

An Audit of Time to CT Imaging

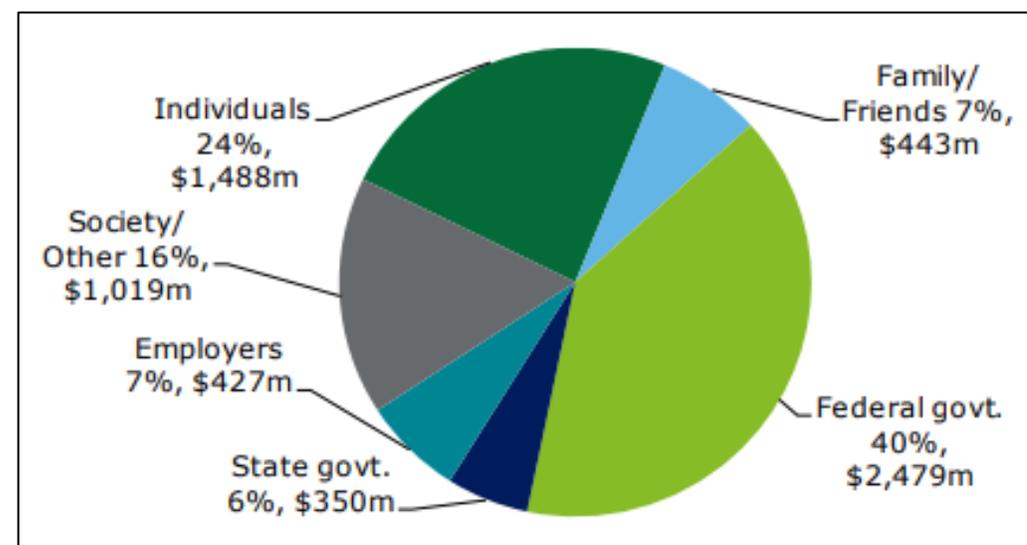
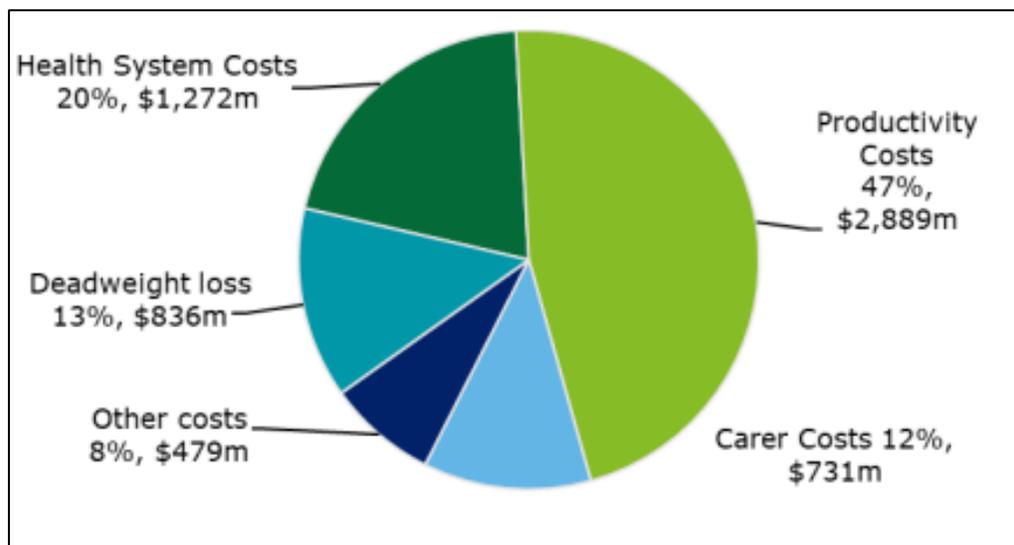
FOR ACUTE STROKE PRESENTATIONS TO EMERGENCY DEPARTMENTS
IN THE DARLING DOWNS HOSPITAL AND HEALTH SERVICE
(STANTHORPE, DALBY, KINGAROY AND WARWICK)

Research Team

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Background

- Ischaemic stroke is the occlusion of arterial blood supply to brain tissue, resulting in persisting neurological deficits such as muscle weakness and motor and speech impairment. [1]
- The estimated economic cost of stroke in 2020 was **\$6.2 billion**: [2]





Background

- **Early diagnosis and intervention** of stroke improves short- and long-term outcomes: [1]
 - Australians living in regional areas have poorer access to diagnostic and treatment options [2]
- Reperfusion treatments must be initiated within a narrow timeframe: [3,4]
 - Thrombolysis within **4.5 hours** of symptom onset
- Non-contrast CT imaging is required to exclude haemorrhagic stroke:
 - The Stroke Foundation recommends this to be completed **within 60 minutes of presentation** [3]



