

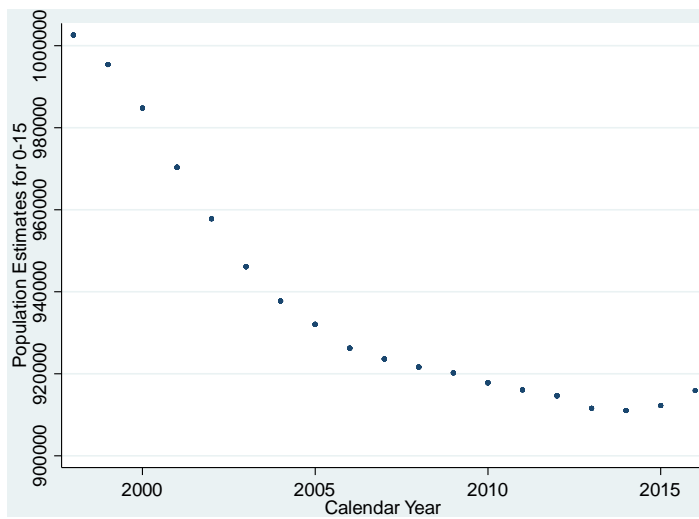
Supplementary Material 1: Summary of Health policies assessed

Policy	Time of Introduction	Key Features
1 st SIGN Head Injury Guideline	August 2000	<p>Indication for CT imaging (referenced directly from 2000 SIGN guideline):</p> <ol style="list-style-type: none"> (1) GCS<13 (2) A deteriorating level of consciousness or progressive focal neurological signs (3) Confusion or drowsiness (CGS 13 or 14/15) followed by failure to improve within at most four hours of clinical observation (4) Radiological/clinical evidence of a fracture, whatever the level of consciousness (5) New focal neurological signs which are not getting worse (6) Full consciousness (GCS 15/15) with no fracture but other features, including: <ul style="list-style-type: none"> – severe and persistent headache – nausea and vomiting – irritability or altered behaviour – a seizure. <p>Skull films should be carried out if any of the following apply and if CT is not being performed: If the patient is alert and orientated and obeying commands (GCS 15/15) but:</p> <ul style="list-style-type: none"> – the mechanism of injury has not been trivial; or – consciousness has been lost; or – the patient has loss of memory or has vomited; or – the scalp has a full thickness laceration or a boggy haematoma; or – the history is inadequate.
4-Hour ED performance target	2004	98% of patients attending the ED to be assessed, treated and either discharged or admitted to hospital within 4 hours of arrival. Financial incentives associated with meeting the target.
2 nd Sign Head Injury Guideline	May 2009	<p>Referenced directly from 2nd SIGN Guidelines</p> <p>Indications Immediate CT scanning (adult):</p> <ul style="list-style-type: none"> - GCS<13/15 - GCS 13/15 or 14/15 followed by failure to improve within one hour of clinical observation - base of skull or depressed skull fracture and/or suspected penetrating injuries - a deteriorating level of consciousness or new focal neurological signs - GCS 15/15 with severe and persistent headache or two episodes of vomiting - coagulopathy (eg warfarin use) and loss of consciousness or amnesia <p>Indications CT scanning within eight (adult):</p> <ul style="list-style-type: none"> - age>65 (with loss of consciousness or amnesia)

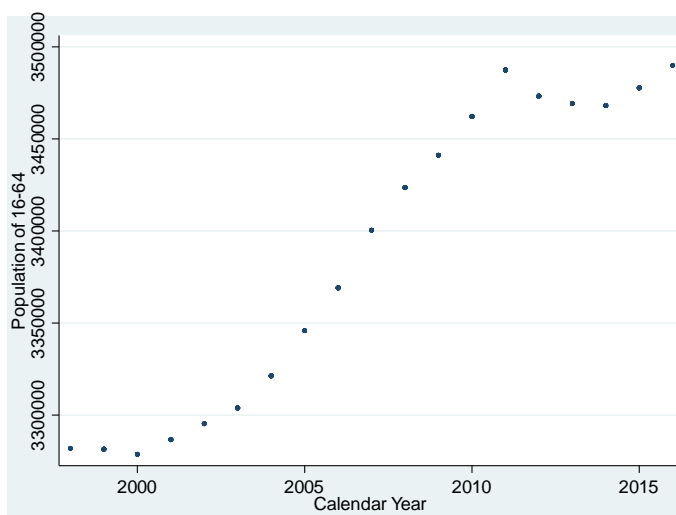
		<ul style="list-style-type: none">- clinical evidence of a skull fracture but no clinical features indicative of an immediate CT scan- any seizure activity- significant retrograde amnesia (>30 minutes)- dangerous mechanism of injury <p>Indications Immediate CT scanning (<16 years):</p> <ul style="list-style-type: none">- GCS≤13 on assessment in ED- witnessed loss of consciousness >5 minutes- suspicion of open or depressed skull injury or tense fontanelle- focal neurological deficit- any sign of basal skull fracture. <p>Indications CT scanning within 8 hours (<16 years):</p> <ul style="list-style-type: none">- presence of any bruise/swelling/laceration >5 cm on the head- post-traumatic seizure- amnesia (anterograde or retrograde) lasting >5 minutes- clinical suspicion of non-accidental head injury- a significant fall- age under one year: GCS<15 in emergency department- three or more discrete episodes of vomiting- abnormal drowsiness.
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Supplementary Material 2: Changes to Scotland's population structure

