



CONNECTED
HEALTH CITIES

 A nhsa project

Developing a pre-hospital decision tool for Stroke

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Stroke Pathway & Exclusions

Inclusion: FAST+ or 'suspected stroke'

Exclusions:

- Age <16 yrs
- Respiration rate <10, >30
- SpO2 <90% post high flow O2
- BP (systolic) <90mmhg
- HR <40bpm or >150bpm
- GCS 7 or less
- Any seizure activity
- BM <4.0mmols post treatment

OR

>48hrs from stroke onset

FAST -ve is still 'okay' if ambulance technician still suspects a stroke

PRF Data

FAST data



Suspected Stroke or TIA? Y <input checked="" type="checkbox"/> N <input type="checkbox"/>		Onset Time: 10:05	4
FAST Positive	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	Referred to hyper-acute stroke service	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
Hospital pre-alert	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	BM recorded	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>

PRF Data

FAST data

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FAST Positive		Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	Referred to hyper-acute stroke service		Y <input type="checkbox"/> N <input checked="" type="checkbox"/>			
Hospital pre-alert		<input type="checkbox"/>	BM recorded		<input checked="" type="checkbox"/>			

Observations data

Observations		PHEW Parameter score	3
Time	10:02	10:15	
LOC	AVPU	AVPU	<input checked="" type="checkbox"/>
Pulse	180	100	
Resps	20	10	
Sys BP	81.5	50	
Dia BP	110	31.5	
SPO2 on air	80%	90%	
SPO2 on O2	90%	15%	
Peak Flow	130	30	
Unable to obtain PF	9	2	
GCS	E V M 132	E V M 10	
GCS Total	99	07	
Temp	39.0	40.0	9
Blood Sugar	15.0	82	
Pain Score	09	5	
PHEW Score	9	9	
Cap refill <2s	<input checked="" type="checkbox"/>	<2s	<input checked="" type="checkbox"/>
Pupils Equal Y	<input checked="" type="checkbox"/>	Y	<input checked="" type="checkbox"/>
Pupils React R	<input checked="" type="checkbox"/>	R	<input checked="" type="checkbox"/>
ETCO2	20	10	
ECG 4 lead	<input checked="" type="checkbox"/>	12 lead	<input type="checkbox"/>
Rhythm	0		

PRF Data

FAST data

Suspected Stroke or TIA? Y ☒ N ☐ Onset Time: 10:05

FAST Positive Y ☒ N ☐ Referred to hyper-acute stroke service Y ☐ N ☒

Hospital pre-alert ☐ BM recorded ☒

Observations data

Observations PHEW Parameter score 3

Time 10:02 10:15

LOC AVPU AVPU

Pulse 180 109

Resps 20 10

Sys BP 81.5 50

Dia BP 110 81.5

SPO2 on air 80% 90%

SPO2 on O2 90% 15%

Peak Flow 130 30

Unable to obtain PF 9 2

GCS E V M 13 2 10

GCS Total 9 7

Temp 39.0 40.0

Blood Sugar 15.0 8.2

Pain Score 09 5

PHEW Score 9 9

Cap refill <2s >2s <2s >2s

Pupils Equal Y N Y N

Pupils React R L R L

ETCO2 20 10

ECG 4 lead 12 lead

Rhythm 0

Demographic data

Past Medical History

Symptoms

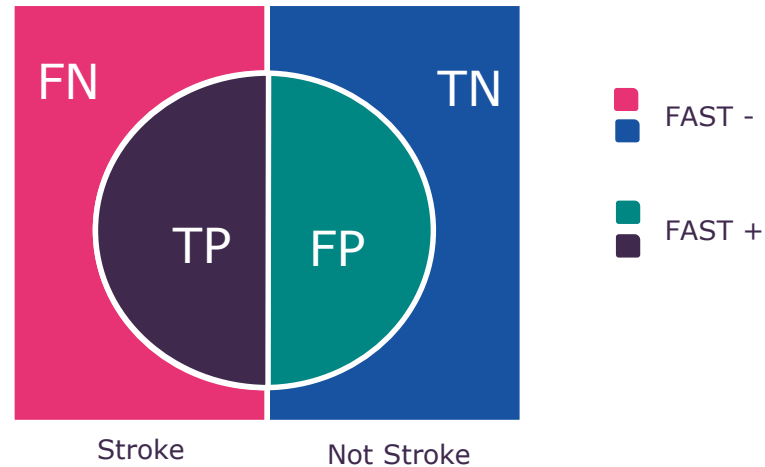
Data

- Manual data collection from PRFs
September 2015 – March 2017
- 4216 patients BIBA on suspected stroke pathway
'suspected stroke' or 'FAST+'
- Final diagnosis verified by stroke clinician

