Harnessing Data Analytics and AI for Health Service Planning

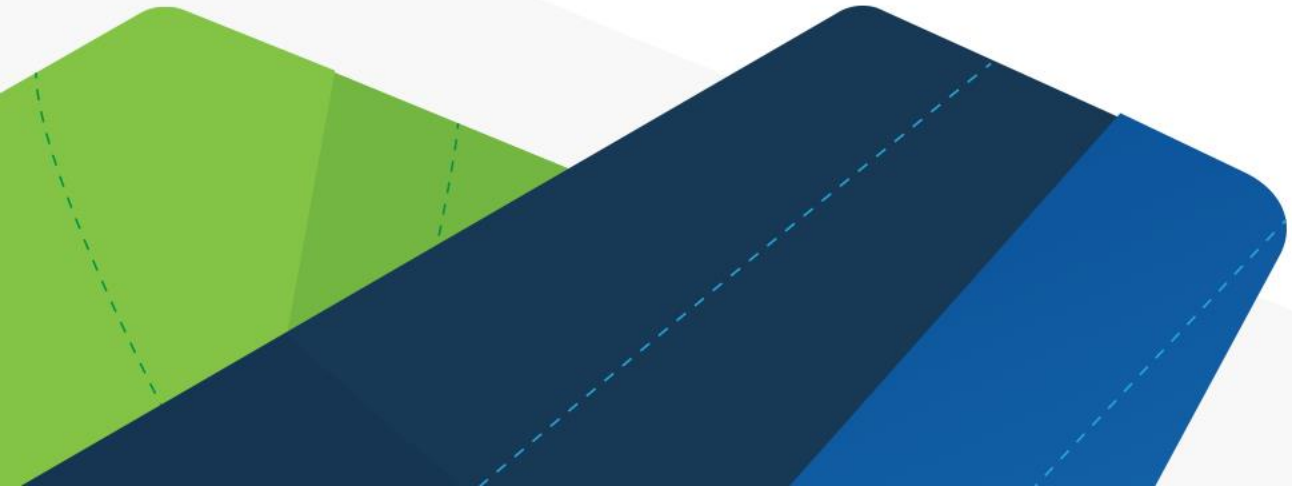
Davids Agboola PhD CHIA

Health Service, Research, Analysis and Modelling

System Planning Branch, Clinical Planning and Strategy Division

Demand Planning and Forecasting

Supply Chain Branch, Corporate Services Division

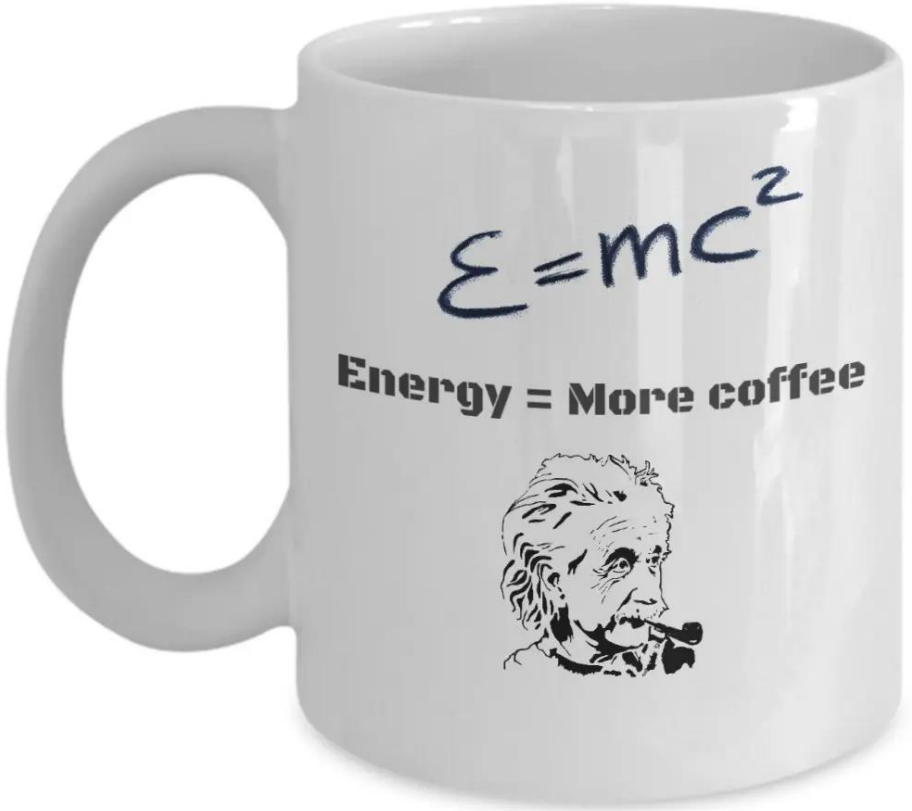


Queensland Government

Outline

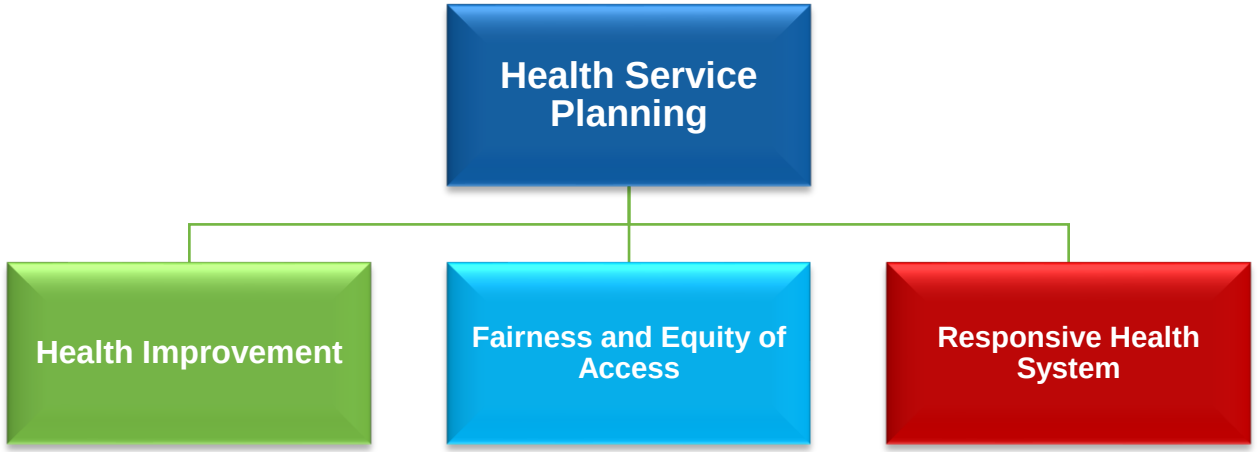
- Overview of Health Service Planning
- Current Challenges and Opportunities in health service Planning
- Role of data analytics/AI in shaping health planning
- Future smart Health planning framework
- Case Example : Queensland Health Acute Inpatient Projection
- Implementation challenges of data analytics in Health Planning

