

# Quantifying the impact of stroke on healthcare systems: A review of clinical variables within stroke data

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# Quantifying the impact of stroke on healthcare systems using ICD10 codes: Are we underestimating clinical workloads, infrastructure requirements & patient flow volume? A review of clinical variables within the Queensland Health stroke cohort data sets



Improvement



Transparency



Patient Safety



Clinician Leadership



Innovation

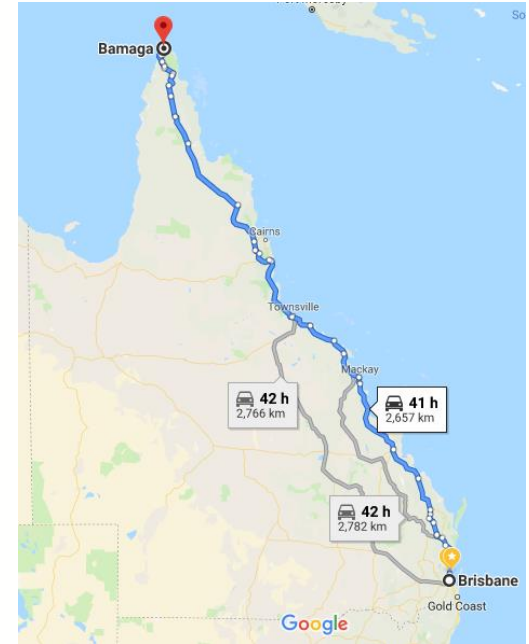
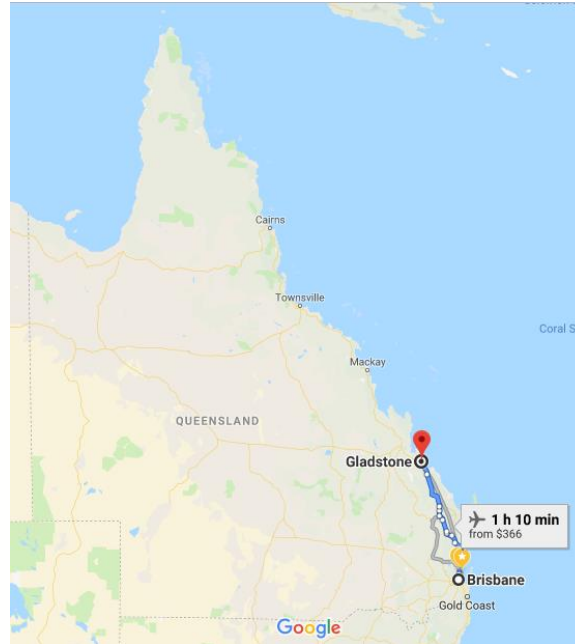
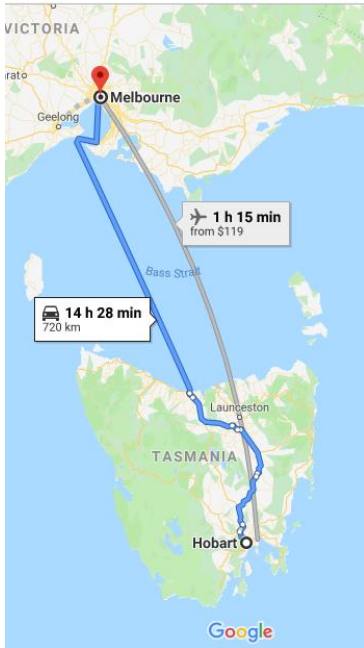
# Project background

- Resounding evidence supporting endovascular clot retrieval (ECR) in ischaemic stroke was published in late 2015.
- There has been a significant increase in Queenslanders undergoing ECR since that time.
- Queensland's population of 5.071 million is dispersed across 1,853,000km<sup>2</sup> yet the 3 ECR referral centres are concentrated in South East Queensland.

# Project background

- Approximately 4000 people per annum experience an ischaemic stroke, of whom 10-20% are likely to benefit from ECR & up to 30% are likely to benefit from intravenous thrombolysis (IV-tPA).
- My role is to assist in informing funding requirements for stroke service expansion at state government level across multiple funding, policy & planning branches.

# Project background



# The problem

- Traditionally at government level, stroke cohorts are quantified, & stroke service provision is then advised using retrospective analysis of ICD10 coded admission data.
- However, evidence supporting endovascular clot retrieval has necessitated stroke service expansion to accommodate inter hospital transfers from remote areas.
- Are these coded? Are they counted in service planning?

