The Trail Making Test, Part B: Minimizing the Risk of False Positives Severely Compromises the Test's Ability to Identify Unsafe Drivers

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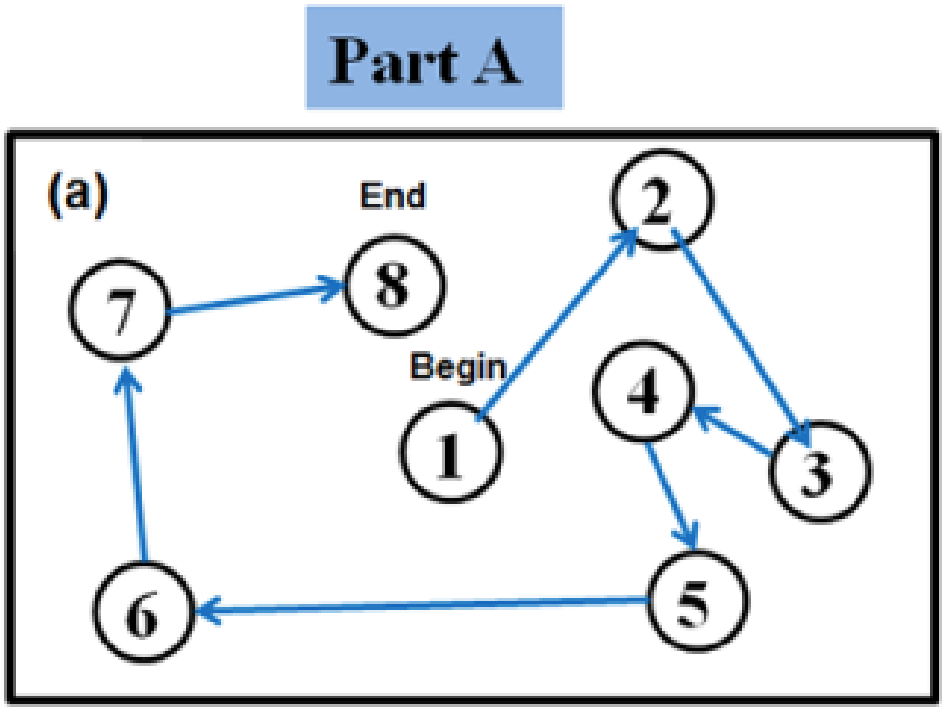
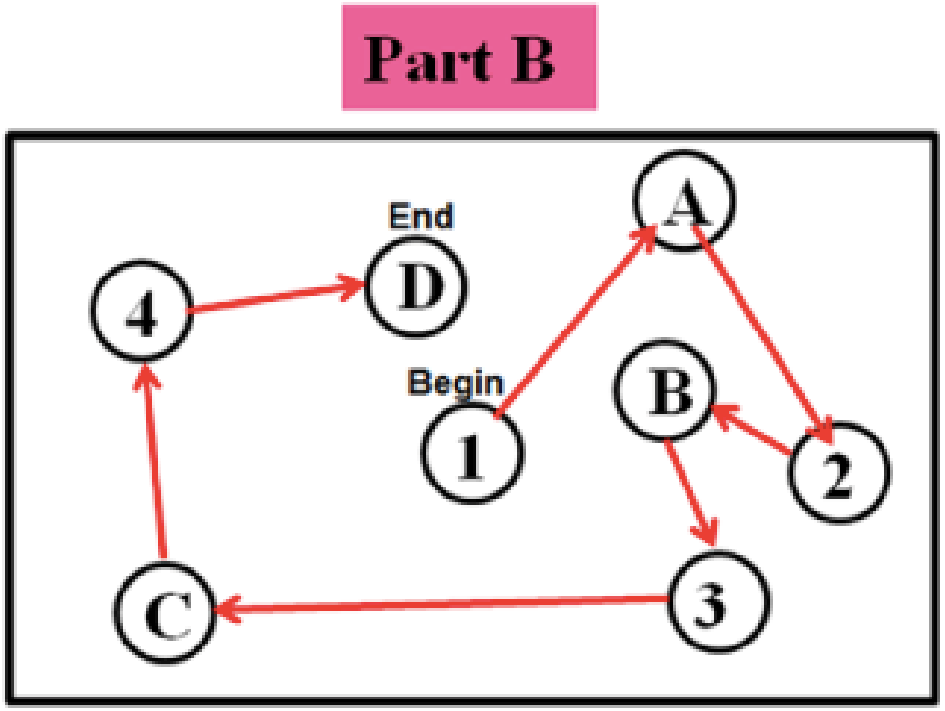
Background

