

Background:

Traumatic brain injury (TBI) can cause severe mortality and social burden because of disability. While symptoms of mild TBI are generally transient, sometimes mild TBI can result in persistant brain cognitive impairments. TBI patients usually activate emergency medical service (EMS) system to seek medical help. However, it is difficult for EMS providers to predict prognosis of TBI patients at field. Adequate assessment and disposition of mild TBI patients from prehospital stage is important for improving outcomes. This study aims to develop and validate prediction model of mild TBI for clinical outcomes in EMS-assessed mild TBI patients using prehospital variables.

Methods :

This is a multi-center and retrospective data analysis study using the Pan-Asian Trauma Outcomes Study (PATOS).

Population :

Adult mild TBI patients transported by EMS in South Korea were analyzed. Severe head injury, emergency departement (ED) visit after 24hours from injury, prehospital arrest, transfer from other medical facility and unknown outcome cases were excluded.

Outcome :

The primary outcome was poor neurological difference of glasgow outcome scale (GOS). GOS difference was calculated by subtracting GOS at hospital discharge from GOS at ED arrival. If the difference was greater than 1, the difference of GOS was considered poor. The secondary outcome was ICU admission or in-hospital mortality.

Statistical Analysis :

We divided the available data set into development (70%) and validation (30%) set randomly. The model was developed in the development set and validated in the validation set. Multiple data imputation was used to account for missing data. The discrimination and calibration performance of the model was calculated by the area under the receiver operating characteristics curve (AUROC) and Hosmer-Lemeshow test in the validation set, respectively. Finally, the performance of the model was compared to that of revised trauma score (RTS) model.

Results & discussion :

Among 84,046 eligible patients, 6,098 patients were enrolled to the final analysis after inclusion and exclusion criteria. The median age of enrolled patients was 55 years old. The proportion of male was 59.4%. Poor neurological difference rate and ICU or in-hospital mortality was 1.8% and 3.3%, respectively. AUROC of the developed model and the RTS model for poor GOS difference was 0.79 (95% CI 0.7-0.88) and 0.74 (95% CI 0.64-0.84), respectively. AUROC of the developed model and the RTS model for ICU admission or in-hospital mortality was 0.77 (95% CI 0.71-0.83) and 0.75 (95% CI 0.68-0.81), respectively.

	Primary outcome		
	AUROC	95% CI	p-value
RTS model	0.74	0.64~0.84	0.11
New model	0.79	0.7~0.88	0.23
	Secondary outcome		
	AUROC	95% CI	
RTS model	0.75	0.68~0.81	0.01
New model	0.77	0.71~0.83	0.19