# The problem

- In the absence of neuroradiological diagnosis in remote areas, undiagnosed stroke & conditions with a similar clinical presentation to stroke will account for a proportion of the cohort that stroke services are now accommodating.
- ICD10 codes limited to the traditional stroke codes may underestimate the volume of presentations requiring diagnosis & or transfer.

# Aim

- This study examines expanding ICD10 code inclusions to quantify the cohort of patients potentially eligible for transfer to neuroglial interventions in the absence of neuroradiological diagnosis of stroke.
- Then quantify this variation of total compared to stroke specific ICD10 code diagnosis totals.



# Method

- Queensland Health Enterprise Reporting System (QHERS) extracted 2017/2018 financial year admission data for all facilities.
- Acute episodes with stroke specific ICD10 codes I61, I63 & I64 were expanded to include G45, G46 & I60-I66.
- Descriptive analysis was used to examine variations in individual site data in relation to these expanded diagnosis subgroups.

# Data sources

	A	B	C	D	E	F	G	H	I	J
34	December									
35	R48003-2	02 - EMERGENCY DEPARTMENT	04 - Oth Hh Care Esta	3.00	AWA	L4E	152.0			
36	November									
37	R347941-2	02 - EMERGENCY DEPARTMENT	16 - Hospital Transfer	10.00	AWA	L4E	152.0			
38	Cerebral Infarction									
39	March									
40	R011255-1	02 - EMERGENCY DEPARTMENT	16 - Hospital Transfer	2.00	AWA	L4E	153.4			
41	R022979-0	02 - EMERGENCY DEPARTMENT	06 - Episode Change	5.00	AWA	L4E	153.9			
42	R120734-20	02 - EMERGENCY DEPARTMENT	06 - Episode Change	7.00	AWA	L4E	153.9			
43	R238950-4	02 - EMERGENCY DEPARTMENT	16 - Hospital Transfer	3.00	AWA	L4E	153.9			
44	R203497-1	02 - EMERGENCY DEPARTMENT	06 - Episode Change	3.00	AWA	L4E	153.9			
45	R319717-7	02 - EMERGENCY DEPARTMENT	06 - Episode Change	4.00	AWA	L4E	153.9			
46	R364003-3	02 - EMERGENCY DEPARTMENT	16 - Hospital Transfer	7.00	AWA	L4E	153.9			
47	February									
48	R220395-4	02 - EMERGENCY DEPARTMENT	06 - Episode Change	3.00	AWA	L4E	153.9			
49	R348495-2	02 - EMERGENCY DEPARTMENT	06 - Episode Change	2.00	AWA	L6W	153.9			
50	R348495-3	06 - Episode Change	05 - Died in Hospital	2.00	PCU	PCU	153.9			
51	R474425-4	02 - EMERGENCY DEPARTMENT	05 - Died in Hospital	2.00	AWA	ICU	153.9			
52	January									
53	R03254-8	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	5.00	AWA	L5E	153.9			
54	R099774-9	06 - Episode Change	05 - Died in Hospital	2.00	L4E	L4E	153.9			
55	R135979-3	02 - EMERGENCY DEPARTMENT	06 - Episode Change	4.00	AWA	L4E	153.4			
56	December									
57	R030508-2	02 - EMERGENCY DEPARTMENT	06 - Episode Change	2.00	AWA	L4E	153.9			
58	R101102-2	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	4.00	AWA	L4E	153.9			
59	R215610-3	02 - EMERGENCY DEPARTMENT	06 - Episode Change	5.00	AWA	AWA	153.9	incorrect, DIC ward was 0		
60	R299463-6	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	4.00	AWA	L4E	153.5			
61	R499422-1	02 - EMERGENCY DEPARTMENT	16 - Hospital Transfer	12.00	AWA	REHAB	153.9	not acute		
62	R499573-1	02 - EMERGENCY DEPARTMENT	06 - Episode Change	7.00	AWA	L4E	153.9			
63	R499725-1	02 - EMERGENCY DEPARTMENT	06 - Episode Change	5.00	ED	L4E	153.9			
64	November									
65	R029396-1	02 - EMERGENCY DEPARTMENT	06 - Episode Change	8.00	AWA	L4E	153.4			
66	R156992-11	02 - EMERGENCY DEPARTMENT	05 - Died in Hospital	2.00	AWA	L4E	153.9			
67	R299324-4	02 - EMERGENCY DEPARTMENT	06 - Episode Change	7.00	ED	L4E	153.9			
68	R500082-3	06 - Episode Change	06 - Episode Change	5.00	L6E	L5W	153.2	vasc surgery post rehab		
69	October									
70	R0742174-5	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	L4E	153.9			
71	R083110-2	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	3.00	AWA	L4E	153.9			
72	R216337-4	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	7.00	AWA	L4E	153.5			
73	R469509-6	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	4.00	AWA	L4E	153.5			
74	R469546-1	02 - EMERGENCY DEPARTMENT	06 - Episode Change	5.00	AWA	L4E	153.9			
75	September									
76	R240946-7	02 - EMERGENCY DEPARTMENT	06 - Episode Change	14.00	AWA	L4E	153.9			