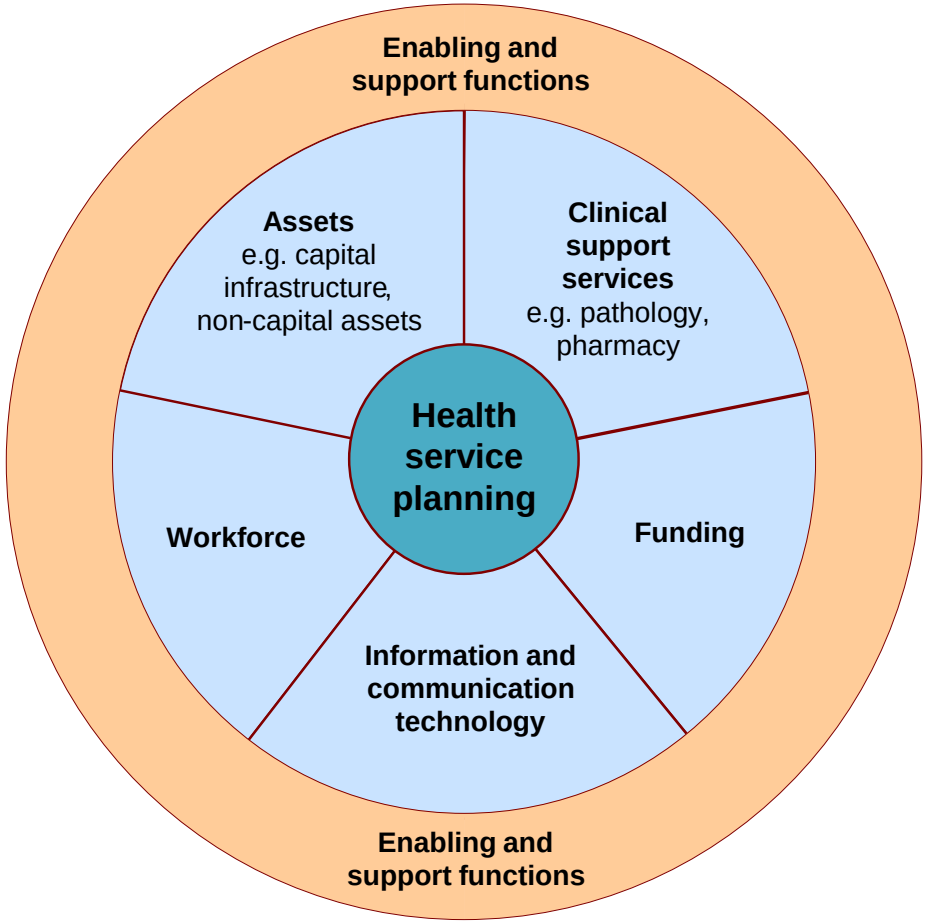
Simple but Elegant!



Disclaimer: Not medically proven.

Health Service Planning: Nutshell





Health service planning specifically aims to improve the health status of a given population while safeguarding equity and fairness of access as well as responsiveness of the health system to the perceived needs of the community. Health service planning should achieve this goal through the provision of efficient and effective health services, considering available resources and the available means and methods of health care

Health Service Planning: Big picture

Questions
How do we:

- Plan for Health Complexity and Comorbidities?
- Plan for Aging population?
- Accurately assess Health Need?
- Improve Service Efficiency & Sustainability?

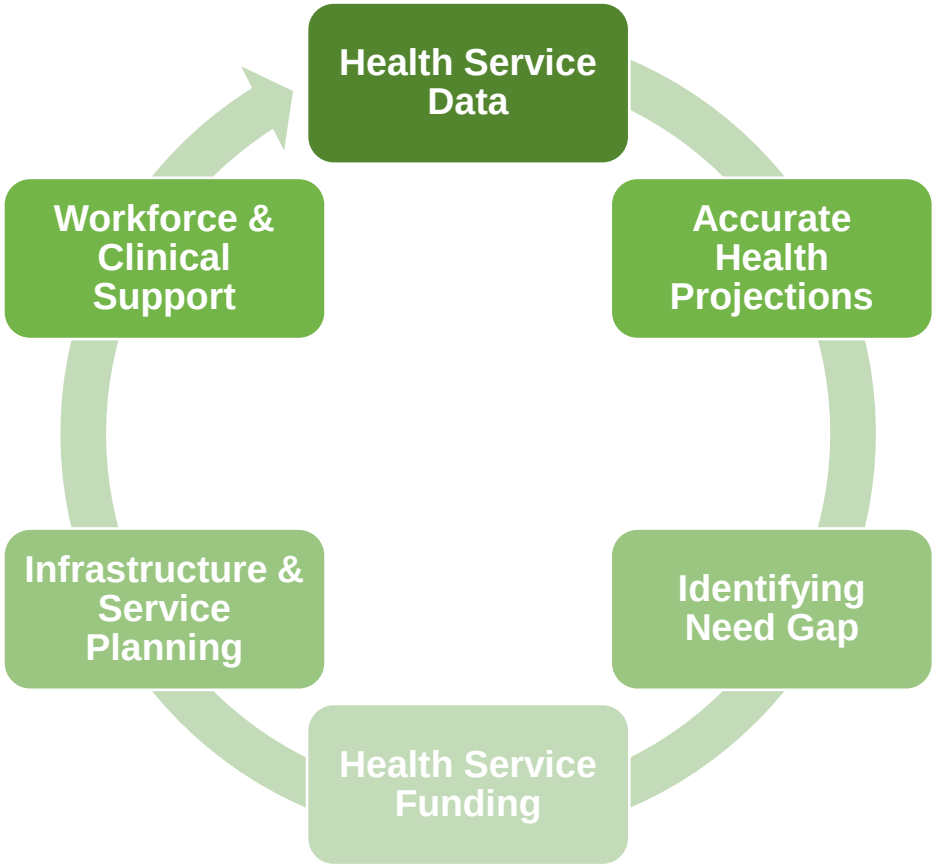
Opportunities
We have:

