

Background information for TBI case study

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Data set description

Traumatic brain injury data set (TBI.sav, n=2159). Patients are from the International and US Tirilazad trials. The primary outcome was 6 months Glasgow Outcome Scale (range 1 for dead to 5 for good recovery).

| Name | Description (coding: no/yes is coded as 0/1) | Development n=2159 |
|------------------|---|--------------------------------|
| trial | Study identification: 74 = Tirilazad international (n=1118) 75 = US (n=1041) | 52% 48% |
| d.gos | GOS at 6 months: 1 = dead 2 = vegetative 3 = severe disability 4 = moderate disability 5 = good recovery | 23% 4% 12% 16% 44% |
| d.mort | Mortality at 6 months (0/1) | 23% |
| d.unfav cause | Unfavorable outcome at 6 months (0/1) Cause of injury 3 = Road traffic accident 4 = Motorbike 5 = Assault 6 = Domestic/fall 9 = Other | 39% 20% 6% 17% 18% |
| age | Age (in years, median [interquartile range]) | 29 [21 – 42] |
| d.motor | Admission motor score (1 – 6, median) | 4 |
| d.pupil | Pupillary reactivity (1=both reactive / 2=one reactive / 3 = no reactive pupils) | 70%/14%/16% |
| pupil.i | Single imputed pupillary reactivity (1/2/3) | 70%/14%/16% |
| hypoxia | Hypoxia before / at admission (0/1) | 22% |
| hypotens | Hypotension before / at admission (0/1) | 19% |
| ctclass | Marshall CT classification (1 – 6, median) | 2 |
| tsah | tSAH at CT (0/1) | 46% |
| edh | EDH at CT (0/1) | 13% |
| cisterns | Compressed cisterns at CT (0=no/1=slightly compressed / 2=fully compressed) | 57%/26%/10% |
| shift | Midline shift > 5 mm at CT (0/1) | 18% |
| glucose | Glucose at admission (mmol/l, median [interquartile range]) | 8.2 [6.7 – 10.4] |
| glucoset | Truncated glucose values (median [interquartile range]) | 8.2 [6.7 – 10.4] |
| ph | pH (median [interquartile range]) | 7.4 [7.3 – 7.5] |
| sodium | Sodium (mmol/l, median [interquartile range]) | 140 [137 – 142] |
| sodiumt | Truncated sodium (median [interquartile range]) | 140 [137 – 142] |
| hb | Hb (g/dl, median [interquartile range]) | 12.8 [10.9 – 14.3] |
| hbt | Truncated hb (median [interquartile range]) | 12.8 [10.9 – 14.3] |

* d. variables denoted 'derived'.

Age – outcome relationships

Hukkelhoven, J Neurosurgery 2003;99:666-673
Meta-analysis, n=2664, severe TBI

Fig 1 Age as a continuous linear term, linear + quadratic, or smoothing spline

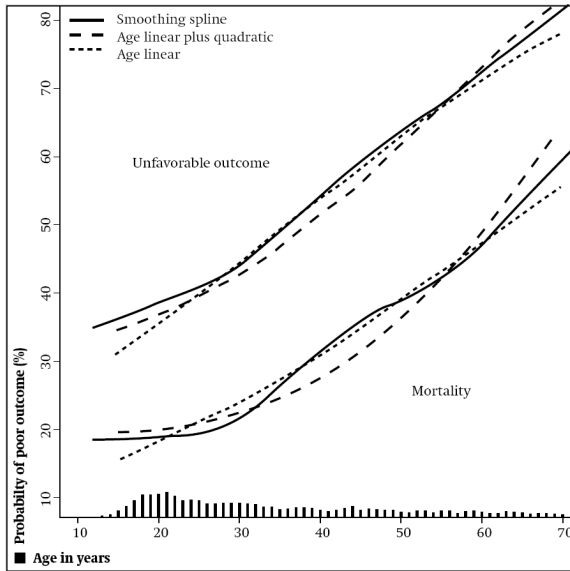
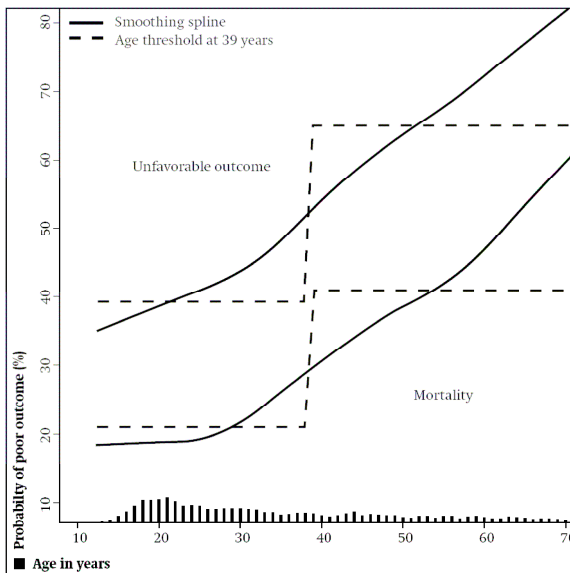


