CANCER RESEARCH UK

Imperial College Healthcare NHS Trust

30 day mortality after surgical resection of a brain tumour

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On behalf of the NCIN Brain & CNS SSCRG

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BTRC

Background

- Evidence of a “volume effect” in some surgery
  - Oesophagus, colorectal, cardiac
- Range of conditions
  - Cancer and non-cancer
- Range of outcomes
  - 30 day mortality, 5 year survival, delayed discharge, etc.

- Surgery is a key modality in the treatment of brain tumours
  - Curative (e.g. meningioma)
  - Prognostic benefit (e.g. GBM)

Brain Tumour Background

- Data in brain tumours all comes from the USA
- Shows that busier surgeons and centres both have better outcomes
- Difference in outcome by tumour types

- Nothing in Europe/ UK
- HC systems aren’t the same in the USA and the UK

- Ideally everyone is operated on by a specialist
  - But some patients have to be operated on as an emergency
  - NICE guidance is to have ‘specialised’ surgeons >50% of their time

Methods

- All English patients with
  - An intracranial neoplasm (primary, met and pituitary)
  - Who had a craniotomy (or similar)
  - 2008 – 2010 (3 years)

  - Excluded Biopsy-only, spinal surgery
  - Only looked at most recent operation

  - Excluded surgeons <=6 operations, and not done one in the first and last 6 months of the period

  - Data from NCRS
  - Linked registry and HES data and vital status from PDS

Results

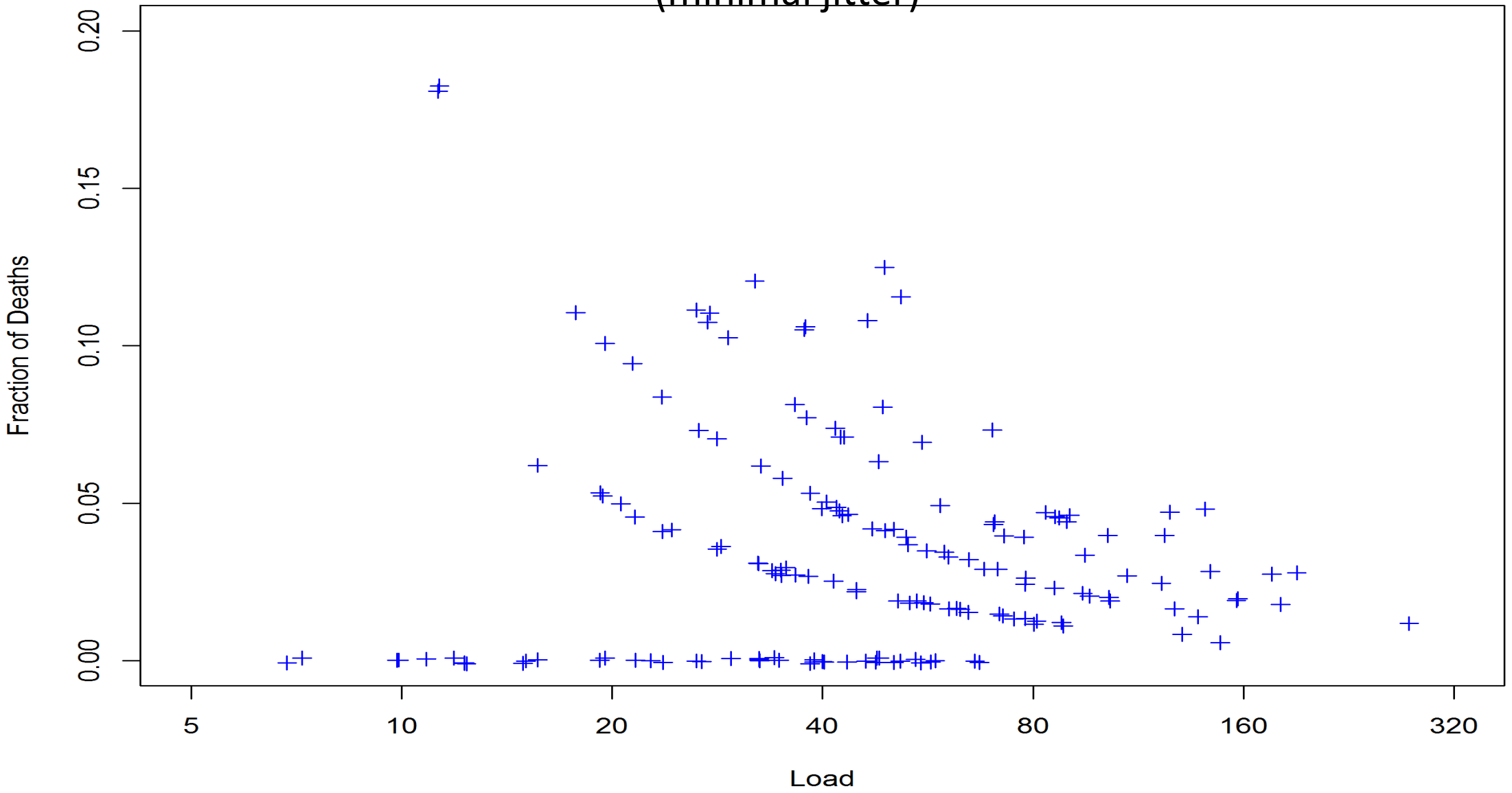
- 10888 patients in all
- 9194 (84%) patients and 163 surgeons (36%) in 30 trusts
- Predominantly brain & meninges
  - Other rare