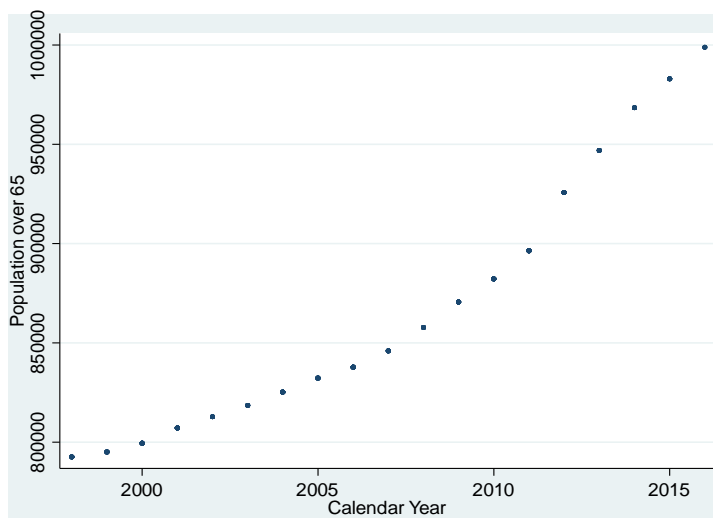
i) Mid-year Estimate Scottish Population 0-15



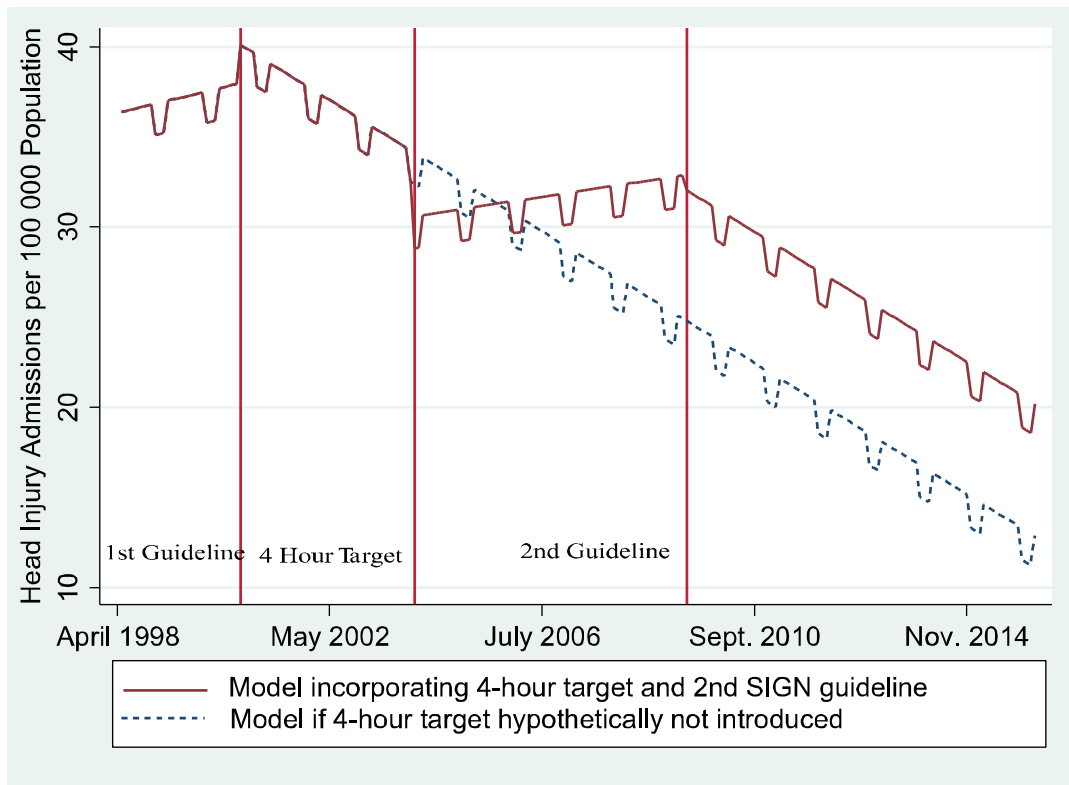
ii) Mid-year Estimate Scottish population 16-64