Purpose

- Compare time from ED presentation to CT imaging for patients with acute stroke in hospitals with CT on-site (Kingaroy and Warwick) and those with no CT on-site (Dalby and Stanthorpe)
 - Investigate the impact of time of presentation (i.e., business hours or after hours) on time to CT imaging and treatment offered
 - Identify missed opportunities for thrombolysis



Methods

- A search of Emergency Department Information System (EDIS) presentations for primary diagnoses of 'Cerebral Infarct' and 'Transient Ischaemic Attack' between **01/07/2021** and **30/06/2022** was conducted
- **30 patients** from each site were randomly selected
- Clinical notes and CT images were accessed through The Viewer and Queensland Health Picture Archiving and Communications System (PACS)

Patient Demographics

	Number of patients	Age	Sex	
			F	M
Stanthorpe	30	72.1	13	17
Dalby	30	65.6	14	16
Kingaroy	30	66.5	11	19
Warwick	30	69.9	13	17
	120 (total)	68.5 (average)	51 (total)	69 (total)

CT Imaging Performed

	Non-contrast CT only	Non-contrast + CT angiography	Non-contrast + CT angiography + CT perfusion
Stanthorpe (No CT)	18	9	0
Dalby (No CT)	19	8	2
Kingaroy (CT)	9	15	6
Warwick (CT)	0	30	0



Fisher Exact Test: Adherence to Guidelines

All hours: **P < 0.05**

Business hours: **P < 0.05**

After hours: **P < 0.05**

- At hospitals with **no CT**:
 - **0%** of patients received CT imaging within one hour (after hours)
 - **13%** of patients received CT imaging within one hour (business hours)
- At hospitals with **CT**:
 - **58%** of patients received CT imaging within one hour (after hours)
 - **67%** of patients received CT imaging within one hour (business hours)

Primary Outcome: Time to CT (All Hours)