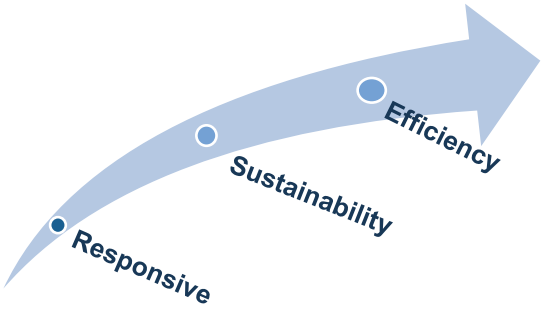
- Digitalized Health Records
- Big Data Analytics
- Advanced AI models to support decision
- Model-of-Care Optimization
  Precision Medicine

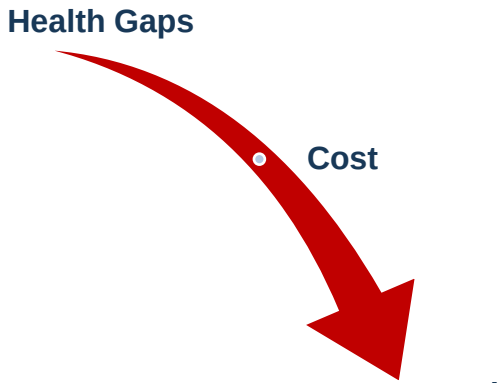
One way efficiency can be measured is by the cost per hospital separation. A sustainable health system maintains, renews and innovates resources to continually improve efficiency and respond to emerging needs ……*Australian Institute of Health and Welfare*

Data Analytics → Health Service Planning

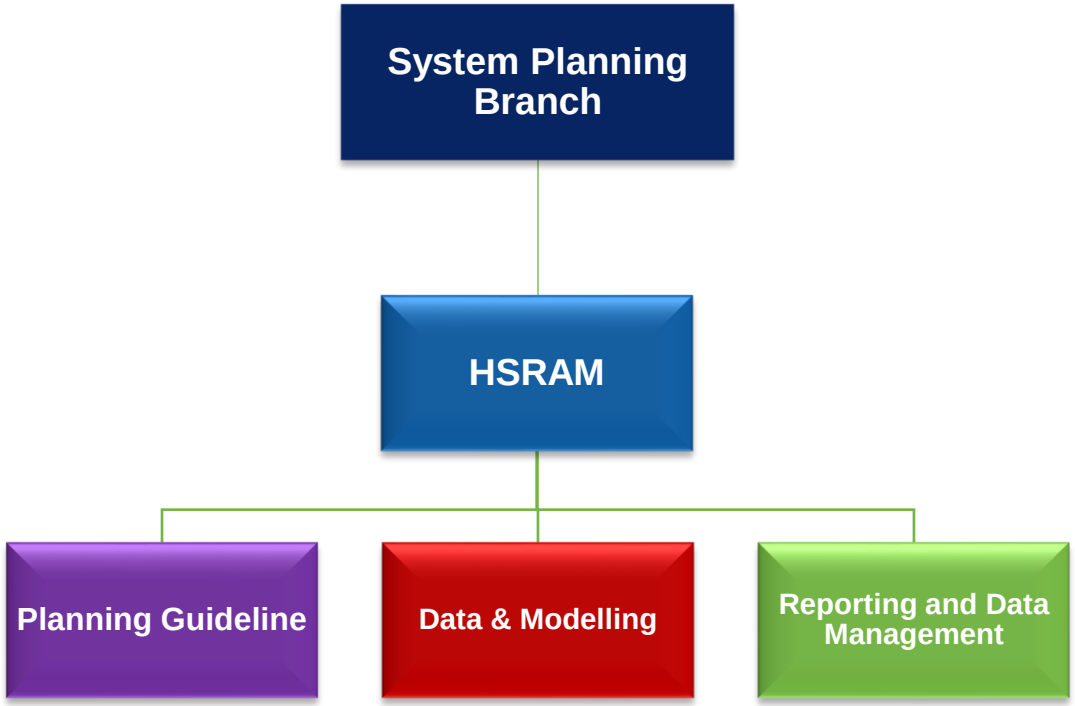
A sustainable health system maintains, renews and innovates resources to continually improve efficiency and respond to emerging needs ……*Australian Institute of Health and Welfare*

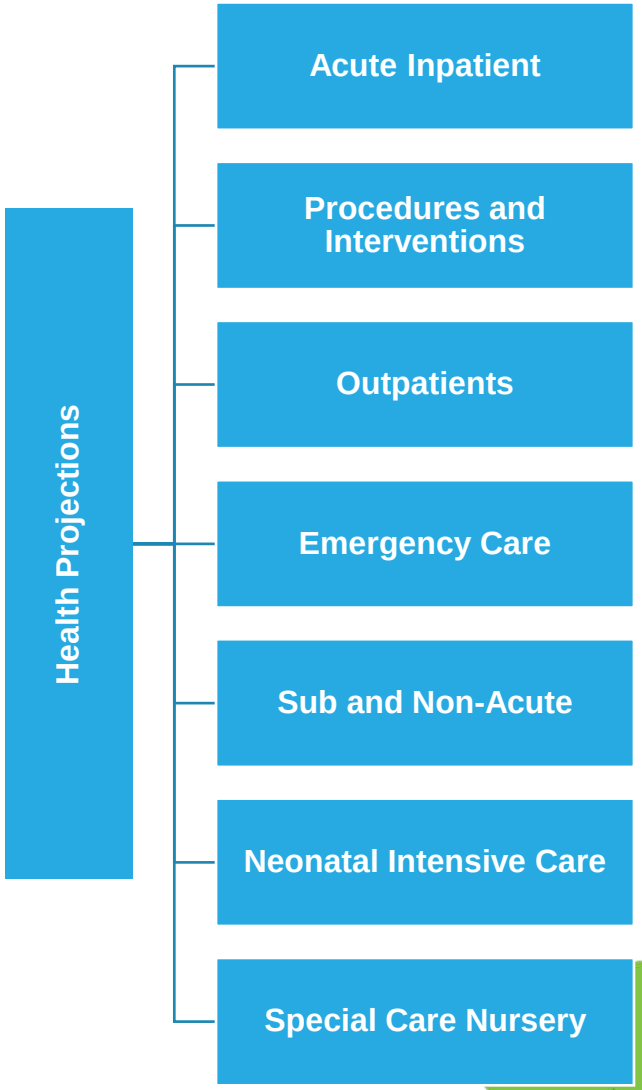






Health Service, Research, Analysis and Modelling (HSRAM)