iii) Mid-year Estimate Scottish population 65+



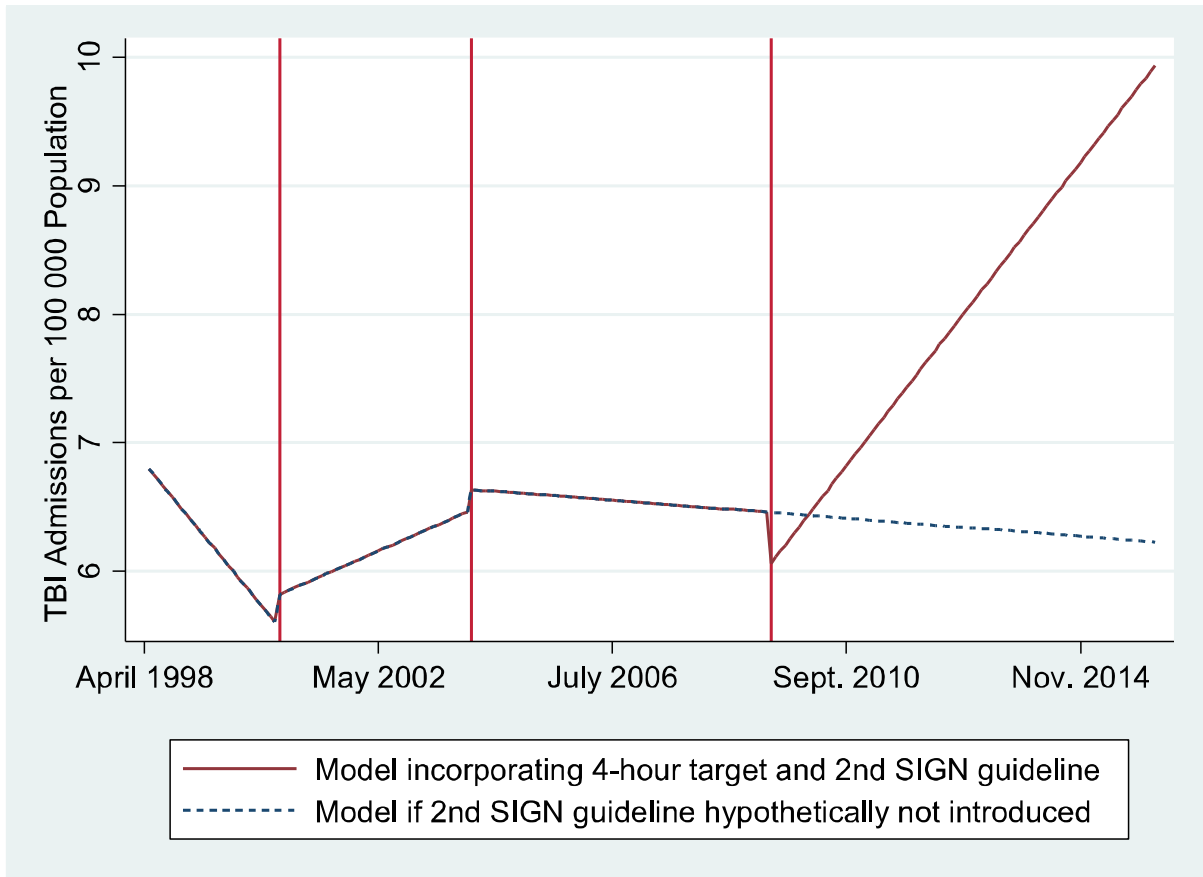
Supplementary Material 3: Increase in admissions related to the introduction of the 4-hour target in the 16-64 age group