- The Trail Making Test-Part B (TMT-B) is among the most widely used screening measures to predict driving performance in a clinical setting for older drivers.
- There is a lack of reported data describing the diagnostic properties of the TMT-B to identify unsafe drivers while minimizing the risk of inappropriately labeling safe drivers as unsafe.

The Trail Making Test





Primary Objective

To determine the sensitivity of the TMT-B to identify unsafe drivers at high levels of specificity (100%, 95%, 90%).

		TRUTH: Unsafe driver	TRUTH: Safe driver
TEST RESULT	+	**A** (True positive)	**B** (False positive)
	−	**C** (False negative)	**D** (True negative)
		T_{Unsafe}	T_{Safe}

Sensitivity = $A/T_{Unsafe} \times 100\%$
% of truly unsafe drivers identified as unsafe

Specificity = $D/T_{Safe} \times 100\%$
% of truly safe drivers identified as safe

Secondary Objectives

- To examine the relationship between TMT-B completion time cut off and sensitivity/specificity.
- To assess the degree of evidence supporting TMT-B as a screening tool for unsafe driving

Methods

- A systematic approach was used to identify TMT-B driver screening literature
- Three reviewers independently extracted sensitivity values at high specificity levels from published ROC curves assessing the discrimination of the TMT-B for driving performance
- Correlations between sensitivity/specificity and TMT-B completion time cut-offs were assessed using Pearson's *r*

