

International Comparison of Ischemic Stroke Outcomes 7-Day Mortality

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Dr. Foster Collaborative Stroke Group

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- **GB:** Marc Randall, Michael Pelly, Caroline Fenwick, Louise Shaw, Emma Vaux
- **NL:** Gabriel Rinkel
- **BL:** Vincent Thijs
- **AU:** Helen Dewey, Ben Clissold
- **Dr. Foster:** Rachel Alsop, Steve Middleton, Alex Bottle, Nina Janda
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Dr. Foster Intelligence

- Provider of Healthcare information and benchmarking in England
 - similar to UHC in the US
 - Have access to administrative data for all hospitals in Great Britain
- Initiated an international collaborative group to benchmark healthcare internationally
 - Global Comparators
 - Great Britain, US, Netherlands, Italy, Belgium, Australia, Norway, Finland
 - Primarily large-volume academic medical centers
 - 5 disease categories: STEMI, CHF, GI surgery, orthopedic surgery, Stroke

Comparison of Ischemic Stroke Outcomes (7-day mortality)

- Inclusion Criteria
 - Discharge diagnosis: Ischemic Stroke
 - LOS > 1 day
 - Admission between 2005-2012
 - Four Countries
 - Australia (AU), Great Britain (GB), Netherlands (NL), United States (US)
 - 36 Hospitals
 - Primarily large academic medical centers
- Data:
 - Demographic data, mortality, LOS, cost
 - In-hospital data
 - US: ICD-9 codes (UHC data feeds)
 - Europe & Australia: ICD-10 codes

Participant Medical Centers

Great Britain

- Cambridge Univ
- Chelsea & Westminster
- Coventry & Warwickshire
- Heart of England
- Imperial College
- Royal Berkshire
- Sheffield
- Univ Leicester
- University College London

Netherlands

- AMC Amsterdam
- AZ Groningen
- AZ Maastricht
- Erasmus MC
- Leiden UMC
- UMC St Radboud
- UMC Utrecht
- VUMC Amsterdam

United States

- Barnes-Jewish
- Beth Israel Deaconess
- Brigham and Women's
- Huntsville
- Massachusetts General
- UC San Diego
- UC San Francisco
- UMass. Memorial
- Upenn
- USC Keck
- UT Southwestern
- Yale-New Haven

Australia

- ALF
- AUS
- BRI
- MEL
- MON
- NSH
- STG

Medical Centers by Country

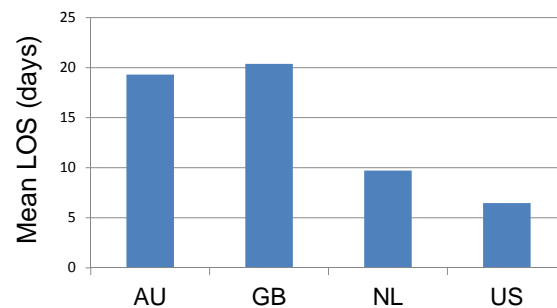
n = 92,426 patients

Country	Institution Study Code	Ischemic Stroke	Average / Year
Australia	101	1420	284
	102	1951	390
	103	1535	307
	104	2083	417
	105	3150	630
	106	1334	267
	107	2218	444
	Total	13691	
United States	201	2316	290
	202	3120	390
	203	4160	693
	204	2964	371
	205	4176	522
	206	1276	160
	207	1210	202
	208	4388	549
	209	2632	329
	210	1424	178
	211	2470	309
Total	30136		
Netherlands	301	1597	200
	302	1392	174
	303	943	135
	304	1373	172
	305	1362	17
	306	830	104
	307	918	115
	308	452	113
	Total	8867	
	Great Britain	401	4158
402		3342	418
403		5722	715
404		3690	461
405		3611	451
406		669	84
407		6293	787
408		2992	374
409		5530	691
410		4254	532
Total	40261		