Acute Inpatient Projections

Health Data

State-wide data capturing information about patients separated and Length-of-stay from any hospital

Queensland Hospital Admitted Patient Data Collection (QHAPDC)

- Patient Hospital Separation
- Patient Hospital Length of stay
- Patients' Demographics
- Patients Service-Related Group

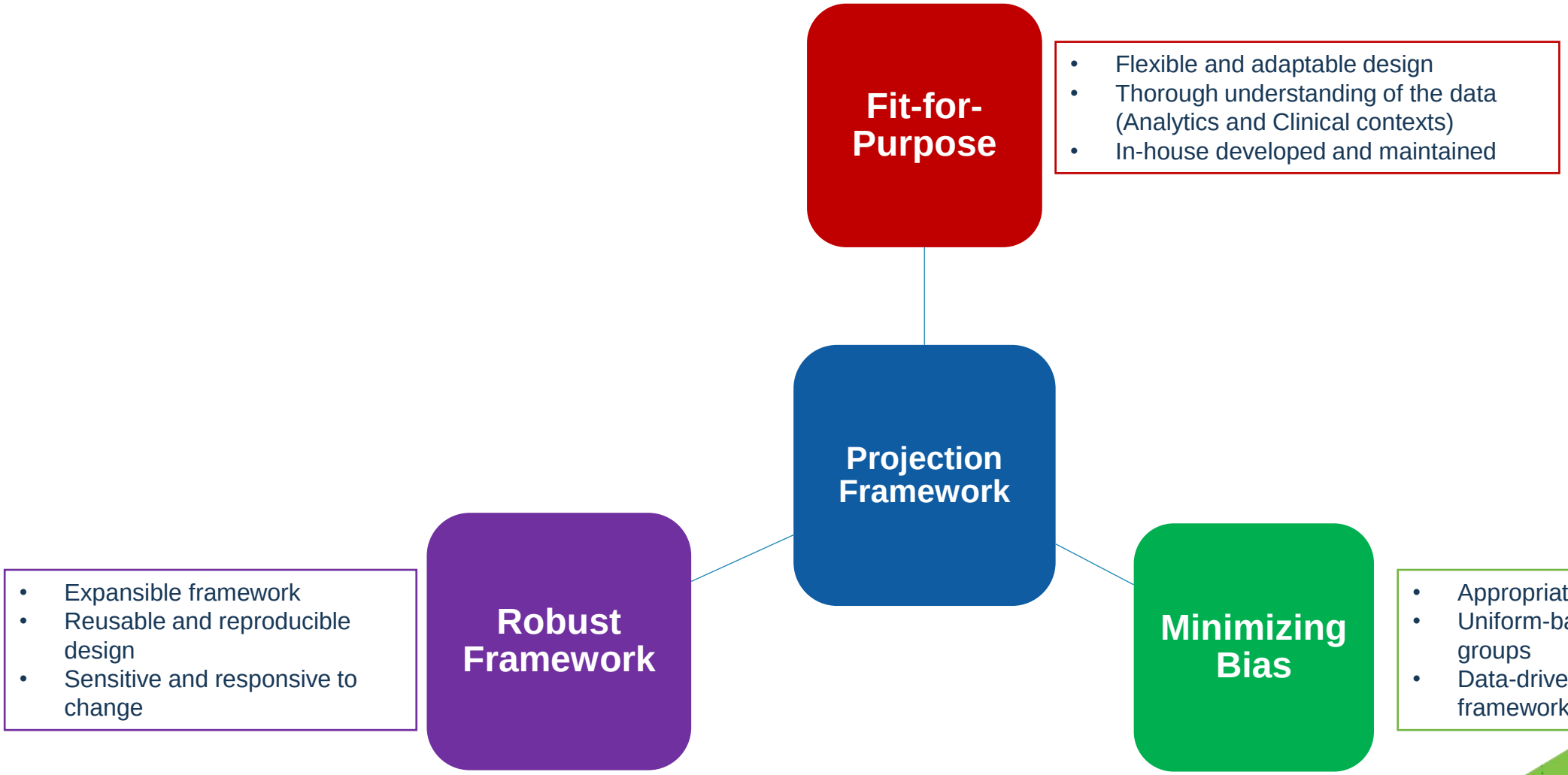
Queensland Government Statistical Office

- Population Data
- Estimated Resident Population (ERP) Data

DRG to ESRG Mapping*

*The Australian Refined Diagnosis Related Groups (AR-DRG) system is not generally considered appropriate as it contains too many classes Australian modification (ICD-10-AM) are also often unsuitable as they generally relate to body systems rather than services. The DRGs are mapped to an Enhanced Service-Related Group (ESRG), which are more appropriate for planning.