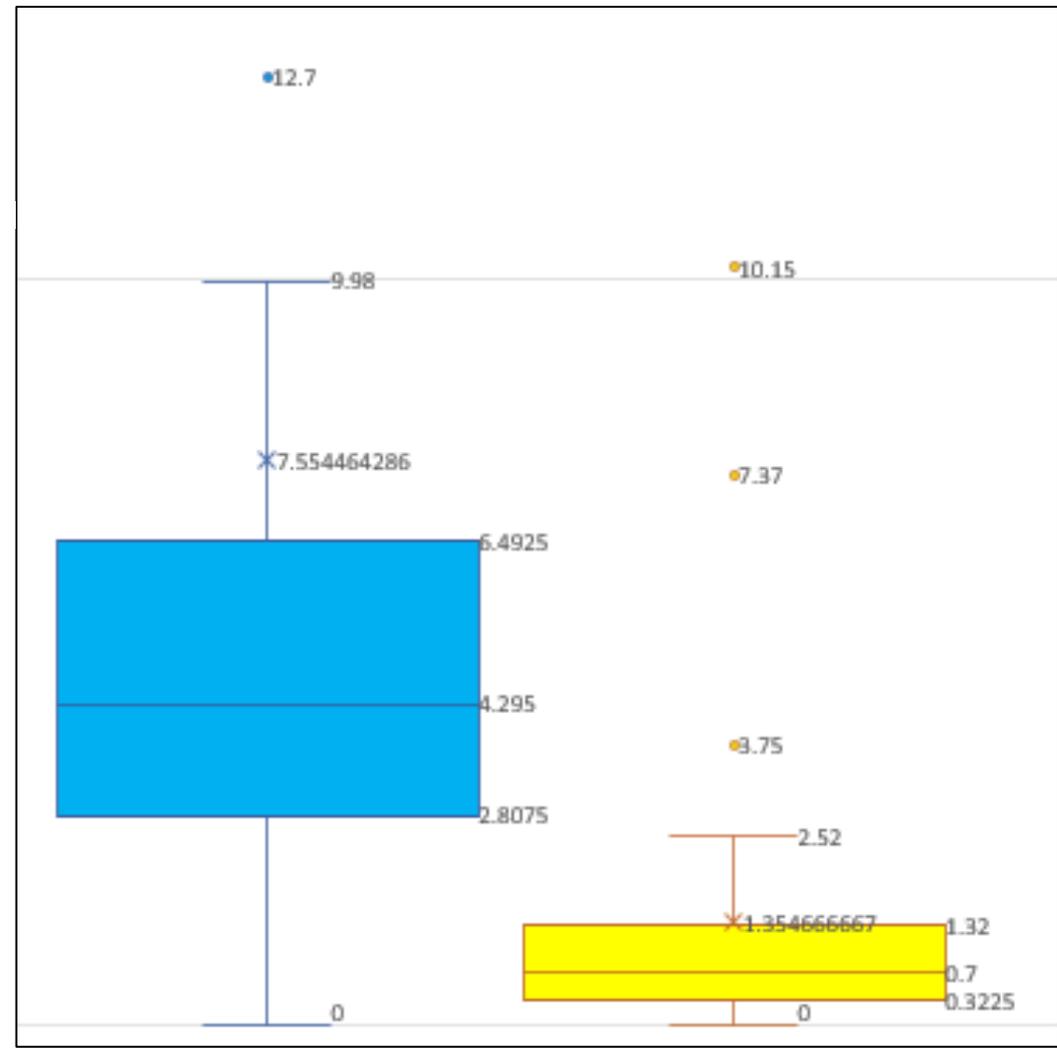
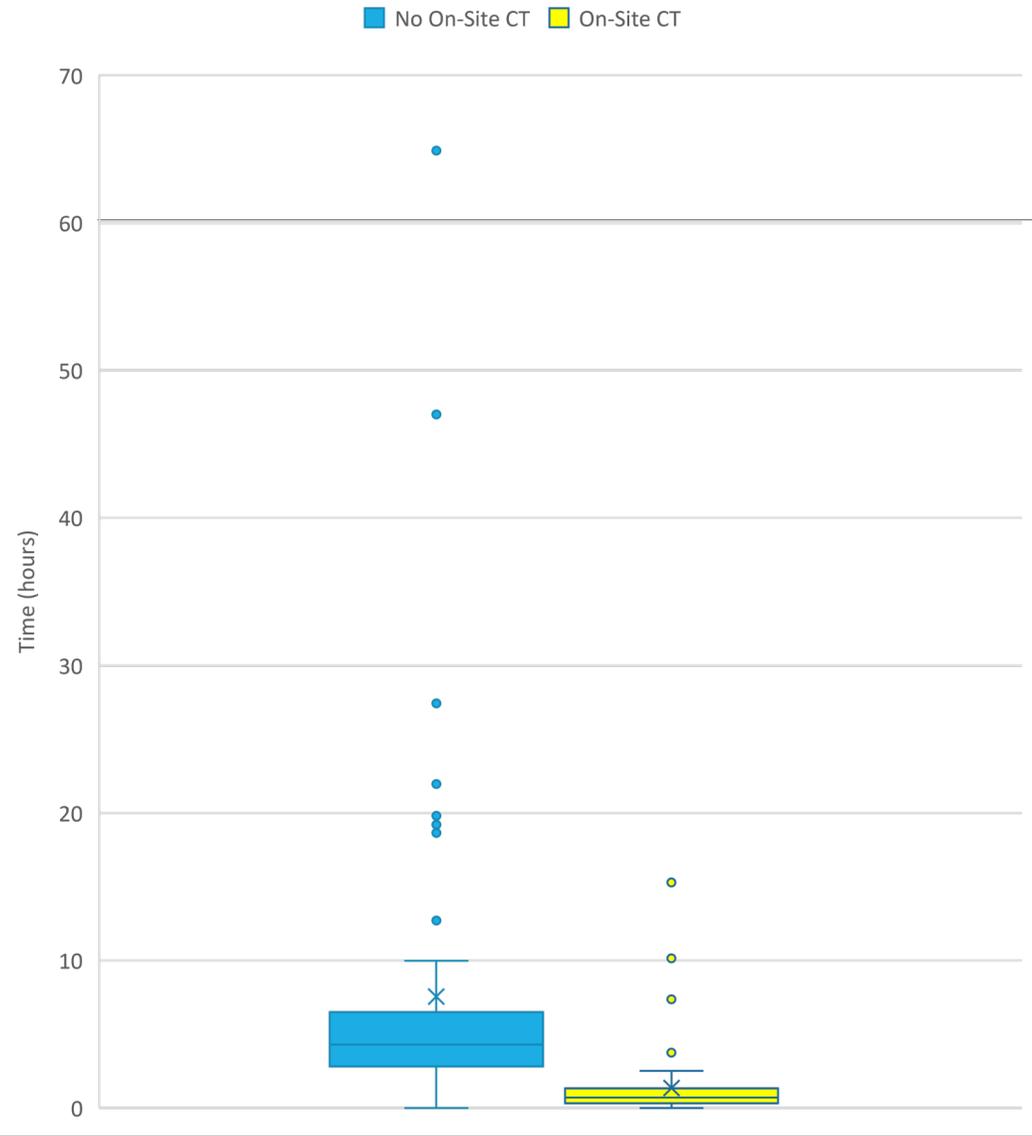
	Median (hours)	Q1, Q3 (hours)	Mean (hours)	Standard deviation
No CT	4.30	2.82, 6.42	7.55	11.05
CT	0.70	0.33, 1.32	1.35	2.45

P-value < 0.05

Cohen's D = 0.77



Time from Presentation to CT (All Hours)





