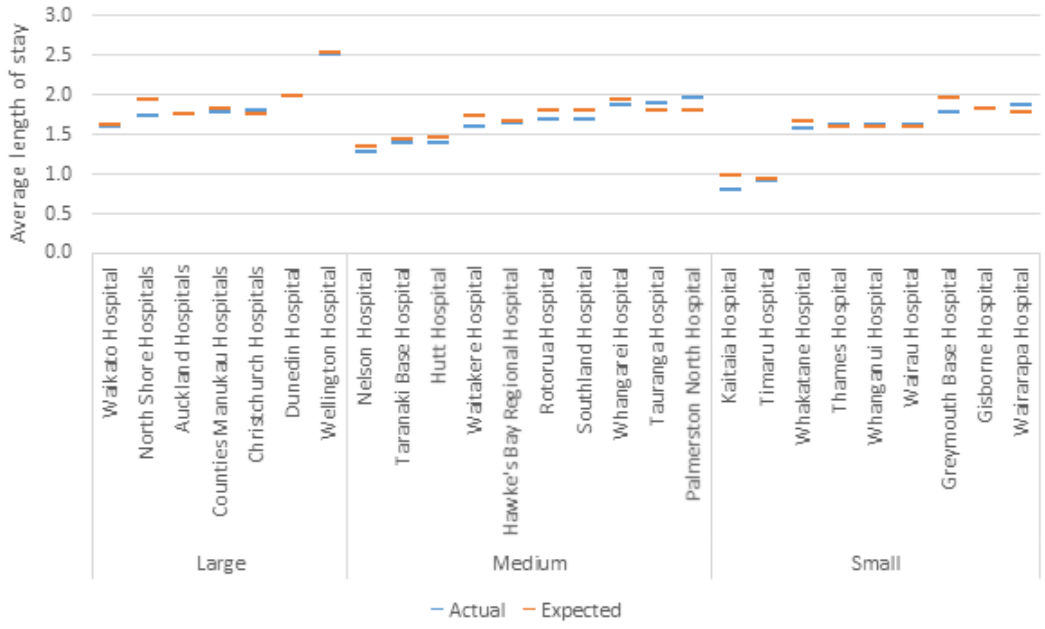

Figure 4: 2018/19 planned care actual and expected length of stay

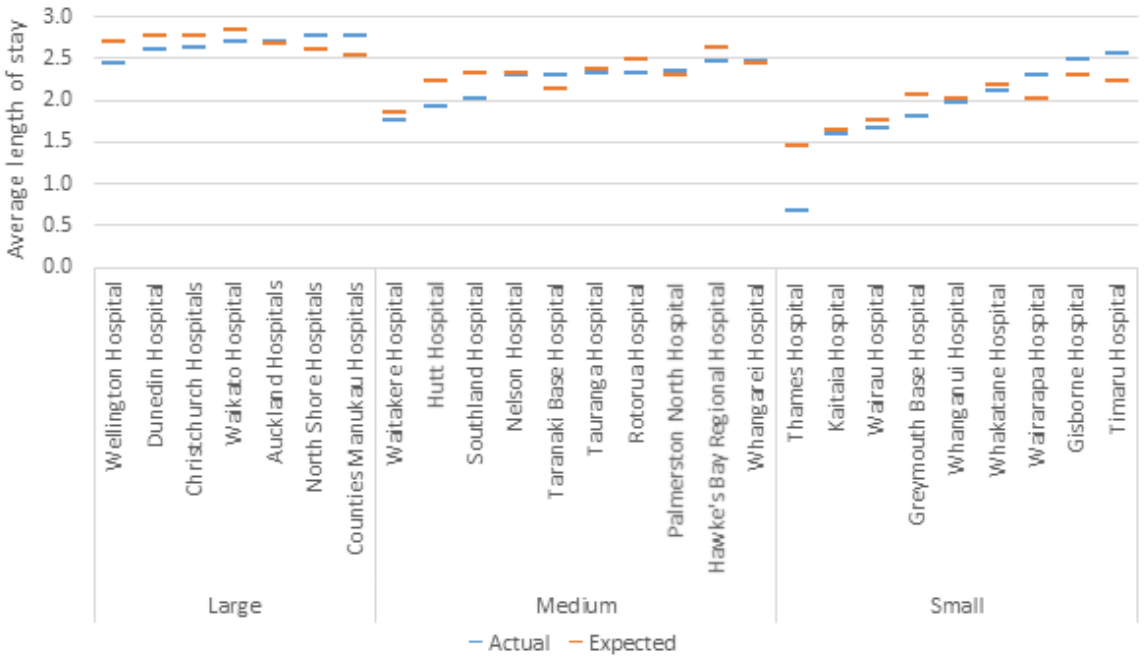

Figure 5: 2018/19 unplanned care actual and expected length of stay

To estimate the impact of reduced length of stay, the overall ratio of actual to expected bed days was reduced to the lower quartile of all facilities over 5 years, that is, from 98% in 2018/19 to 94% in 2022/23.

However, this will double count some of the savings the reduced variation in unplanned readmissions and hospitalisations. Therefore, it should only apply on the remaining hospitalisations after removal of the unplanned readmissions and hospitalisations, excluding the share which are not specifically publicly funded casemix included. It was estimated that the share of activity this should apply to was ~77%, however this number varies by DHB depending on reductions to unplanned admissions.

Given that this reduction is only on a length of stay basis, it is difficult to accurately estimate the reduction in cost that might be achieved. Here we make the assumption that the reduction in bed-days can be translated into a cost based on national pricing using WIES per bed-day (for