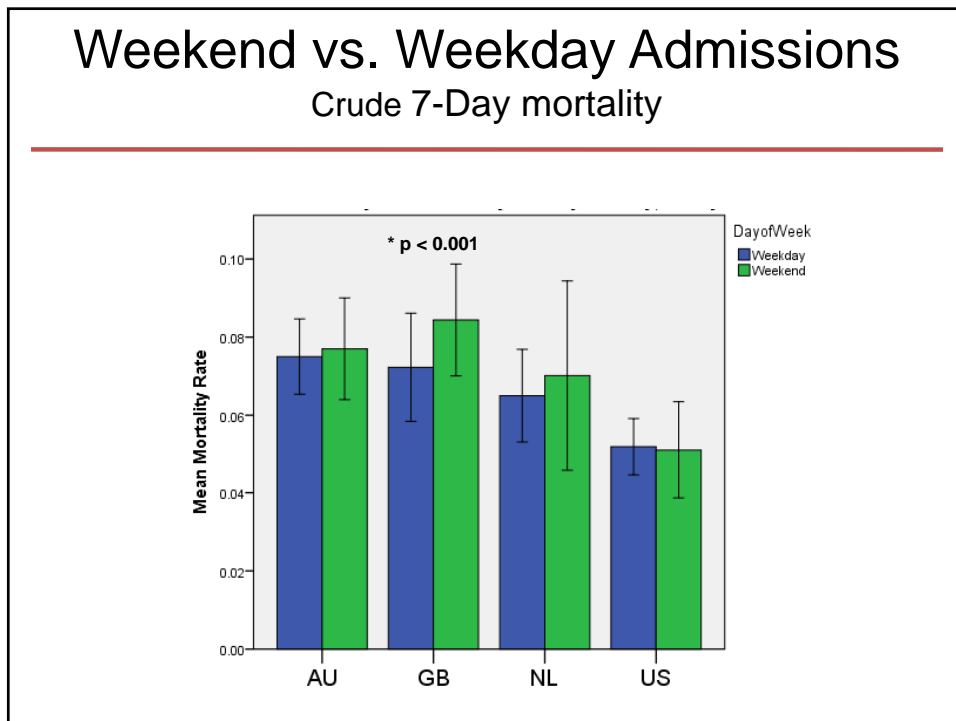
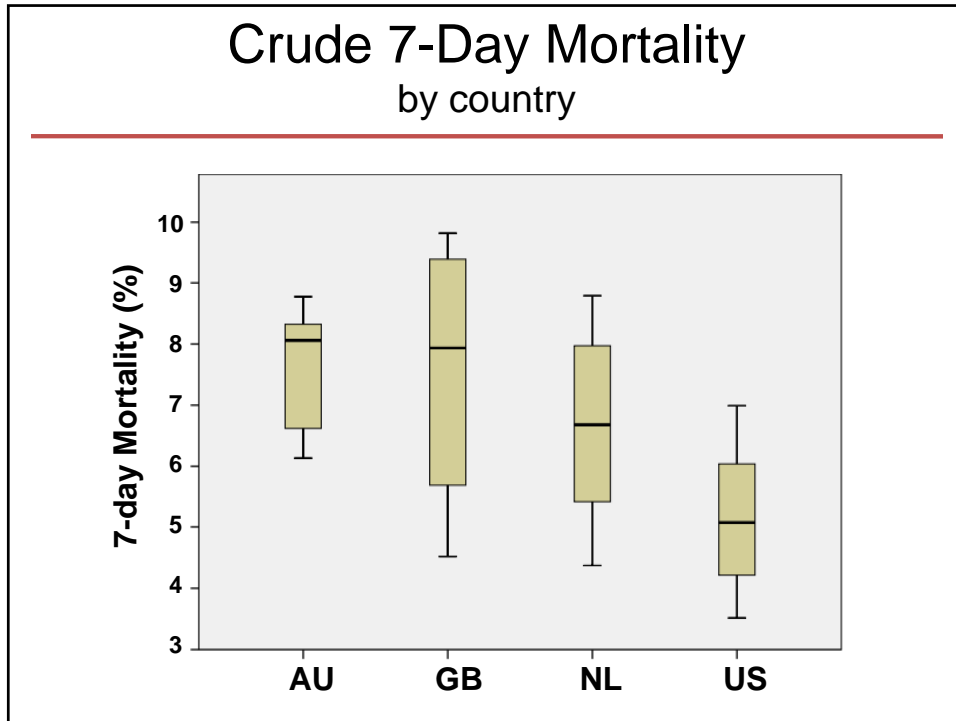
Patient data