Acute Inpatient Projections

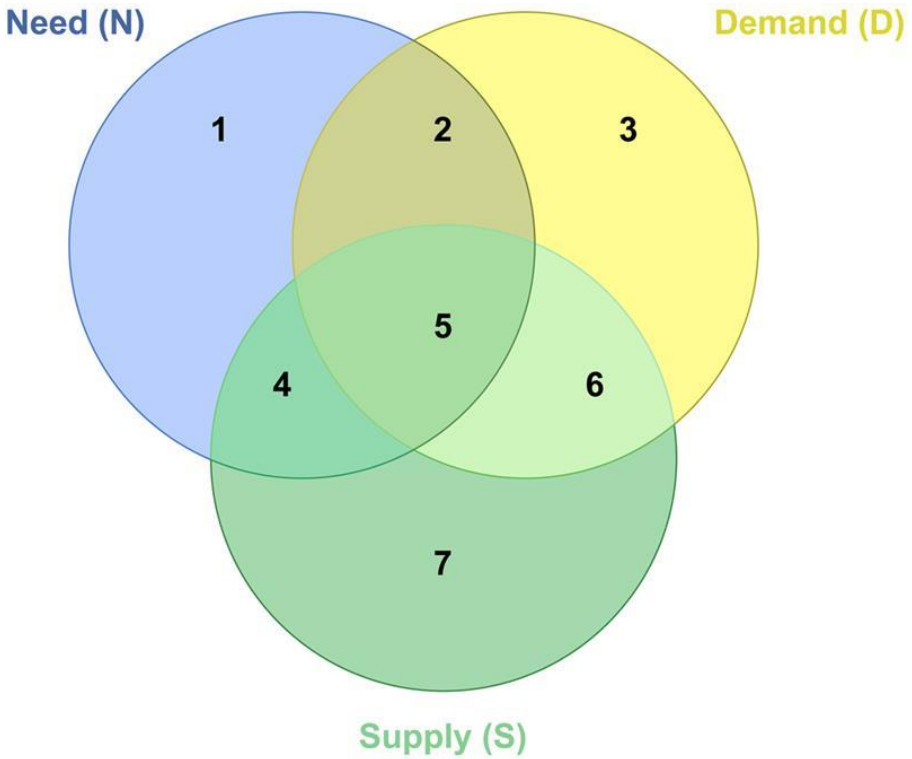


Acute Inpatient Projections

Projection Process

Planning regions are defined by the Department of Health to offer the flexibility of modelling inpatient services at a sub-HHS level. This is particularly useful for planning services for a hospital catchment which may not extend across the whole HHS. The planning regions are aligned to the Australian Statistical Geography Standard (ASGS) 2021. Projection is based on **ESRG-AGEGROUP-SEX-SAMEDAY granularity**

Scenario Modelling
Unmet Need

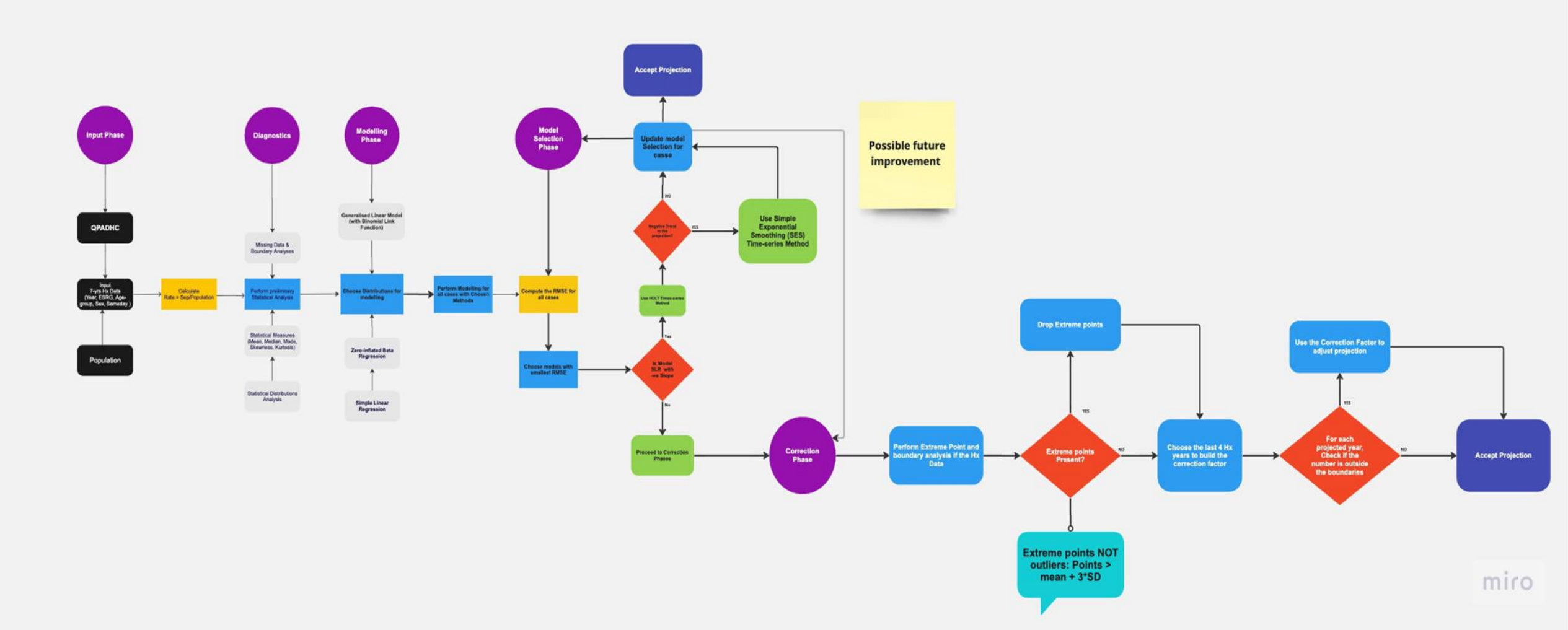


Area	Logic	Description of the area	Need	Unmet need	Demand	Supply	Access[a]	Example	Potential indicators
1	$(N \setminus D) \cap (N \setminus S)$ There is Need – but neither Demand nor Supply	The need for health care is unmet, and there is no access to health care. The unmet needs in this area are either (a) unperceived by the individual, or (b) needs the individual recognises but chooses not to have met.	Yes	Yes	No	No	No	(a) **Unperceived unmet need** Ms T is getting increasingly forgetful. Unknown to her and her family, she has dementia but been neither diagnosed nor treated. (b) **Chosen unmet need** Ms N has a condition she knows is treatable but she decides not to visit the GP about it.	Estimates of under-detected dementia Rate of cancer diagnoses by disease stage Acute myocardial infarction survival rates
2	$(N \cap D) \setminus S$ There is Need and Demand – but not Supply	Health care needs are expressed as demand, but supply does not meet demand. Hence, there is no access to health care. In this case, health care needs are unmet and 'supply-constrained.' Potential causes include access barriers, capacity constraints and waiting times.	Yes	Yes	Yes	No	No	Ms D has been depressed for some weeks and her low mood is not improving. She has asked the GP to refer her for psychotherapy. The GP has referred her but the waiting time is 6 months.	Referral waiting times
3	$(D \setminus N) \cap (D \setminus S)$ There is Demand – but neither Need nor Supply	Demand for health care is not linked to health care need and is not met by supply. There is no access to health care.	No	No	Yes	No	No	Ms Z has a painful hip. She asks her GP to refer her for an x-ray but the GP refuses her request because there is no evidence of arthritis or fracture. Ms Z has heard of a new drug for a condition she has. She asks her GP to prescribe it, but the GP refuses her request because the drug is not of proven cost-effectiveness.	Variation in referral thresholds Variation in prescribing rates
4	$(N \cap S) \setminus D$ There is Need and Supply – but not Demand	This area where need meets supply and not demand is the natural place of prevention policies. There is access to health care.	Yes	No	No	Yes	Yes	Ms G receives a letter from her child's school saying that all pupils in her child's class will receive a routine vaccination the following week.	Uptake of routine vaccinations and screening
5	$N \cap D \cap S$ There is Need, Demand and Supply	Health care is effective: supply meets demand (based on need) and capacity to benefit is positive. There is access to health care.	Yes	No	Yes	Yes	Yes	It is hay fever season and Ms W is having sinus problems. She visits her GP who prescribes a nasal spray and antihistamines.	Prescribing indicators Quality indicator performance emergency readmission rates delayed transfers of care
6	$(D \cap S) \setminus N$ There is Demand and Supply – but not Need	Supply meets demand but demand is not linked to health care need. There is utilisation but no access to health care.	No	No	Yes	Yes	No	**(a) Supplier induced demand** Ms P's dental practice calls her for a dental health check-up 6 months after her last check-up. She has good dental health and, according to national guidance, only requires annual checks. **(b) Patient induced demand** Ms N has a cold. Her GP diagnoses a respiratory virus, so there is no need for antibiotics. However, in response to patient pressure he prescribes antibiotics anyway. Ms W is in hospital following a fall but is medically fit for discharge. The discharge team have identified a care home placement, but Ms W's family refuse to pay the fees. Ms W remains in hospital and continues to 'demand' hospital services.	Risk-adjusted activity rates Measures of observed vs expected activity Prescriptions for drugs of limited clinical value Procedures of limited clinical effectiveness Rates of delayed transfers of care
7	$(S \setminus D) \cap (S \setminus N)$ There is Supply – but neither Need nor Demand	This case represents situations where there is excess capacity or inefficiencies in the delivery process. There is service availability but no access to health care.	No	No	No	Yes	No	In hospital F, one-third of outpatient appointments are 'did not attend' (DNA). Hospital F pays its staff the same regardless of whether or not people attend their appointments.	DNA rates