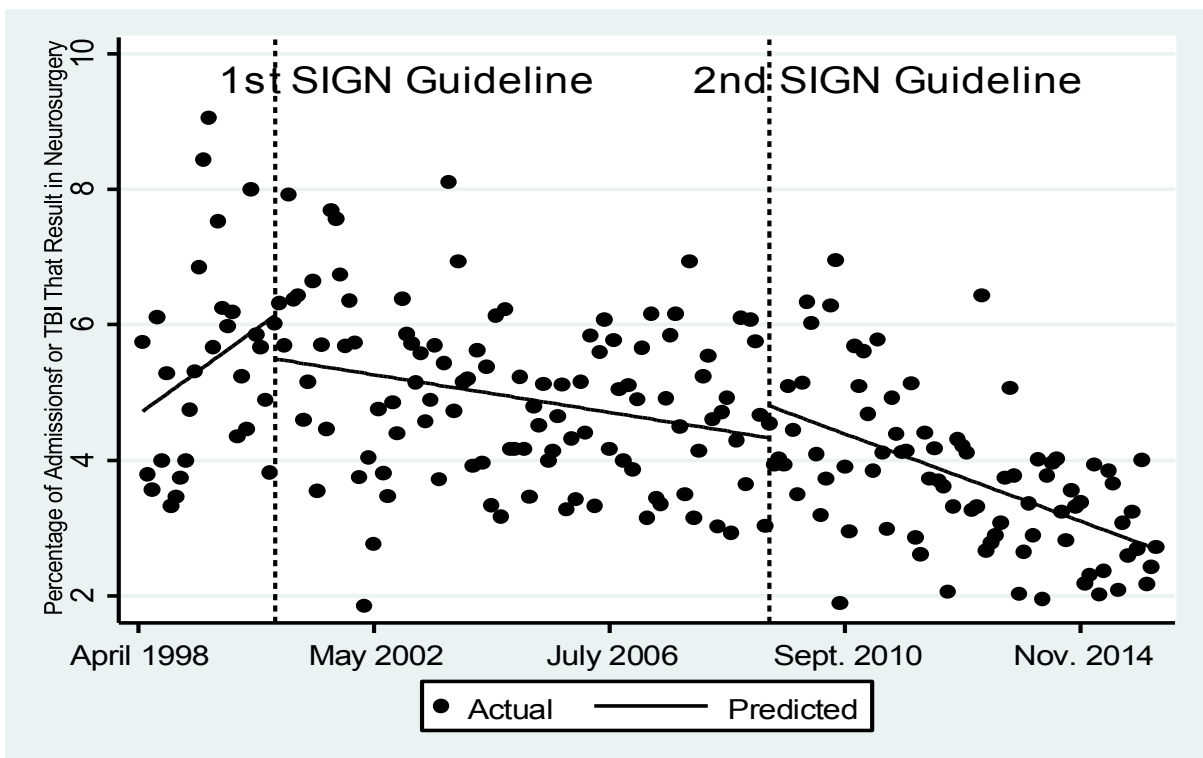
Supplementary Material 4: Estimate of Impact of the SIGN guidelines and introduction of 4-Hour Target admissions for head injury with 12-month time lag