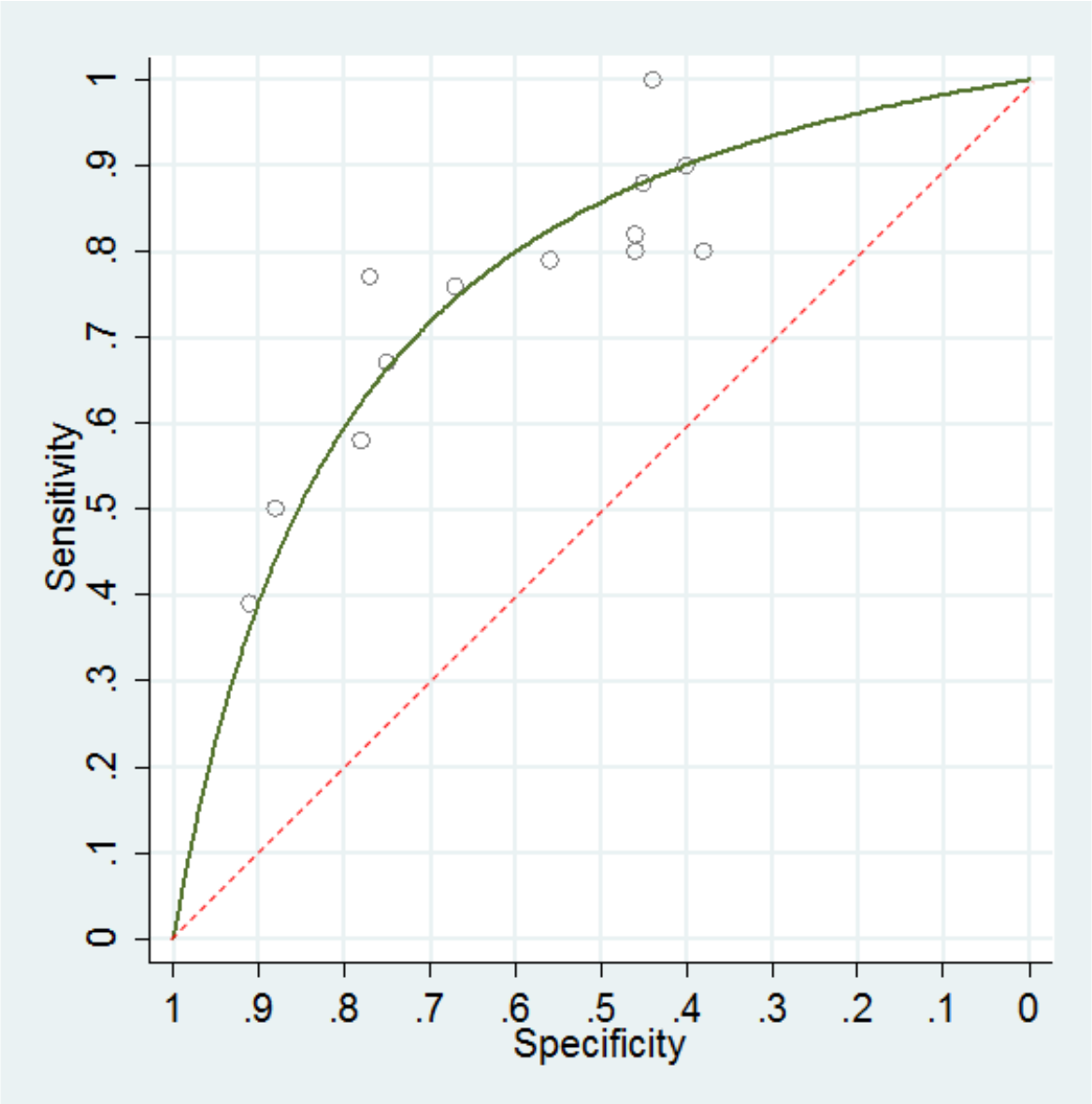
Search Results

	#	REMAINING
ARTICLES IDENTIFIED	60	
NON-TITLE MATCH	15	45
LACK OF TMT-B DATA	16	29
INAPPROPRIATE GOLD STANDARD	9	20
OTHER INELIGIBILITY (non-English; abstract only; review; screening approach; TBI population)	14	6
NO ROC CURVE	2	4

MEAN ESTIMATES OF SENSITIVITY AT HIGH LEVELS OF SPECIFICITY

	ESTIMATED SENSITIVITY		
	100% SPECIFICITY	95% SPECIFICITY	90% SPECIFICTY
STUDY			
Bowers 2013	9.3	24.6	24.6
Classen 2013	16.6	28.3	35.6
Devos 2011	17.9	22.2	28.1
Dobbs & Shergill 2013	0.0	15.2	42.5
Mean	**11.0**	**22.6**	**32.7**

ROC Plot



Correlations of Sensitivity and Specificity with cut-off time

Property	Pearson r	95% CI
Sensitivity	-0.837	-0.953 to -0.507
Specificity	0.852	0.545 to 0.957