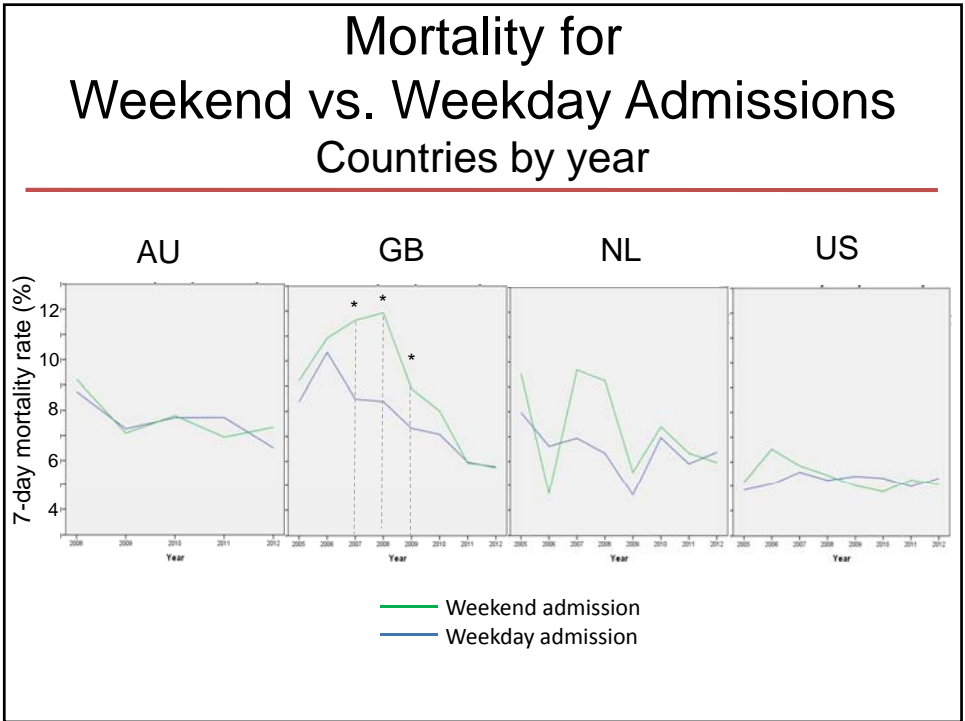
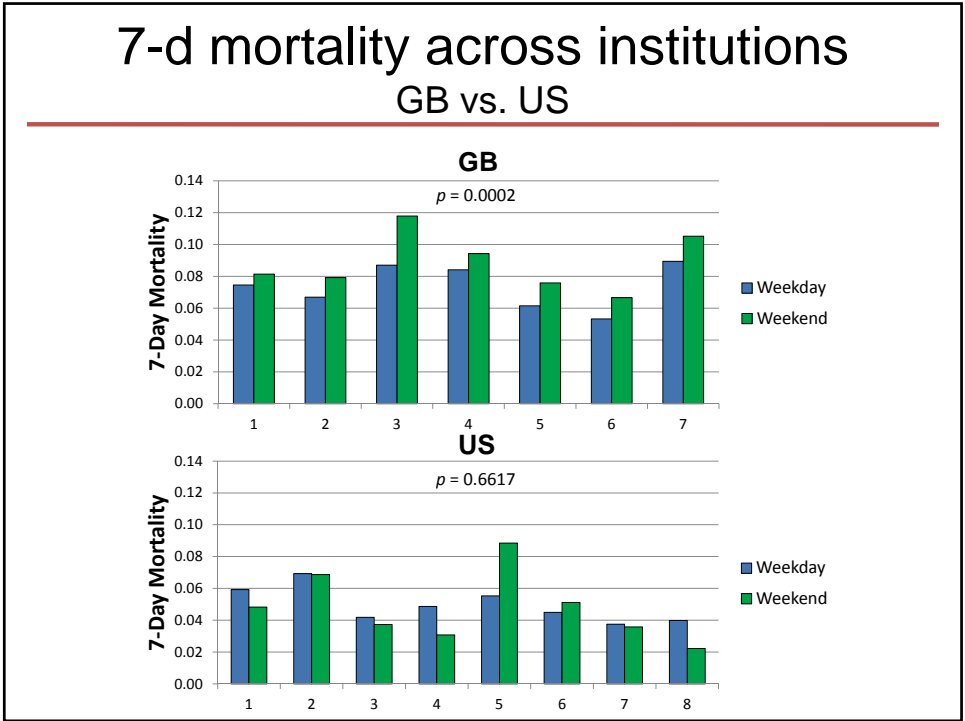
	AU	GB	NL	US
Mean Age (SD)	74.0 (14.3)	75.2 (13.4)	69.0 (14.8)	68.2 (15.4)
Female patients (%)	6,415 (48)	20,976 (52)	4,134 (47)	15,012 (50)
Mean Co-morbidity Score (SD)	9.4 (3.6)	4.1 (2.6)	2.2 (2.1)	8.7 (4.3)
Day of Admission				
Weekday (%)	9,733 (73)	29,814 (74)	6,275 (71)	21,780 (72)
Weekend (%)	3,591 (27)	10,381 (26)	2,509 (29)	8,343 (28)
Admissions per year (% total)				
2005	N/A	4,484 (11)	890 (10)	2,393 (8)
2006	N/A	4,355 (11)	840 (10)	2,575 (9)
2007	N/A	4,350 (11)	950 (11)	3,625 (12)
2008	2,640 (18)	4,741 (12)	875 (10)	3,984 (13)
2009	2,757 (21)	4,922 (12)	1,208 (14)	4,113 (14)
2010	2,718 (20)	5,576 (14)	1,382 (16)	4,207 (14)
2011	2,640 (20)	5,843 (16)	1,278 (15)	4,467 (15)
2012	2,596 (19)	5,924 (15)	1,361 (14)	4,809 (16)