Age Band	Winter	Initial Trend	1 st SIGN Guideline	4-hour Target Introduced	2 nd SIGN Guideline	Durbin-Watson Statistic
All ages	-3.00 (95% CI: -3.75 to -2.26) P<0.01	0.04 (95% CI: -0.07 to 0.14) P=0.48	Change level: 2.66 (95% CI:0.27 to 5.04) P=0.03	Change level: -2.73 (95% CI:-4.85 to -0.61) P<0.01	Change level: -2.07 (95% CI:-3.74 to -0.40) P=0.02	Untransformed 1.77 Prais-Winsten 2.00
			Change trend: -0.23 (95% CI:-0.38 to -0.08) P<0.01	Change trend: 0.25 (95% CI: 0.14 to 0.36) P<0.01	Change trend: -0.13 (95% CI: -0.18 to -0.08) P<0.01	
0-15	-9.31 (95% CI: -11.05 to -7.59) P<0.01	-0.18 (95% CI:-4.89 to 0.13) P=0.26	Change level: 8.53 (95% CI:1.93 to 15.13) P=0.01	Change level: 1.61 (95% CI:-4.39 to 7.61) P=0.60	Change level: -1.71 (95% CI:-6.61 to 3.20) P=0.49	Untransformed 1.37 Prais-Winsten 1.85
			Change trend: -0.17 (95% CI:-0.61 to 0.28) P=0.47	Change trend: 0.15 (95% CI: -0.17 to 0.48) P=0.36	Change trend: 0.10 (95% CI:-0.50 to 0.26) P=0.18	
16-64	-1.80 (95% CI:-2.56 to -1.04) P<0.01	0.06 (95% CI:-0.06 to 0.17) P=0.34	Change level: 1.29 (95% CI:-1.28 to 3.85) P=0.32	Change level: -4.19 (95% CI:-6.48 to -1.89) P<0.01	Change level: -3.06 (95% CI:-4.88 to -1.24) P<0.01	Untransformed 1.57 Prais-Winsten 2.05
			Change trend: -0.25 (95% CI:-0.41 to -0.09) P<0.01	Change trend: 0.29 (95% CI: -0.17 to 0.40) P<0.01	Change trend: -0.25 (95% CI:-0.30 to -0.19) P<0.01	
65+	1.69 (95% CI: 0.22 to 3.17) P=0.03	0.17 (95% CI:-0.04 to 0.38) P= 0.10	Change level: 3.64 (95% CI:-1.08 to 8.36) P= 0.13	Change level: -1.64 (95% CI:-5.83 to 2.55) P=0.44	Change level: 2.30 (95% CI:-1.00 to 5.60) P=0.17	Untransformed 1.78 Prais-Winsten 2.00
			Change trend: -0.22 (95% CI:-0.51 to 0.07) P=0.14	Change trend: 0.26 (95% CI: 0.04 to 0.48) P=0.02	Change trend: 0.003 (95% CI:-0.10 to 0.10) P=0.95	

Supplementary Material 5: Increase in admissions related to the introduction of the 2nd SIGN guideline



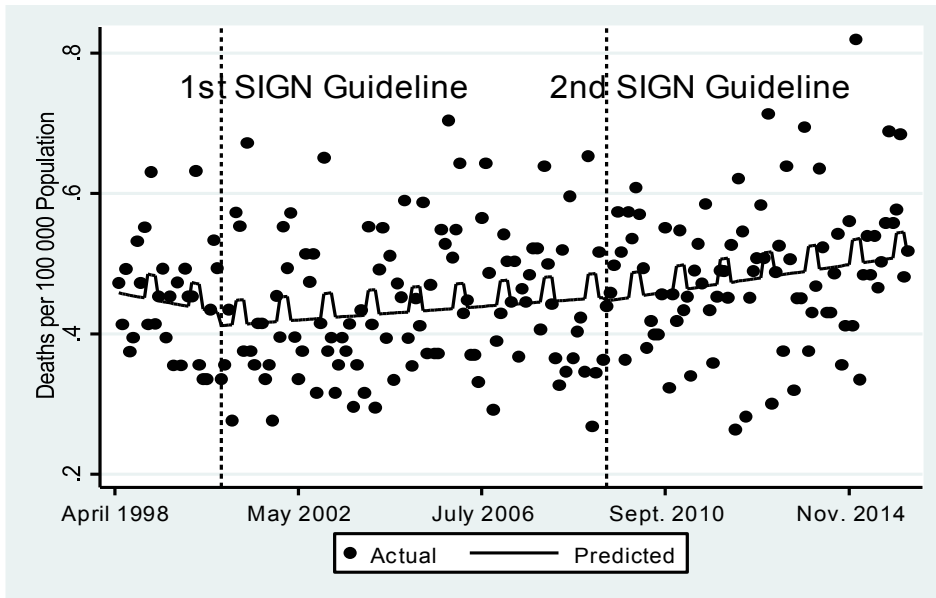
Supplementary Material 6: The impact of the SIGN guidelines on the percentage of admissions for TBI that resulted in neurosurgery