	A	B	C	D	E	F	G	H	I
1	Metro North H	Redcliffe Hospital	Stroke/TIA Admissions & Disol	Summary:T	Selection	Criteria2	Source: Transition	IIC:Yea	
2	Admit Source	Discharge Disposition and Desc	Length of Stay	Admit Ward	Discharge	ICD_PRINCIPAL_DIAG_CODE			
3	Transient Cerebral Ischaemic attacks								
4	March								
5	R055015-2	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	L4E	G45.9		
6	R229470-3	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	L4E	G45.9		
7	February								
8	R000301-1	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	3.00	AWA	MAU	G45.9		
9	R374273-5	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	4.00	AWA	L4E	G45.9		
10	December								
11	R025800-14	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	MAU	G45.9		
12	R164641-3	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	3.00	AWA	L4E	G45.9		
13	R375611-6	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	3.00	AWA	L4E	G45.9		
14	R426601-1	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	L5E	G45.9		
15	R493082-2	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	3.00	AWA	L5E	G45.9		
16	R497127-2	02 - EMERGENCY DEPARTMENT	06 - Episode Change	5.00	AWA	L4E	G45.9		
17	R499795-1	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	L4E	G45.9		
18	November								
19	R205954-1	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	L4E	G45.9		
20	October								
21	R210138-0	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	L4E	G45.9		
22	R392303-5	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	3.00	AWA	L4E	G45.9		
23	September								
24	R493481-1	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	2.00	AWA	MAU	G45.9		
25	Intracerebral Haemorrhage								
26	January								
27	R351130-2	02 - EMERGENCY DEPARTMENT	01 - Home/Usual Reside	7.00	AWA	L4E	151.1		
28	R416355-3	02 - EMERGENCY DEPARTMENT	06 - Episode Change	13.00	AWA	L6W	151.1		
29	December								
30	R329570-10	24 - Admit Transf'd Other Hosp	06 - Died in Hospital	11.00	PCU	PCU	151.0		
31	September								
32	R029393-6	02 - EMERGENCY DEPARTMENT	05 - Died in Hospital	7.00	PCU	PCU	151.9		
33	Other Non-Traumatic Intracranial Haemorrhage								
34	December								
35	R48003-2	02 - EMERGENCY DEPARTMENT	04 - Oth Hh Care Esta	3.00	AWA	L4E	152.0		
36	November								
37	R347941-2	02 - EMERGENCY DEPARTMENT	16 - Hospital Transfer	10.00	AWA	L4E	152.0		
38	Cerebral Infarction								
39	March								
40	R011255-1	02 - EMERGENCY DEPARTMENT	16 - Hospital Transfer	2.00	AWA	L4E	153.4		
41	R022979-0	02 - EMERGENCY DEPARTMENT	06 - Episode Change	5.00	AWA	L4E	153.9		
42	R120734-20	02 - EMERGENCY DEPARTMENT	06 - Episode Change	7.00	AWA	L4E	153.9		
43	R238950-4	02 - EMERGENCY DEPARTMENT	16 - Hospital Transfer	3.00	AWA	L4E	153.9		