Primary Outcome: Time to CT (Business Hours vs After Hours)

		Median (hours)	Q1, Q3 (hours)
Business Hours	No CT	3.10	(2.20, 5.33)
	CT	0.68	(0.23, 1.10)
After Hours	No	5.20	(4.27, 6.53)
	CT	0.81	(0.51, 1.69)

- **Business Hours: (No CT) / (CT) = 4.55**
- **After Hours: (No CT) / (CT) = 6.42**

Secondary Outcome: Treatment Received

	Thrombolysis and/or thrombectomy	Contra-indications	Outside thrombolysis window at presentation	Anti-coagulation	Haemorrhagic stroke	Resolving symptoms	Other
Stanthorpe (No CT)	1	16	8	4	1	2	1
Dalby (No CT)	0	14	4	5	2	0	3
Kingaroy (CT)	1	18	9	4	2	0	3
Warwick (CT)	2	18	11	4	1	1	1



Secondary Outcome: Missed Opportunity for Thrombolysis

- 79-year-old female, with no significant medical history, presented to a hospital with **no CT** with acute stroke symptoms at **8:25am** on a **Wednesday morning**:
 - Presented < 3 hours after symptom onset (**within thrombolysis window**)
 - Non-contrast CT and angiography performed at private radiology clinic **2.5 hours after presentation (outside thrombolysis window)**
 - Acute stroke revealed on imaging
 - CT perfusion was not performed
 - Transferred to Toowoomba Hospital and then Princess Alexandra Hospital
 - Progression of acute stroke, with no treatment being offered



Secondary Outcome: Missed Opportunity for Thrombolysis

- 69-year-old male presented to a hospital with **CT** with acute stroke symptoms at **3:56pm** on a **Monday afternoon**:
 - Presented < 2 hours after symptom onset (**within thrombolysis window**)
 - Non-contrast CT and angiography performed **18 minutes after presentation (within thrombolysis window)**
 - Acute stroke revealed on imaging
 - Urgently transferred by air to Princess Alexandra Hospital for thrombectomy



Secondary Outcome: Potential Missed Opportunity for Thrombolysis

- Patients who had persisting symptoms but did not receive CT angiography and/or CT perfusion
- Patients who declined interhospital transfer for CT imaging after hours
- Patients suffering complications or adverse events when being transferred for CT imaging

	Number of patients (out of 60)
No CT	15
CT	6



Discussion

- **Time to CT >> with no CT on-site, no on-call service**
- Implications:
 - Missed opportunities for thrombolysis
 - Potential for clinical deterioration whilst waiting for interhospital transfer for CT imaging
 - Less CT angiography and CT perfusion imaging ordered
 - Patients declining interhospital transfer for CT imaging
- **Further cost-benefit analysis is required:**
 - Utility of CT imaging for other clinical presentations
 - Cost of interhospital transfers
 - Impact of wait times for patients requiring CT imaging



Limitations

- **Nature of transient ischaemic attack:**
 - Some patient symptoms resolve soon after presentation to hospital or before CT imaging can be organised

- **Low power:**
 - Why / why not thrombolysis not well-explained in a small cohort

- **No consideration of transfer for mechanical thrombectomy:**
 - There were no clinical notes to suggest why patients were or were not considered for mechanical thrombectomy



Future Suggestions

- **On-call service for private CT imaging in towns with no hospital CT imaging:**
 - Time to CT imaging is exacerbated after hours due to the requirement of transfer to a larger hospital
 - Patients often decline transfer to a larger hospital for many different reasons
- **Ordering of CT imaging:**
 - Hospitals with no on-site CT were less likely to order CT angiography and/or CT perfusion
 - “CT angiography increases diagnostic certainty and likelihood of treatment with thrombolysis in patients with acute stroke” [5]
 - A review of CT imaging ordering protocols may be beneficial

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References

- [1] Hurford R, Sekhar A, Hughes TAT, Muir KW. (2020). Diagnosis and management of acute ischaemic stroke. *Practical Neurology*. 20(4), 304.
- [2] Stroke Foundation. (2020). *The economic impact of stroke in Australia 2020*. Deloitte Access Economics. <https://strokefoundation.org.au/media/nydptqxi/economic-impact-of-stroke-report-30-october-final-report.pdf>
- [3] Stroke Foundation. (2022). *Australian and New Zealand clinical guidelines for stroke management*. <https://informme.org.au/Guidelines/Clinical-Guidelines-for-Stroke-Management>
- [4] Nogueira RG, Jadhav AP, Haussen DC, Bonafe A, Budzik RF, Bhuva P, et al. (2017) Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct. *New England Journal of Medicine*. 378(1), 11-21.
- [5] Douglas V, Shamy M, Battacharya P. (2015) Should CT angiography be a routine component of acute stroke imaging? *Neurohospitalist*. 5(3), 97-98.