Rodriguez Santana, I., Mason, A., Gutacker, N., Kasteridis, P., Santos, R., & Rice, N. (2023). Need, demand, supply in health care: Working definitions, and their implications for defining access. *Health Economics, Policy and Law, 18*(1), 1-13. doi:10.1017/S1744133121000293

Acute Care Estimates: State Projections

Model Pipeline

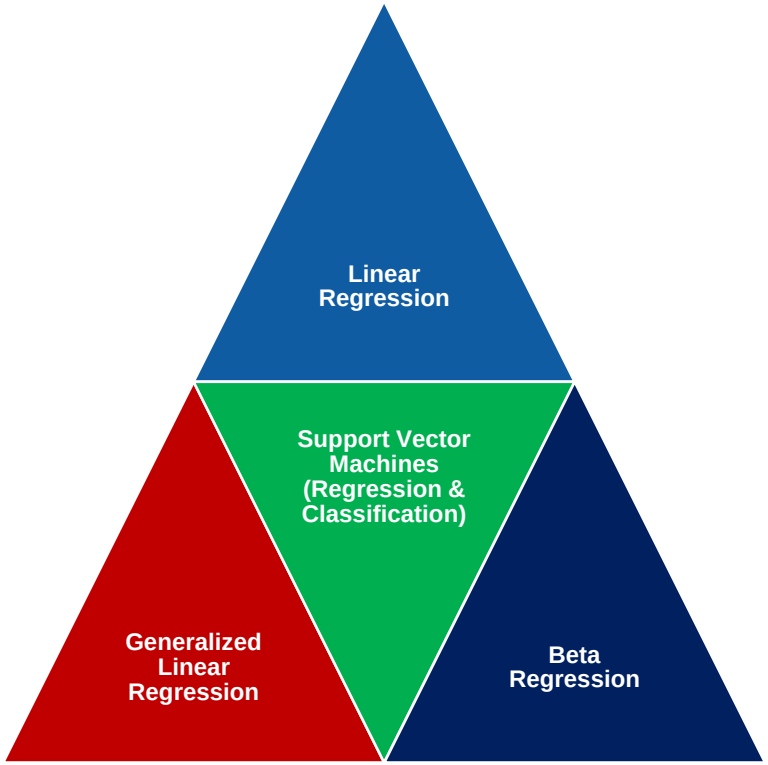


Acute Care Estimates

Other Models

Relative Utilization Modelling (Trial Model)