the publicly funded casemix included group). The estimated costs in the table below are likely to be overestimated, given the contribution of bed-days to calculation of WIES is not equal across the casemix.

Table 5: Yearly reductions in events, bed-days, and WIES and cost savings from reduced length of stay

	2018/19	2019/20	2020/21	2021/22	2022/23
Reduction in ratio of actual to expected	0.3%	2.0%	2.0%	2.0%	2.0%
Yearly reduction in bed-days	7,695	24,628	24,761	24,932	25,108
Yearly reduction in WIES	3,182	10,185	10,240	10,311	10,384
Yearly cost saving	$9M	$30M	$30M	$30M	$30M

What this amounts to

Based on the three reductions in variation presented here, in 2018/19, these reductions could be expected to reduce activity by 12,000 events, 140 beds, and save $63 million in 2018/19 dollars.

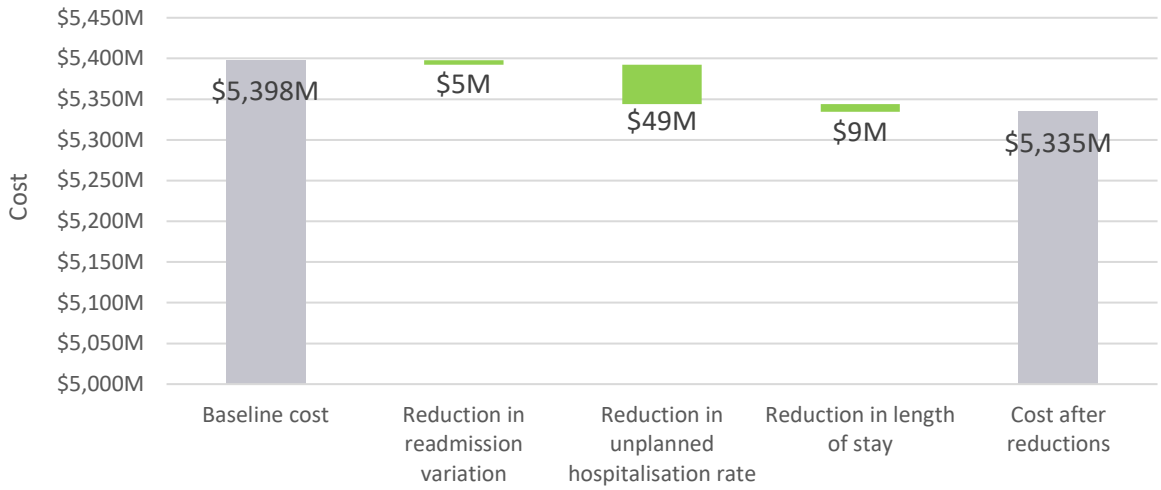

Figure 6: 2018/19 single year impacts of reduced variation on total cost

The savings potential becomes much greater when the cumulative impact from 2018/19 to 2028/29 is considered. Over this period, these reductions could be expected to reduce activity by 577,000 events, 8,740 bed-years (1,070 beds by the end of the period), and save $3,865 million in 2018/19 dollars.[8]