- 30 day mortality was 3%

- Lowest surgical activity = 7 (2.3) (3yr/ annualised)
- Median number = 46 (15)
- Quartiles:
  - 7 – 29 (2.3 – 10)
  - 29 – 46 (10 – 15)
  - 46 – 70 (15 – 23)
  - 70 – 272 (23 – 91)

  - US: Busiest 10%: 11 – 29/ year

Enriched dataset, rescaled (minimal jitter)



Results

- Age, deprivation and individual surgeon volume correlated with 30 day mortality
  - Patient sex & trust volume were not
- Same factors preserved on multivariate, on both step-forward and step-backwards analysis of factors
- RR for surgeon volume is 0.8, p = 0.0003
  - 20% relative risk reduction in 30 day death for doubling a surgeon's workload

Results

- Significant variation between trusts for 30 day mortality
  - But not volume related: 80% of trusts >100 cases
  - 0.95% - 8.62% 30DM

- Predicted mortality (age, tumour type, surgery location & deprivation) is higher in busier surgeons

Discussion

- Little previous work on neurosurgical volumes and outcomes
  - Evidence for volume effect in SAH, aneurysm, trauma and MVD
  - Patient volumes may not be key:
    - Proxy for other services, sub-specialisation, staffing levels, etc.
- Limits to the data – tumour location & co-morbidities
- There is a surgical volume effect
- There is probably not a centre volume effect

Study	Patient Group	Data source	Country	N	Annual Surgeon volume: Median (Upper quartile)	Annual Centre volume: Median (Upper quartile)	Surgeon effect	Centre Effect
Trinh, 2015	Supratentorial brain tumour (Biopsy and surgery)	NIS	USA	62 514	2·5 (6 – 29)	9·5 (20 – 142)	Y	Y
Barker, 2003	Acoustic Neuroma	NIS	USA	2643	5 (34)	19 (37 – 229)	Y	Y
Barker, 2003	Pituitary tumour (trans-sphenoidal)	NIS	USA	5497	3 (7 – 33)	10 (25 - 126)	Y	Y
Curry, 2005	Meningioma (craniotomy)	NIS	USA	15208	3 (6 – 39)	9 (18-82)	Y	Y
Barker, 2005	Supratentorial brain tumours (biopsy & resection)	NIS	USA	38028	NA	22 (45 – 264)	Y	Y
This study	**Supratentorial tumours (resection only)**	**NCRS**	**England**	**9194**	**15 (23 – 91)**	**91 (152 - 222)**	**Y**	**N**