Length of Stay by country

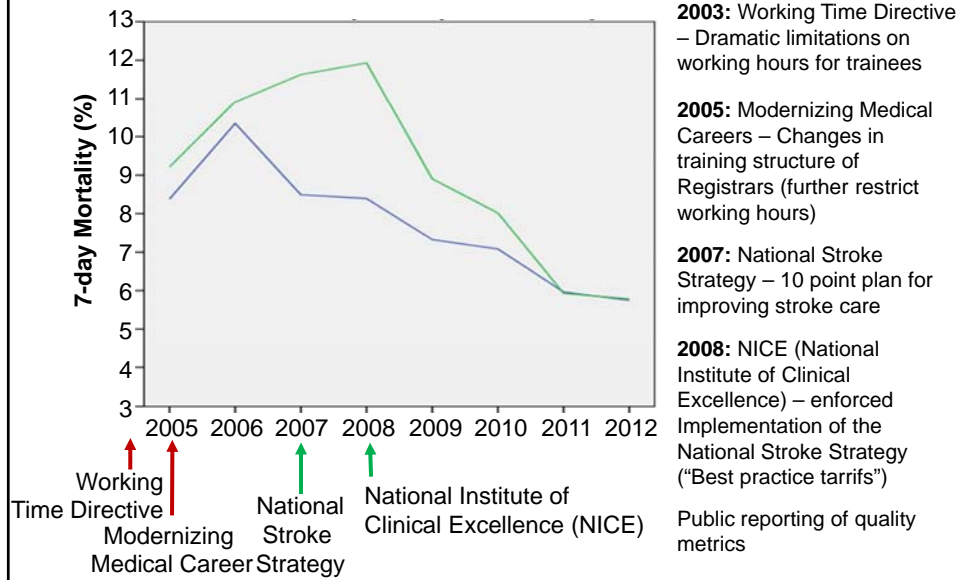


Primary outcome: 7-day in-hospital mortality





Weekend Effect Great Britain



Logistic Regression

Coefficient	Reference	Odds Ratio	95% CI	p-Value
Sex	Female	0.82	0.78-0.87	<0.001
Age		1.03	1.03-1.03	<0.001
Comorbidity Score		1.07	1.07-1.08	<0.001
Day of Admission	Weekday	1.09	1.03-1.16	<0.001
AU	US	1.35	1.24-1.47	<0.001
GB	US	1.21	1.13-1.29	<0.001
NL	US	1.24	1.12-1.37	<0.001
2005	2012	1.28	1.14-1.43	<0.001
2006	2012	1.44	1.29-1.61	<0.001
2007	2012	1.34	1.20-1.49	<0.001
2008	2012	1.30	1.18-1.44	<0.001
2009	2012	1.10	1.00-1.22	0.054
2010	2012	1.12	1.01-1.23	<0.05
2011	2012	1.01	0.91-1.11	0.871

International comparison across disease categories?