Table 2. AUROC comparison between the new and RTS model in the validation set

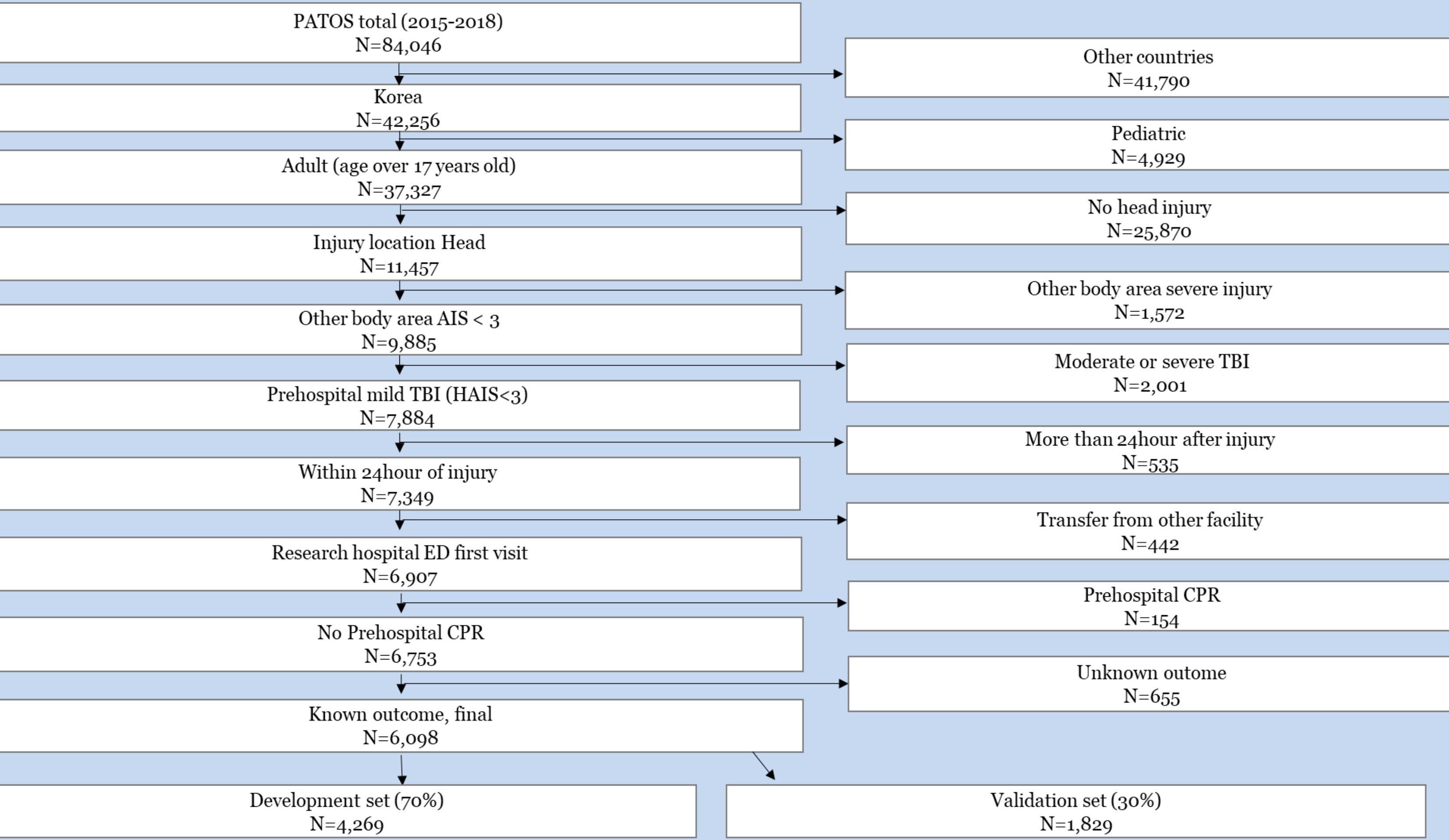


Fig 1. Study flow chart

All		All		Development set		Validation set		p-value
		N	%	N	%	N	%	
		6098	100.0	4269	70.0	1829	30.0	
Age								0.88
	Median (IQR)	55 (39-68)		54 (39-68)		55 (40-68)		
Gender								0.01
	Male	3624	59.4	2587	60.6	1037	56.7	
	Female	2474	40.6	1682	39.4	792	43.3	
ISS								0.40
	1~8	5880	96.4	4122	96.6	1758	96.1	
	9~15	218	3.6	147	3.4	71	3.9	
	Median (IQR)	1 (1-3)		1 (1-3)		1 (1-3)		
GOS difference								0.67
	Good	5988	98.2	4194	98.2	1794	98.1	
	Poor	110	1.8	75	1.8	35	1.9	
ICU or In-hospital mortality								0.19
	No	5896	96.7	4136	96.9	1760	96.2	
	Yes	202	3.3	133	3.1	69	3.8	

Table 1. Demographic findings between development and validation set

Conclusion :

This unique prediction model with variables available from the prehospital stage can offer clue for effective patient triage. Our model was slightly superior to the RTS model in predicting poor GOS difference and ICU admission or in-hospital mortality.