# Data sources

Hospital	Site	Anglo/Int CT	Intstar	CT	Annual Strokes
1 Birnieys QLD 4875, Australia	Sunshine Coast Uni		2	Yes	CT
2 Southport QLD 4215, Australia	Sold Coast Uni	2	5	Yes	CT
3 Nambour QLD 4568, Australia	Nambour	2	2	proposed	CT
4 Herston QLD 4029, Australia	RWH	2	3	Yes	CT
6 Woolongabba QLD 4102, Australia	Brisbane Alexandra	3	4	Yes	CT
7 Cairns QLD, Australia	Cairns	2	2	Yes	CT
8 Townsville City QLD 4810, Australia	Townsville	1	2	Yes	CT
9 Toowoomba QLD, Australia	Toowoomba	1	1	Yes	CT
10 Logan, QLD, Australia	Logan		2	Yes	CT
11 Hervey Bay QLD 4655, Australia	Hervey Bay		1	Yes	CT
12 Caboolture QLD 4510, Australia	Caboolture		2	Yes	CT
13 Rockhampton City QLD 4700, Australia	Rockhampton		1	Yes	CT
14 Coopers Plains QLD 4108, Australia	Queen Elizabeth II		1	No	CT
15 Ipswich, QLD, Australia	Ipswich		2	Yes	CT
16 Chermiside West QLD 4032, Australia	The Prince Charles	1	3	Yes	CT
17 Redcliffe QLD 4026, Australia	Redcliffe	1	1	Yes	CT
18 Mackay QLD 4740, Australia	Mackay		1	Yes	CT
19 Bundaberg Central QLD 4670, Australia	Bundaberg		1	Yes	CT
20 Redlands, Australia	Redland		1	No	CT
21 Caloundra QLD 4551, Australia	Caloundra		1	No	CT
22 Mount Isa City QLD 4825, Australia	Mount Isa		1	Proposed	CT
23 Gladstone Central QLD 4610, Australia	Gladstone		1	proposed	CT
24 Warwick QLD 4370, Australia	Warwick		1	proposed	CT
25 Innisfail QLD 4868, Australia	Innisfail		1	proposed	CT
26 Proserpine QLD 4880, Australia	Proserpine		1	proposed	CT
27 Atherton QLD 4863, Australia	Atherton		1	No	CT
28 Heppenheim QLD 4703, Australia	Capricorn Coast		1	No	CT
29 Roma QLD 4485, Australia	Roma		1	No	CT
30 Emerald QLD 4720, Australia	Emerald		1	No	CT
31 Goondiwindi QLD 4390, Australia	Goondiwindi		1	No	CT
32 Longreach QLD 4790, Australia	Longreach		1	No	CT
33 South Brisbane QLD 4101, Australia	Lady Chierlo Childrn	1	2	Abx	CT
34 South Brisbane QLD 4101, Australia	Mater Brisbane Pub	1	1	proposed	CT
35 Robina QLD 4226, Australia	Robina			No	CT
36 Gympie QLD 4570, Australia	Gympie			No	CT
37 Kingoonya QLD 4610, Australia	Kingoonya			No	CT
38 Ingham QLD 4850, Australia	Ingham			No	CT
39 Mareeba QLD 4680, Australia	Mareeba			No	CT
40 Ayr QLD 4807, Australia	Ayr			No	CT

# Data analysis

The screenshot displays an Excel spreadsheet with the following structure:

Patient ID	Patient Name	Age	Gender	Admission Date	Discharge Date	ICU Stay	Mortality	Cost
1001	John Doe	65	M	2024-01-15	2024-02-10	25	0	\$15,000
1002	Jane Smith	52	F	2024-01-20	2024-02-05	15	0	\$8,000
1003	Michael Brown	78	M	2024-02-01	2024-02-20	30	1	\$22,000
1004	Emily White	45	F	2024-02-10	2024-02-15	5	0	\$3,000
1005	David Green	60	M	2024-02-15	2024-03-01	15	0	\$9,000

# Results presentation

- Data results used in internal department of health documents aim to clearly yet simply describe service volumes & gaps to a broad audience of varied professional backgrounds, not necessarily inclusive of clinicians with academic backgrounds.
- Results are often summarised within 2 page briefs & need to summarise much information with maximum impact.

# Results

- A total of 5316 'stroke' episodes were identified: ischemic(n=3954), haemorrhagic(n=868) & unknown type(n=494) stroke & an additional 3330 neurological episodes with comparable presenting symptoms.
- These comprised of TIAs & related cerebrovascular syndromes(n=2782), subarachnoid haemorrhages(n=232), subdural haematomas(n=167), occlusion & stenosis of cerebral arteries(n=149).

# Results

- These additional diagnoses indicate a 62.6411% increase in base cohort numbers being used to estimate the impact of 'stroke' on presentations requiring diagnosis & or transfer. Simply, an additional 2/3 of patients.

# Limitations

- Need for ambulance data & flight retrieval data to correlate cases better
- Non admitted patient data sets to correlate presentation cases better
- Coding errors and/or poor diagnosis documentation
- Case studies of more value for patient flow barrier identification



# Conclusion

- ICD10 codes acquired from accurate stroke diagnosis methods are inaccurate & inadequate in quantifying service expansion requirements in sites lacking neuroradiological imaging capabilities.
- Estimations must include similar presentations to stroke that would require similar pre hospital, emergency department & transfer considerations.