Market Share Modelling



Acute Care Estimates

Cross-Sectional view

Cross Sectional | Overview Last update: 27 Feb, 2024

HHS Subset: Cairns and Hinterland

Year: All

HHS, Planning Region: All

HHS, Facility of Treatment: All

Adult/Child, Age Group: All

Hospital Type, Facility St…: All

SRG, ESRG: All

Stay Type: All

Emergency Status: All

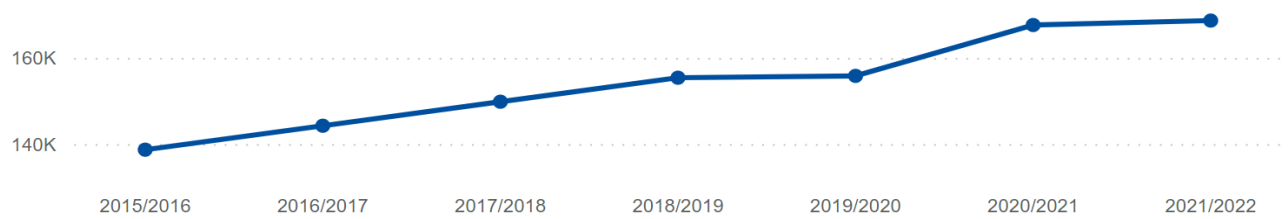
MSP Classification: All

Separations (2021/2022) **168,667**

Beddays (2021/2022) **395,200**

ALOS (days) (2021/2022) **2.3**

Cairns and Hinterland - Separations by Year



Cairns and Hinterland - Cross Sectional Summary

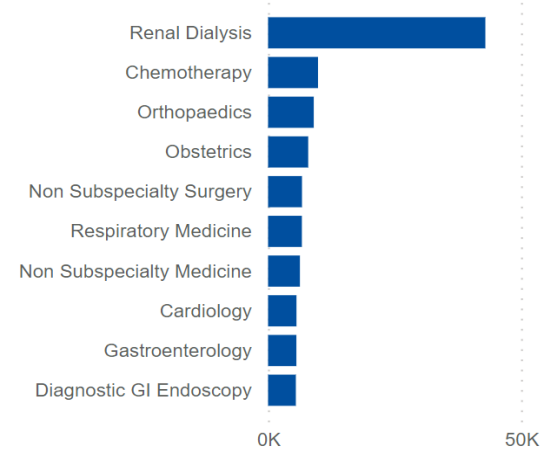
	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Separations	138,706	144,267	149,841	155,407	155,830	167,633	168,667
Expected Separations	125,629	132,108	138,394	143,475	142,317	153,083	153,492
Beddays	350,872	361,049	357,852	369,285	360,907	379,143	395,200
Excess 90 Days	16,579	20,828	11,704	16,002	20,191	18,660	10,792
Beddays (Total)	367,451	381,877	369,556	385,287	381,098	397,803	405,992
Relative Utilisation	104.4	102.4	101.0	100.8	102.1	102.8	104.7
ALOS (days)	2.53	2.50	2.39	2.38	2.32	2.26	2.34
ALOS (hours)	51.91	51.50	46.97	47.16	45.96	44.09	44.98
ICU Days	0	5,446	5,048	5,774	5,095	5,533	5,264
CCU Days	0	3,862	3,854	4,151	3,775	3,753	3,747
PICU Days	0	343	239	607	452	1,063	460
NICU Days	0	1,220	858	1,089	977	1,350	1,142
SCN Days	0	6,585	6,166	6,144	6,881	6,954	7,022
LOS Hours	7,200,897	7,430,222	7,037,614	7,328,725	7,162,383	7,390,666	7,586,727
Psych Days	28,234	35,110	24,477	25,426	28,147	24,182	27,987
HITH Days	3,451	4,575	4,082	4,499	6,554	6,778	9,347
QWAU Q25	0.00	0.00	0.00	114,029.07	114,720.78	123,374.90	122,055.94

Apply Base Case exclusions

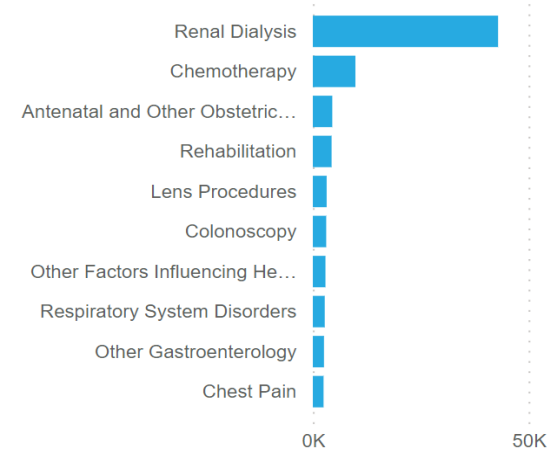
*ALOS = Beddays (excluding stays in excess 90 days) divided by Total Separations

Metric Selection: Separations

Top 10 SRGs by Separations (2021/2022)



Top 10 ESRGs by Separations (2021/2022)



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System Planning Branch | Clinical Planning and Service Strategy | Queensland Health

Acute Care Estimates

State-wide Trend

Acute Care Estimates

Base-Case

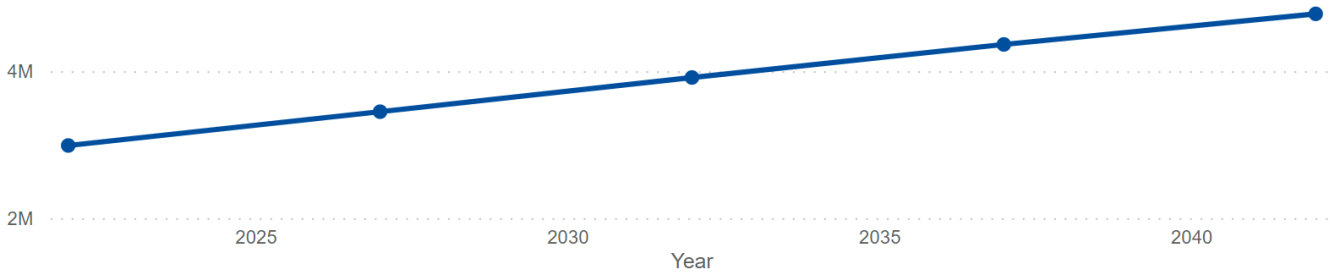
ACE Base Case (2021-22) | Overview — Last update: 23 Feb, 2024

HHS Subset: All
HHS Group: All
HHS, Planning Region: All
HHS, Facility of Treatment: All
Hospital Type, Facility St…: All
Adult/Child, Age Group: All
SRG, ESRG: All
Emergency Status: All
Stay Type: All
MSP Classification: All

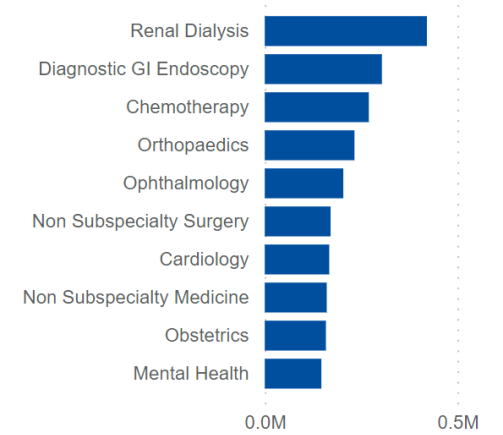
Separations (2021/2022)	Separations (2031/2032)	CAGR from 2022 to 2032
2,988,686	3,914,274	2.7%

Year Selection: 2031/2032
Metric Selection: Separations

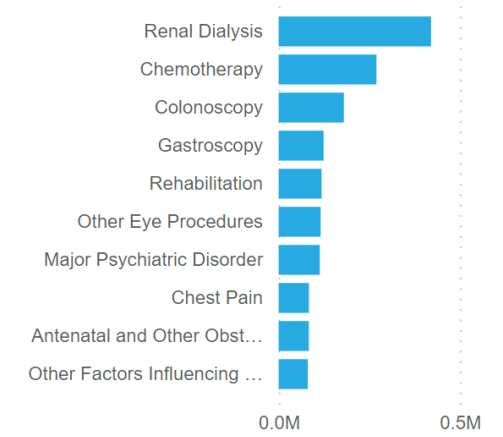
Separations by Year



Top 10 SRGs by Separations (2031/2032)



Top 10 ESRGs by Separations (2031/2032)