Summary Diagnoses

Final Diagnosis	Total
Stroke	2213 (52.5%)
TIA	492 (11.7%)
Epilepsy	244 (5.8%)
Migraine	241 (5.7%)
Sepsis	218 (5.2%)
Other	808 (19.2%)

Summary - FAST



	FAST+	FAST-
Stroke	TP = 2079	134
Not Stroke	FP = 1739	264

Positive Predictive Rate = $TP / (TP + FP) = 54.5\%$

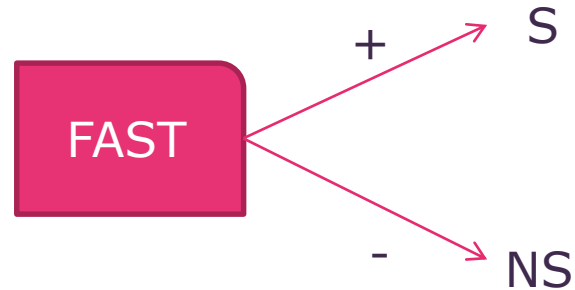


How can we improve?

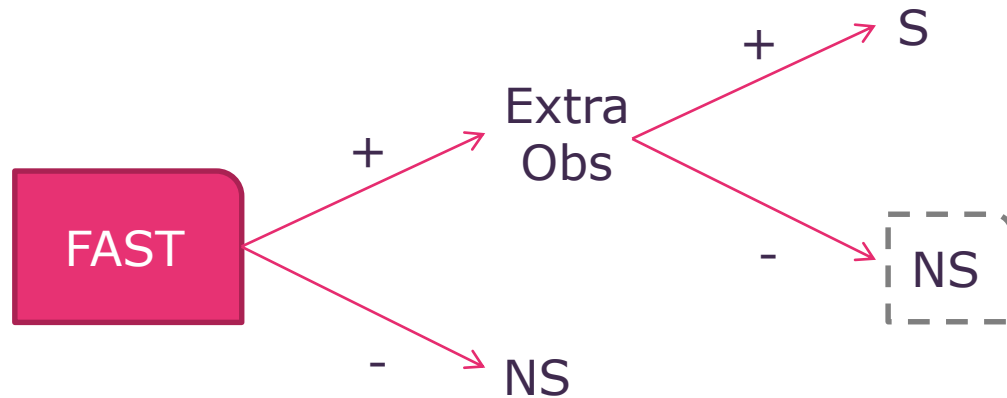
Enhanced FAST test

→ Utilise all information

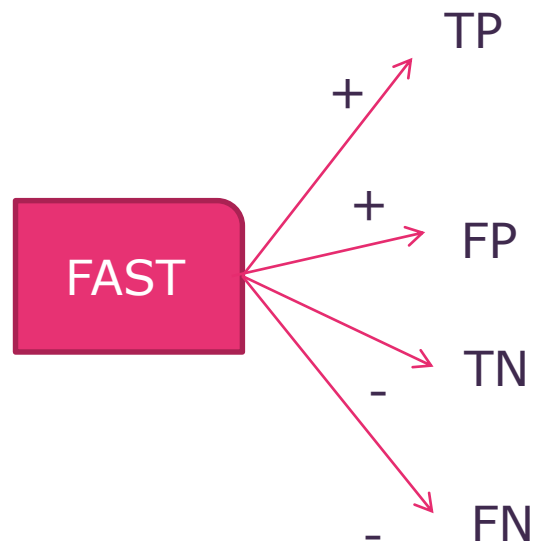
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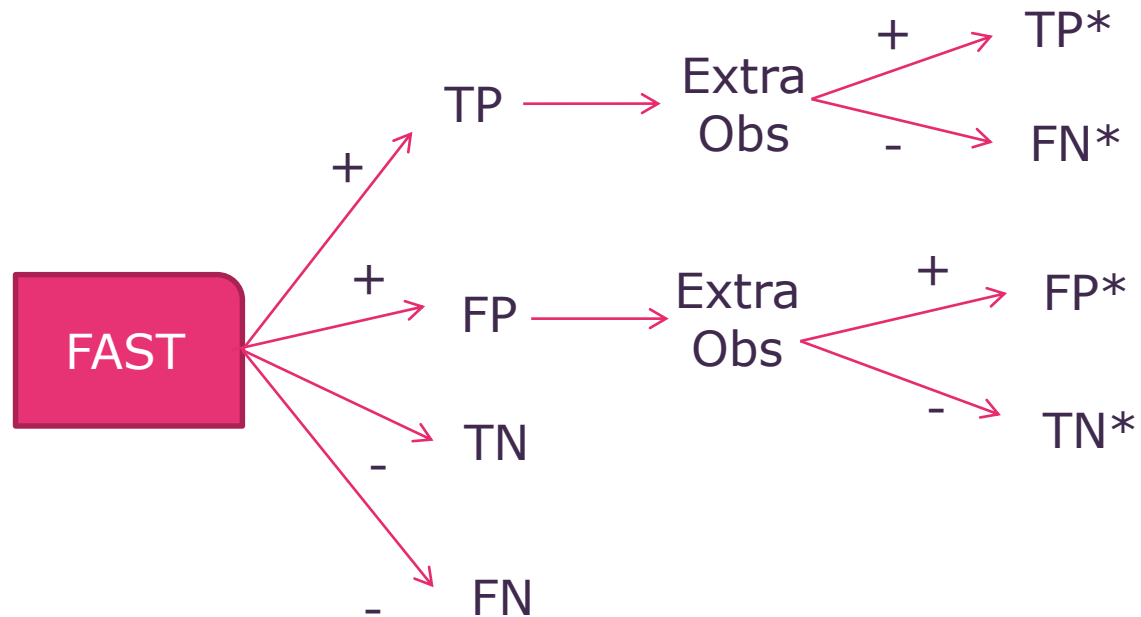
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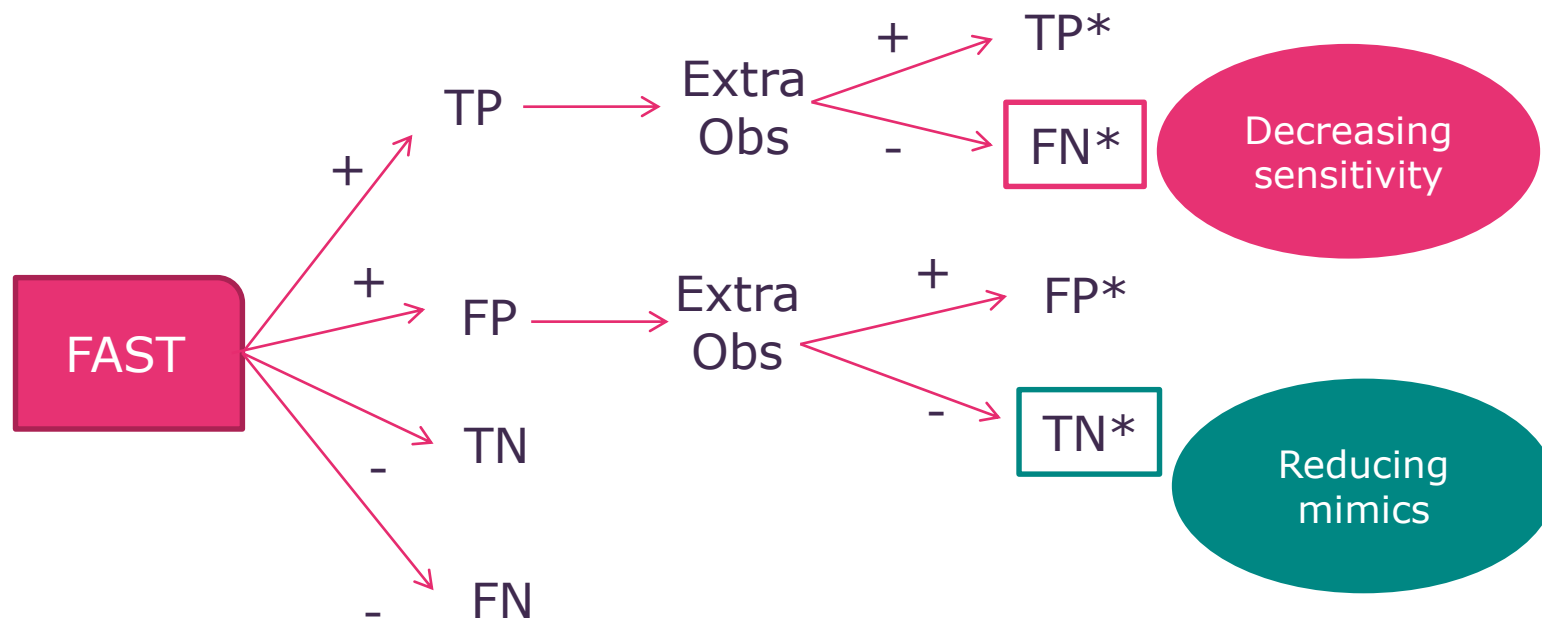
Enhanced FAST test



Enhanced FAST test



Enhanced FAST test



Three-pronged approach:

- Logistic Regression
 - Random Forest
 - Neural Network
-
- Constraints we need to consider:
 - Depth of machine learning algorithms
 - How many true negatives are needed for every additional false negative identified?

Future Plans

- If 'successful':
 - Embed it into app, turning app into medical device to aid decision making
 - Observe (test for) change in proportion of patients admitted that are strokes on the stroke pathway
 - Widespread implementation

Join in!

Do you have electronic PRF data for your stroke pathway that we could validate our models on?

Talk to us 😊