Acute Myocardial Infarction

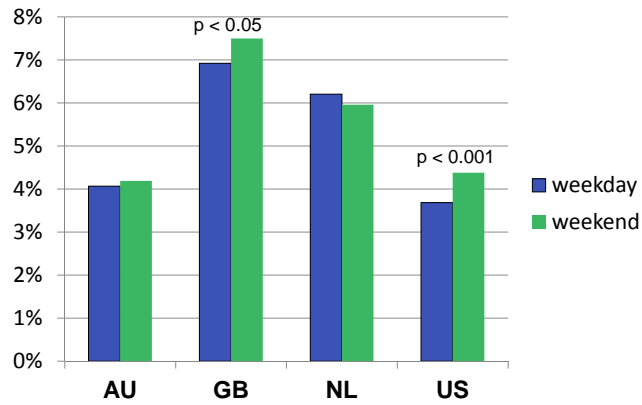
Medical Centers by Country

AMI: 149,014 patients

Country	Institution Study Code	AMI	Country	Institution Study Code	AMI
Australia	101	3456	Netherlands	301	2937
	102	3257		302	2139
	103	6942		303	1939
	104	3073		304	3607
	105	6320		305	2004
	106	2674		306	2568
	107	3498		307	862
	Total	29220		308	2361
United States	201	5315	Total	18417	
	202	9265	Great Britain	401	3092
	203	5741		402	3667
	204	5391		403	8998
	205	5023		404	3680
	206	1963		405	5595
	207	978		406	616
	208	9640		407	6805
	209	1957		408	1392
	210	1202		409	9266
	211	6546		410	5183
Total	53083	Total	48294		

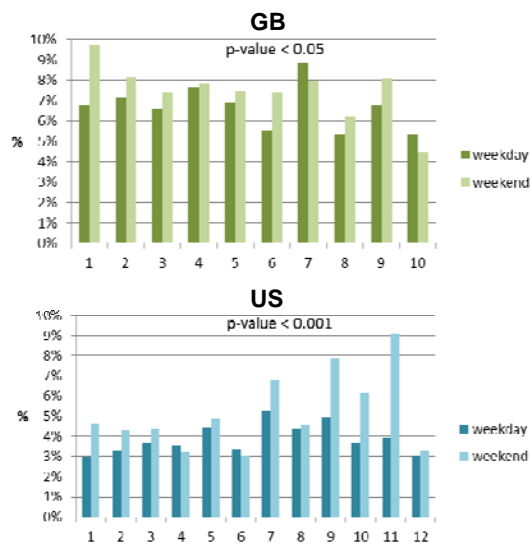
Weekend vs. Weekday Admissions

AMI: Crude 7-Day mortality

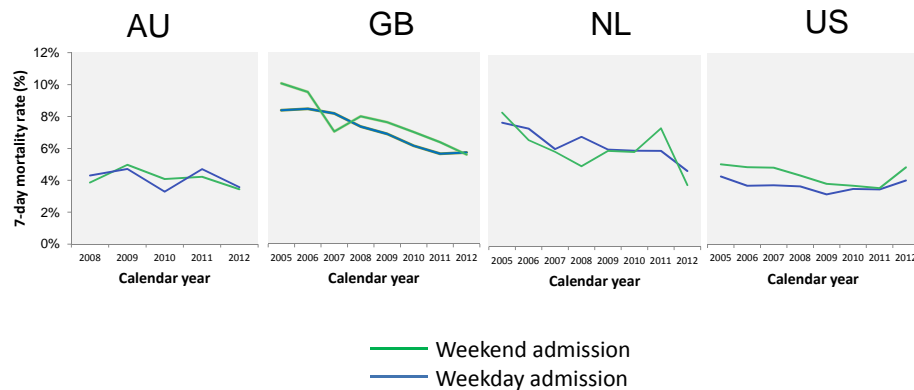


7-d mortality across institutions

AMI: GB vs. US



Mortality for Weekend vs. Weekday Admissions Countries by year



Summary

- Large differences in 7-day mortality between countries
- The week-end effect is complex
 - Unrelated to overall mortality
 - Is disease- and country-specific
 - The US has the lowest 7-day mortality across both diseases, but has a week-end effect for AMI but not stroke
- Some of the time-dependent changes appear to be associated with national health policy or national practice changes
 - GB has the highest 7-day mortality in both ischemic stroke and AMI, but demonstrates the greatest improvement over this period of time

How can this be translated to the Stroke Belt Consortium?

- National healthcare policies affect stroke outcomes. Do state policies also affect stroke outcomes?
 - Over 20 states have passed stroke-care legislation
- Several studies have taken advantage of GWTG data to demonstrate improvements in stroke care at the national level
- Very few have compared stroke outcomes across states.
 - Important to examine the impact of state health policy on outcomes
 - Difficult to balance variables that influence outcome (e.g. hospital populations, regional or hospital-specific practice patterns) across states
 - But possible, especially using data from larger states
 - Time-trends for outcomes may be helpful, especially when associated with policy changes
 - Mortality is a crude outcome measure—may require longer-term disability scales

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