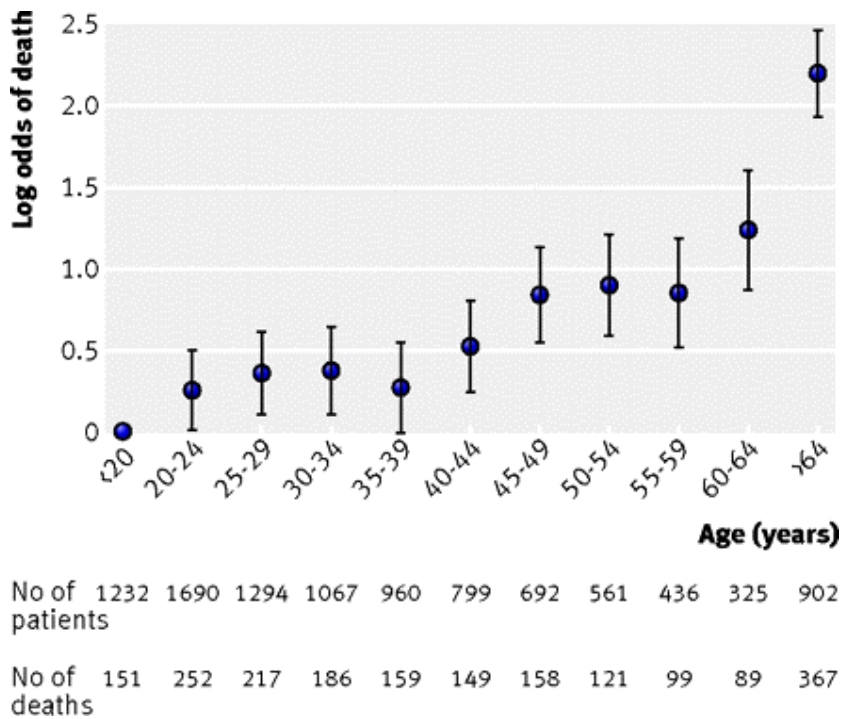
Fig 2 Age with a threshold of 39 years, or smoothing spline



Perel et al, BMJ 2008;(12 February), 336: 397-398
 doi:10.1136/bmj.39461.643438.25
 10,008 patients from the CRASH trial

“... The relation between age and the log odds of death within 14 days showed no association until the age of 40 and a linear increase afterwards.”

Fig 1 Relation between age and mortality at 14 days (n=10,008)



Prediction models

Steyerberg, PLoS Medicine 2008 5(8): e165. doi:10.1371/journal.pmed.0050165

Fig 1 Score chart

| Characteristics | Value | Score | Sum |
|---------------------------------|-----------------------------------|-------|----------------------|
| Age (years) | ≤ 30 | 0 | |
| | 30 – 39 | 1 | |
| | 40 – 49 | 2 | |
| | 50 – 59 | 3 | |
| | 60 – 69 | 4 | |
| | 70 + | 5 | |
| Motor score | None/extension | 6 | |
| | Abnormal flexion | 4 | |
| | Normal flexion | 2 | |
| | Localizes/obeys | 0 | |
| | Untestable/missing | 3 | |
| Pupillary reactivity | Both pupils reacted | 0 | |
| | One pupil reacted | 2 | |
| | No pupil reacted | 4 | |
| Sum score core model | | | <input type="text"/> |
| Hypoxia | Yes or suspected | 1 | |
| | No | 0 | |
| Hypotension | Yes or suspected | 2 | |
| | No | 0 | |
| CT classification | I | -2 | |
| | II | 0 | |
| | III/IV | 2 | |
| | V/VI | 2 | |
| | Traumatic subarachnoid Hemorrhage | 2 | |
| Epidural hematoma | Yes | 0 | |
| | No | -2 | |
| Subscore CT | | | <input type="text"/> |
| Sum score extended model | | | <input type="text"/> |
| Glucose (mmol/l) | < 6 | 0 | |
| | 6–8.9 | 1 | |
| | 9–11.9 | 2 | |
| | 12–14.9 | 3 | |
| | 15 + | 4 | |
| | | | |
| Hb (g/dl) | < 9 | 3 | |
| | 9–11.9 | 2 | |
| | 12–14.9 | 1 | |
| | 15 + | 0 | |
| Subscore lab | | | <input type="text"/> |
| Sum score lab model | | | <input type="text"/> |

Figure 1. Score Chart for 6 Month Outcome after TBI

LP refers to the linear predictor in a logistic regression model. Six LPs were defined as follows:

$$LP_{\text{core, mortality}} = -2.55 + 0.275 \times \text{sum score core}$$

$$LP_{\text{core, unfavorable outcome}} = -1.62 + 0.299 \times \text{sum score core}$$

$$LP_{\text{extended, mortality}} = -2.98 + 0.256 \times (\text{sum score core} + \text{subscore CT})$$

$$LP_{\text{extended, unfavorable outcome}} = -2.10 + 0.276 \times (\text{sum score core} + \text{subscore CT})$$

$$LP_{\text{lab, mortality}} = -3.42 + 0.216 \times (\text{sum score core} + \text{subscore CT} + \text{subscore lab})$$

$$LP_{\text{lab, unfavorable outcome}} = -2.82 + 0.257 \times (\text{sum score core} + \text{subscore CT} + \text{subscore lab})$$

External validation: AUC (c- statistics) for mortality / unfav outcome in CRASH data:

Core: 0.78 / 0.78

Extended: 0.80 / 0.80

Cross-validation: AUC (c- statistics) for mortality / unfav outcome

Tirilazad Int Tirilazad US

Core 0.70 / 0.75 0.74 / 0.78

Extended 0.78 / 0.80 0.77 / 0.80

Lab 0.80 / 0.80 0.79 / 0.82