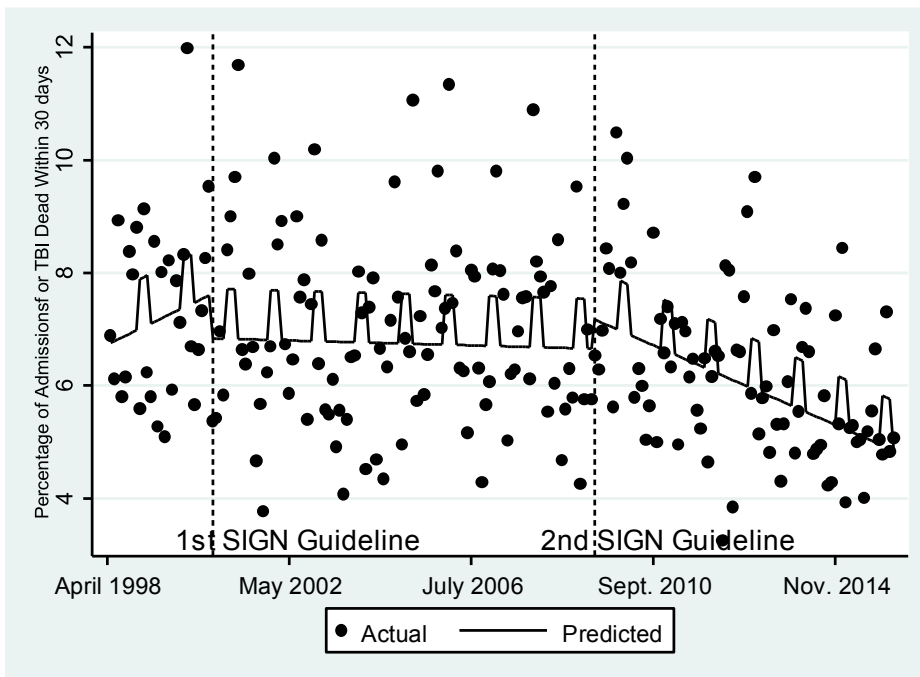
Supplementary Material 7: Estimate of impact of the SIGN guidelines and 4-Hour Target on admissions for Traumatic Brain Injury with 12-month time lag

Outcome	Initial Trend	1st SIGN Guideline	4-hour Target Introduced	2nd SIGN Guideline	Durbin-Watson Statistic
Admissions for TBI/ 100 000	-0.05 (95% CI: -0.10 to 0.003) P=0.07	Change level: 0.75 (95% CI:-0.34 to 1.84) P=0.18	Change level: 0.35 (95% CI:-0.63 to 1.33) P=0.48	Change level: -0.16 (95% CI: -0.92 to 0.60) P=0.69	Untransformed 1.44 Prais-Winsten 2.03
		Change trend: 0.05 (95% CI:-0.02 to 0.12) P=0.16	Change trend: -0.01 (95% CI:-0.06 to 0.04) P=0.66	Change trend: 0.05 (95% CI:3 to 0.08) P<0.01	
Percentage TBI admissions neurosurgical	0.05 (95% CI: -0.01 to 0.11) P=0.10	Change level: -0.96 (95% CI:-2.19 to 0.28) P=0.13		Change level: 0.17 (95% CI:-0.59 to 0.93) P=0.66	Untransformed 1.85
		Change trend: -0.06 (95% CI:-0.12 to 0.003) P=0.06		Change trend: -0.02 (95% CI:-0.04 to -0.004) P=0.01	

Supplementary Material 8: The impact of the SIGN guidelines on deaths per 100 000 population within 30 days of admission with traumatic brain injury



Supplementary Material 9: The impact of the SIGN guidelines on the percentage of patients admitted with TBI who died within 30 days of admission



Supplementary Material 10: Estimate of impact of the SIGN guidelines on deaths following admission for Traumatic Brain Injury with 12 month time lag

Outcome	Winter	Initial Trend	1st SIGN Guideline	2nd SIGN Guideline	Durbin-Watson Statistic
Deaths/100 000	0.03 (95% CI:-0.01 to 0.06) P=0.15	-0.001 (95% CI:-0.004 to 0.003) P=0.59	<u>Change level:</u> -0.02 (95% CI:- 0.09 to 0.06) P=0.66	<u>Change level:</u> -0.03 (95% CI:-0.08 to 0.03) P=0.32	Untransformed 2.29
			<u>Change trend:</u> 0.001 (95% CI:-0.002 to 0.005) P=0.44	<u>Change trend:</u> 0.001 (95% CI:-0.0002 to 0.002) P=0.10	
Percentage TBI admissions death	0.74 (95% CI: 0.18 to 1.30) P=0.10	0.03 (95% CI:-0.03 to 0.10) P=0.34	<u>Change level:</u> -1.06 (95% CI: -2.40 to 0.29) P=0.12	<u>Change level:</u> -0.37 (95% CI:-1.20 to 0.47) P=0.39	Untransformed 2.17
			<u>Change trend:</u> -0.03 (95% CI:-0.10 to 0.04) P=0.38	<u>Change trend:</u> -0.02 (95% CI:-0.04 to -0.004) P=0.02	