Table 4: Previous Studies

Discussion

- Our findings are different to the US

- UK Centres and surgeons are busier
  - Probably appropriately centralised at a centre level
  - Probably not yet centralised enough at surgeon level
  - ~700 pts had surgery with a LVS over 3 years
  - Prevent ~25 deaths @ 30 days if we moved from LVS to '>= 1/week surgeons'
  - BUT: Most of the risk is from the diagnosis, not the surgery

Conclusions

- Centralisation is a thorny issue
- These data suggest some simple changes
- NICE guidance was published in 2006
- How do we implement it
  - Not trivial to do so
  - Have to avoid harms from delays

Thanks

- Peter Treasure & David Greenberg
- NCIN CNS SSCRG

	Total	Primary Brain	Meninges	Pituitary	Other CNS Primary	Secondary
Age						
0 - 9	390	364	6	5	7	8
10 – 19	387	342	14	11	6	14
20 – 29	553	458	64	7	13	11
30 – 39	875	631	204	8	9	23
40 – 49	1497	944	499	5	10	39
50 - 59	1878	1155	635	14	17	57
60 – 69	2247	1397	749	8	7	86
70 - 79	1212	703	452	5	1	51
80 +	155	40	98	0	2	15

Table 1: Patient and Tumour Characteristics by age

		Number of operations: Median (IQR)
Surgeon	Total	46 (29 – 70)
	Brain	28 (16 – 47)
	Meninges	13 (6 – 23)
	Pituitary	0 (0 – 0)
	Other CNS Primary	0 (0 – 1)
	Secondary Tumour	1 (0 – 3)
Centre	Total	272·5 (171-463)
	Brain	169 (106-327)
	Meninges	83·5 (22 - 154)
	Pituitary	2 (1 – 3)
	Other CNS Primary	1·5 (0 – 3)
	Secondary Tumour	8 (3 – 13)

Table 2: Surgeon and Centre Characteristics

Factor		Univariate Analysis	N	Absolute Risk	Multivariate Analysis	
		P value			Relative risk	P value
Patient Age	< 30 yr	<0·0001	1330	1.35%	1	<0·0001
	30 – <60		4250	2.33%	2·15	
	60-<70		2247	3.60%	3·45	
	70+		1367	5.85%	5·83	
Patient Deprivation (IMD 2010 category)	1	0·0383	2012	2.34%	1	0·0116
	2,3,4		5816	3.03%	1·30	
	5		1366	4.03%	1·85	
Site of operation	Brain	0·0344	6574	3.29%	1	0·0004
	Meninges		2620	2.37%	0·59	
Patient sex	Male	0·2673	4700	3.21%	1	0·6720
	Female		4494	2.83%	0·95	
Surgeon Volume	Doubling in load	0·0137	Q1: 739	4.6%	0·80	0·0025
			Q2: 1531	3.85%		
			Q3: 2278	3.07%		
			Q4: 4646	2.48%		

Table 3: Univariate and Multivariate analyses

APPENDIX TABLE 1. Annual volume of primary brain tumor resections for hospitals and surgeons

	Hospital Level		Surgeon Level*	
Volume Group (percentile)	Annual Caseload Category	No. of Patients	Annual Caseload Category	No. of Patients
Total no.		62,514		36,125
Quartile 1 (0–25th)	1–4	16,941	1	14,765
Quartile 2 (26th–50th)	5–9	16,462	2	5195
Quartile 3 (51st–75th)	10–19	14,131	3–5	8116
Quartile 4 (76th–100th)	20–142	14,980	6–29	8048
Top decile (90th–100th)	34–142	5109	11–29	3113

* Incomplete reporting in the data set.