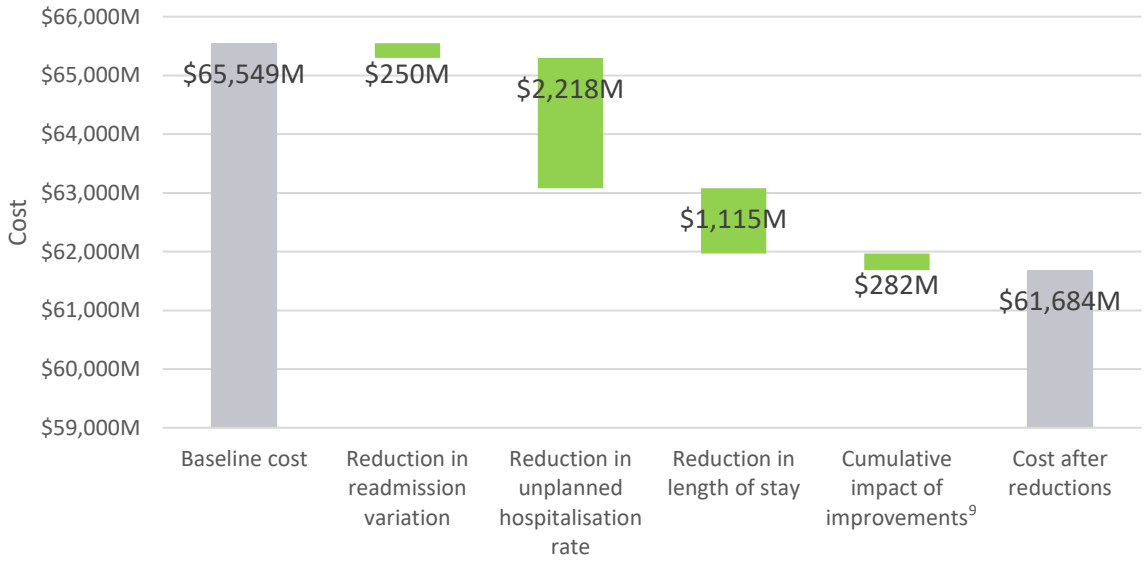

Figure 7: 2028/29 cumulative impacts of reduced variation on total cost

[8] Unadjusted for cost inflation. Based on historic price increases from 2008/09 through to 2018/19, the cost could be expected to be as much as ~32% higher by 2028/29, for reference, $3,865M multiplied by 1.32 equates to $5,101M, which is $1,236M more than the projected cost saving based on 2018/19 National Pricing.

[9] Additional cost savings are made due to the cumulative impact of improvements meaning projections are made to a lower base each year resulting in lower growth each year.