- ACE Base Case Projections Summary

	2021/2022	2026/2027	2031/2032	2036/2037	2041/2042
Separations	2,988,686.00	3,448,825.18	3,914,273.80	4,364,181.80	4,780,641.72
Expected Sepns	2,914,860.91	3,360,424.25	3,816,241.54	4,257,765.08	4,666,976.61
Beddays	7,210,752.00	7,837,347.20	8,850,445.92	9,933,612.49	10,956,525.52
Excess 90 Days	87,950.00	109,446.73	123,117.71	138,435.17	151,729.39
Beddays (Total)	7,298,702.00	7,946,793.93	8,973,563.63	10,072,047.66	11,108,254.91
Relative Utilisation	102.53	102.63	102.57	102.50	102.44
ALOS	2.41	2.27	2.26	2.28	2.29
ICU Days	62,619.32	73,239.44	81,501.12	88,333.27	94,775.92
CCU Days	37,742.00	46,454.53	54,154.75	61,025.33	67,174.55
PICU Days	9,576.02	11,022.82	12,054.54	12,761.06	13,574.06
NICU Days	26,031.63	32,767.64	37,447.95	39,755.37	42,384.55
SCN Days	78,724.88	86,658.22	93,126.07	99,042.21	105,825.65
Psych Days	635,117.00	730,612.56	786,727.75	837,481.43	887,784.57
HITH Days	224,643.00	167,446.19	197,937.64	226,212.26	252,191.01
QWAU Q25	1,714,416.63	1,702,335.35	1,962,240.77	2,196,461.56	2,412,119.84

Apply Base Case exclusions

*ALOS = Beddays (excluding stays in excess 90 days) divided by Total Separations

Reset Filters

Acute Care Estimates

Relative Utilization

Acute Care Estimates

Self-Sufficiency

ACE Base Case (2021-22) | Self-Sufficiency — Last update: 23 Feb, 2024

HHS Group: All

HHS, Planning Region: All

HHS, Facility of Treatment: All

Hospital Type, Facility St…: All

Adult/Child, Age Group: All

SRG in scope: All

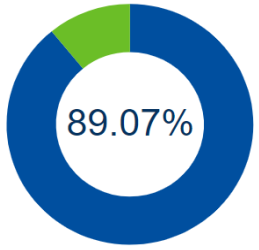
SRG, ESRG: All

Emergency Status: All

Stay Type: All

MSP Classification: All

Public Self-Sufficiency



In HHS	Separations
In-HHS	10,645,906.1
Out-HHS	1,306,238.3
Total	**11,952,144.4**

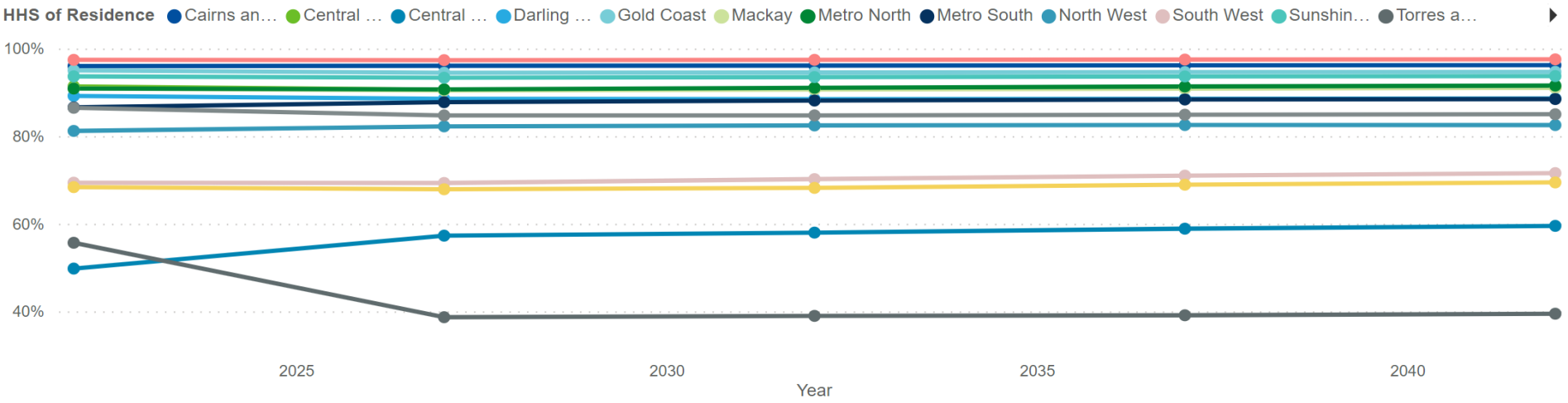
Year Selection: All

Visual Selection: HHS of Residence | Planning Region

Residents - Patient Flows (Public and Private Separations) by Place of Residence - Multiple years

In HHS HHS of Residence	In-HHS Separations	%RT Separations	Out-HHS Separations	%RT Separations	**Total Separations**	**%RT Separations**
Cairns and Hinterland	118,073	75.24%	38,857	24.76%	**156,930**	**100.00%**
Central Queensland	72,032	64.90%	38,959	35.10%	**110,991**	**100.00%**
Central West	2,321	40.73%	3,378	59.27%	**5,699**	**100.00%**
Darling Downs	91,505	55.88%	72,260	44.12%	**163,765**	**100.00%**
Gold Coast	189,805	49.76%	191,664	50.24%	**381,469**	**100.00%**
Mackay	64,490	65.95%	33,297	34.05%	**97,787**	**100.00%**
Metro North	299,082	51.40%	282,799	48.60%	**581,881**	**100.00%**
Metro South	315,204	51.04%	302,315	48.96%	**617,519**	**100.00%**
North West	16,468	75.59%	5,317	24.41%	**21,785**	**100.00%**
South West	6,563	53.67%	5,666	46.33%	**12,229**	**100.00%**
Sunshine Coast	149,324	55.02%	122,069	44.98%	**271,393**	**100.00%**
Torres and Cape	9,923	53.78%	8,529	46.22%	**18,452**	**100.00%**
Townsville	99,861	64.96%	53,872	35.04%	**153,733**	**100.00%**
Total	**1,599,368**	**54.87%**	**1,315,496**	**45.13%**	**2,914,864**	**100.00%**

Public Self-Sufficiency by Year per HHS of Residence



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System Planning Branch | Clinical Planning and Service Strategy | Queensland Health

Implementation Challenges

Workforce

- Change management
- Continuous learning and adaptation
- Risk-Taking and Learning from Failures
- Interdisciplinary Collaboration

Technology & Data

- Redefining Decision-Making
- Silo Data storage system
- Aggregated Data

Funding

- Lack of funding to procure software, computing power
- Lack of funding models to drive innovation for the use of AI

Thank You