Discussion

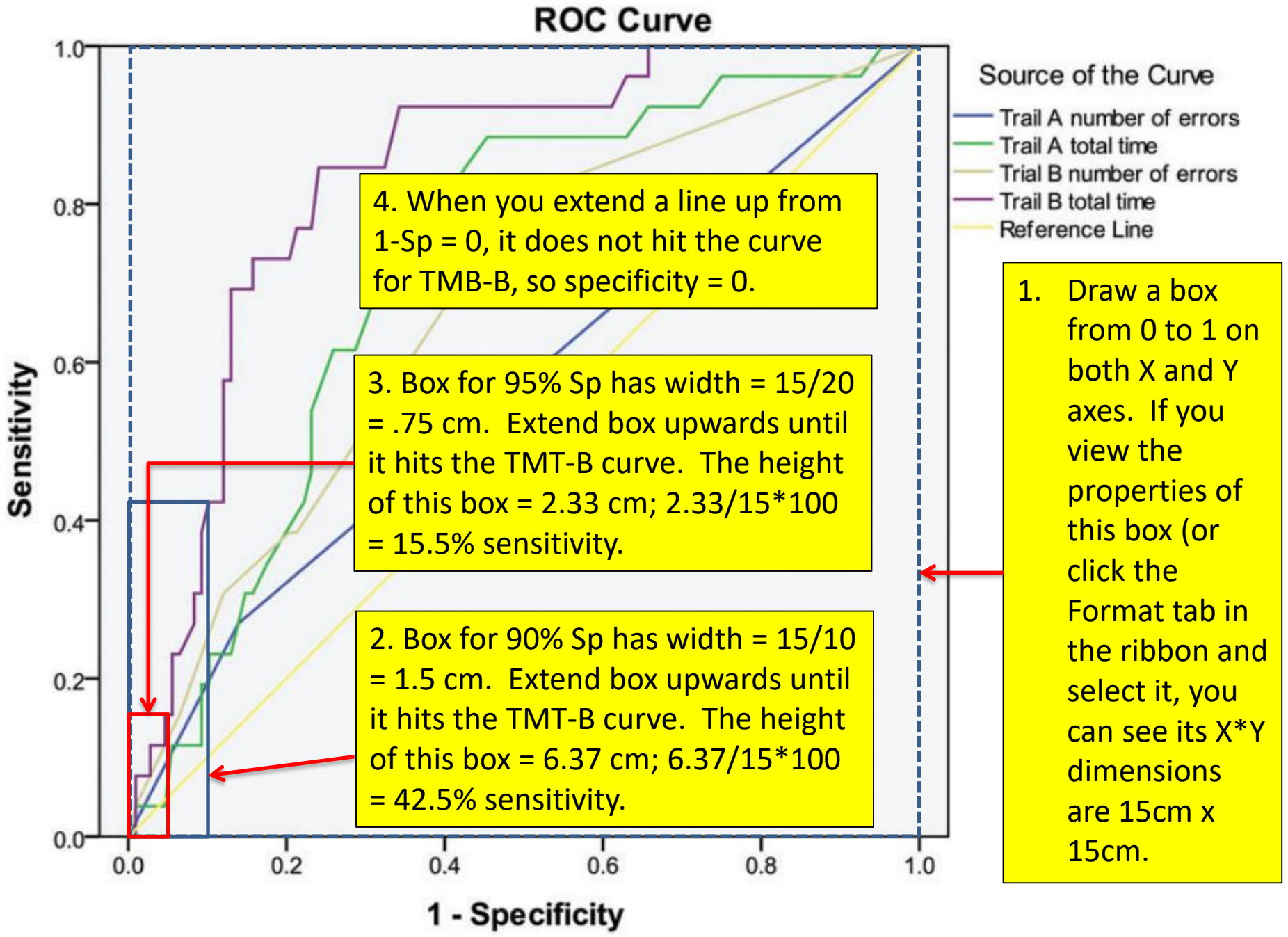
- Very few studies describe screening properties fully (4 of 60)
- When risk of mislabeling safe drivers as unsafe was minimized the TMT-B's ability to detect unsafe drivers was severely compromised
- At high levels of specificity (100%, 95%, 90%), sensitivity was low (11%, 23%, 33%)

Discussion

- While failing to identify unsafe drivers is certainly a public safety concern, ensuring a high level of specificity is a priority to minimize the risk of misclassifying safe drivers as unsafe

Acknowledgements

Extra Slides


ROC Curve
Sensitivity
1 - Specificity
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Source of the Curve
Trail A number of errors
Trail A total time
Trial B number of errors
Trail B total time
Reference Line
4. When you extend a line up from 1-Sp = 0, it does not hit the curve for TMB-B, so specificity = 0.
3. Box for 95% Sp has width = 15/20 = .75 cm. Extend box upwards until it hits the TMT-B curve. The height of this box = 2.33 cm; 2.33/15*100 = 15.5% sensitivity.
2. Box for 90% Sp has width = 15/10 = 1.5 cm. Extend box upwards until it hits the TMT-B curve. The height of this box = 6.37 cm; 6.37/15*100 = 42.5% sensitivity.
1. Draw a box from 0 to 1 on both X and Y axes. If you view the properties of this box (or click the Format tab in the ribbon and select it, you can see its X*Y dimensions are 15cm x 15cm.