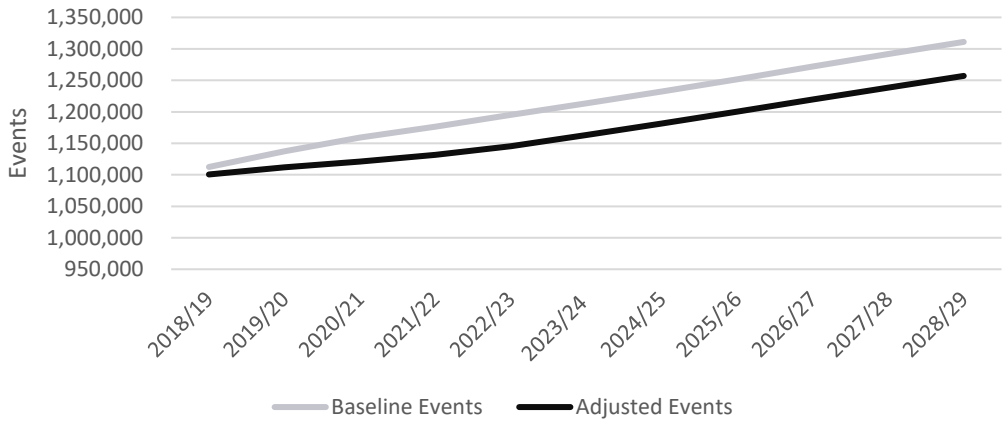

Figure 8: Baseline projected events and the moving average of adjusted events

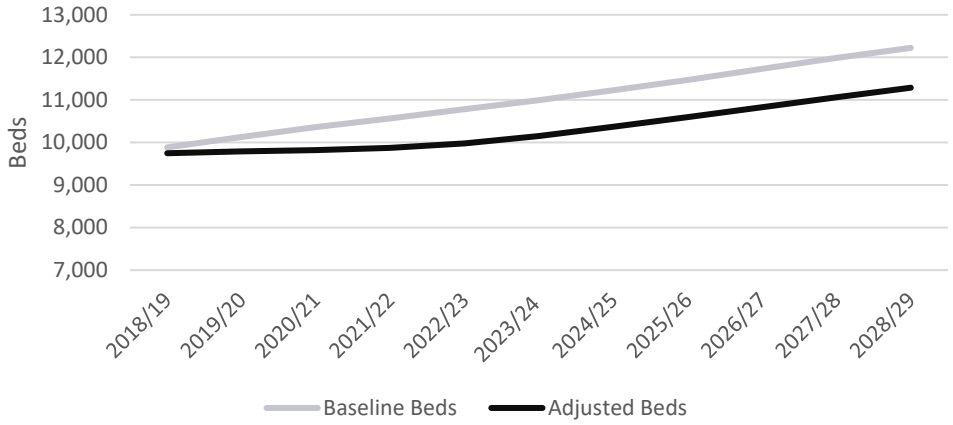

Figure 9: Baseline projected beds and the moving average of adjusted beds

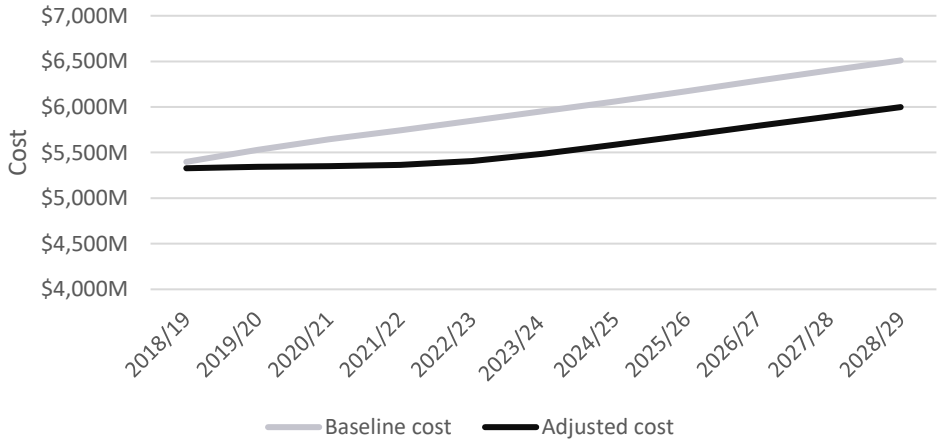

Figure 10: Baseline projected costs and the moving average of adjusted costs

Data Appendix

Data was extracted from the National Minimum Dataset (NMDS, extracted 1 November 2020). This data covered the period from 1 July 2018 through to 30 June 2019.
The data was filtered to exclude all well neonates (health specialty codes P61 and P71 – due to fact that these events are duplicates of the mother's admission, i.e., same case-weight) and non-DHB provider agency events, before being sorted into the following categories:

- **Publicly funded casemix-included** – Purchase unit not equal to EXCLU and Purchaser = 20,34,35
- **Publicly funded purchase unit funded** – Purchase unit = EXCLU, Purchaser = 20,34,35 and EXCLU_PURCHASE_UNIT not equal to EXCLU
- **Publicly funded casemix-excluded** - Purchase unit = EXCLU, Purchaser = 20,34,35 and EXCLU_PURCHASE_UNIT = EXCLU
- **ACC funded inpatient discharges** – Purchaser = A0
- **Overseas ineligible** – Purchaser not = 20, 34, 35, A0
- **Excluded** - EXCLU_PURCHASE_UNIT = BOARDER or CANC_OP.

Assumption Appendix

Choice of activity data:

- The 2018/19 financial year was selected due to being the most recent full financial year that was not impacted by COVID-19.

Choice of population data:

- The PBFF population data was used for this analysis due to being the most consistently used population projection dataset for health service planning.

Rationale for projection methodology:

- Population projections applied to crude, specific rates are a common methodology used in health service planning, and more broadly in epidemiology and public health.
- Here rates are age (five-year age bands to 85+) and ethnic (Māori, Pacific, Asian and Other) specific. These two factors explain a large proportion of the variability in secondary care attendance rates, while not overcomplicating the specificity of the analysis, e.g., one could also adjust for deprivation and gender which would mean the rates would become more and more specific and many of those categories may have few events and/or small populations – this tends to then over-emphasise cases where patients are frequent users of services and can lead to instability in projections, particularly if those small populations are expected to change dramatically due to increased diversity and/or ageing.

Rationale for selection of unplanned readmission rates, unplanned admission rates and standardised length of stay (see Table 6 for methodology), and their relevant reductions and phasing:

- These three metrics were selected due to the ease of mutually exclusively defining their impacts, as well having good coverage of levers which support improvement on them, i.e., improvements may be due to improved efficiency of care delivery, improved quality / effectiveness of care delivery, and/or avoidance of patient need in the first place. Their reductions and rationale are as follows:
    - Unplanned readmission rates (under 28 days, excluding same day readmissions – which accounts for activity such as discharge from medical / surgical services before readmission into AT&R services on the same day) – all DHB unplanned readmission rates were shifted to the lower quartile over a five-year period (assumed to be phased as a steady ~0.1% decline each year). This had the effect of decreasing the national unplanned readmission rate from 8.4% in 2018/19 down to 7.9% in 2022/23.
    - Unplanned admission rates (excluding unplanned readmissions) – all DHB unplanned admission rates were shifted to the lower quartile over a five-year period (assumed to be phased as a steady ~1.8% decline each year). This had the effect of decreasing the national unplanned admission rate from 128 admissions per 1,000 population in 2018/19 down to 116 admissions per 1,000 population in 2022/23.

- Standardised length of stay (excluding reductions in unplanned readmissions and admissions, and non-publicly funded admissions) – all DHB standardised lengths of stay (by planned and unplanned admissions) were shifted to the lower quartile of standardised length of stay (based on the ratio of actual and expected length of stay) over a five-year period (assumed to be phased with a relatively small decrement over first year before growing to a larger decrement for the remaining four years). This had the effect of decreasing the national ratio of actual to expected length of stay from 98.3% in 2018/19 down to 94.0% in 2022/23.

Table 6: Standardised length of stay methodology

Measure	Definition	Notes
Planned and Unplanned Actual and expected length of stay	**Actual**: Planned / unplanned inpatient LOS for chosen facility **Expected**: Planned / unplanned inpatient LOS across peer group hospitals over last five financial years stratified by admission type, DRG, PCCL, event end type and peer group applied to the 2019/20 casemix of selected hospital	**Time period**: 2019/20, reference period (2015/16 – 2019/20) **Data sources**: NMDS **Exclusions**: Non-casemix, non-DHB provider agencies, in-hospital deaths, well neonates, statistical discharges based on event end type and purchasers outside of overseas eligible, MoH-funded and DHB-funded