

REVIEW ARTICLE

Recognition of Stroke in the Emergency Room (ROSIER) Scale in Identifying Strokes and Transient Ischemic Attacks (TIAs); a Systematic Review and Meta-Analysis

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Received: July 2023; Accepted: August 2023; Published online: 5 October 2023

Abstract: **Introduction:** A range of screening tools has been developed to assist emergency healthcare providers in rapidly and accurately diagnosing strokes. In this study, we investigated the diagnostic value of the Recognition of Stroke in the Emergency Room (ROSIER) scale in identifying individuals with stroke and transient ischemic attack (TIA). **Methods:** We conducted a systematic search across online databases of PubMed, Embase, Scopus, and Web of Science until June 12th, 2023, aiming to identify studies that assessed the diagnostic performance of the ROSIER scale in detecting strokes and TIAs among individuals with suspected stroke symptoms. **Results:** Data extracted from 34 studies were analyzed, demonstrating that the ROSIER score, with a cut-off value of ≥ 1 , has sensitivity of 0.89 (95% confidence interval (CI): 0.86–0.92), specificity of 0.76 (95% CI: 0.69–0.81), diagnostic odds ratio (DOR) of 25.41 (95% CI: 17.2–37.54), and area under the curve (AUC) of 0.91 (95% CI: 0.85–0.90) in detection of strokes and TIAs. Meta-regression subgroup analysis revealed variations in sensitivity and specificity based on different settings and assessors. Sensitivity was higher in pre-hospital settings when the test was administered by emergency medical services (EMS) and emergency department (ED) paramedic staff, whereas specificity was higher in emergency department settings and when physicians and neurologists conducted the test. **Conclusion:** A moderate level of evidence shows that the ROSIER scale is considered an excellent tool for identifying strokes and TIAs. As a valid method for identifying strokes, it holds applicability across diverse settings and can be effectively used by assessors with different specialties.

Keywords: Stroke; Diagnosis; Diagnostic techniques and procedures; Systematic review; Meta-analysis

Cite this article as: Chehregani Rad I, Azimi A. Recognition of Stroke in the Emergency Room (ROSIER) Scale in Identifying Strokes and Transient Ischemic Attacks (TIAs); a Systematic Review and Meta-Analysis. Arch Acad Emerg Med. 2023; 11(1): e67. <https://doi.org/10.22037/aaem.v11i1.2135>.

1. Introduction

Stroke is the third leading global cause of death and the second major contributor to both mortality and disability. Between 1990 and 2019, the incidence of stroke increased by 70%, leading to a 32% rise in Disability-Adjusted Life Years (DALY) associated with strokes (1). The initiation of treatments, such as recombinant tissue plasminogen activator (rt-PA), results in improved outcomes within 24 hours and a better prognosis at three months (2). Furthermore, treatment benefits increase with earlier administration, particularly within the first 90 minutes. However, potential benefits

can still be observed up to three hours later, albeit with some accompanying risks (3).

Despite these advantages, the misdiagnosis of stroke in triage settings often leads to many patients missing the optimal treatment window. This underscores the need for improved approaches to stroke detection (4,5). To address this issue, a range of screening tools has been developed to assist emergency healthcare providers in rapidly and accurately diagnosing strokes, including Recognition of Stroke in the Emergency Room (ROSIER) (6), Face, Arms, Speech, Time (FAST) (7), Cincinnati Prehospital Stroke Scale (CPSS) (8), National Institutes of Health Stroke Scale (NIHSS) (9), and LAPSS (Los Angeles Prehospital Stroke Screen) (10). Among these tools, the ROSIER scale, introduced by Nor and colleagues in 2005, has gained prominence.

The ROSIER scale is a 7-item stroke recognition instrument employing clinical history and neurological signs, ranging

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from -2 to +5. A score of +1 or higher indicates a positive diagnosis of stroke or transient ischemic attack (TIA). The scale encompasses assessment criteria such as loss of consciousness, seizure activity, asymmetric facial, arm, and leg weakness, speech disturbance, and visual field defect (6).

Although a systematic review was conducted in 2020 (11), numerous publications featuring large sample sizes have emerged since then (12–17). To address this gap, we aimed to conduct a systematic review and meta-analysis on current literature. This investigation will focus on evaluating the ROSIER scale's clinical utility and diagnostic accuracy in different settings, by different assessors, and in various study designs. Moreover, our study, in contrast to the existing systematic reviews in the field, incorporates an inclusive approach encompassing non-English literature.

2. Methods

2.1. Study design and search strategy

This systematic review and meta-analysis aimed to assess the effectiveness of ROSIER in detecting stroke and TIA in suspected patients. The PICO framework was defined as P: suspected stroke patients, I: ROSIER scoring system, C: radiographic imaging, O: diagnosis of stroke and TIA. A systematic search was performed in databases of Medline (through PubMed), Scopus, Embase and Web of Science until June 12th 2023. Pertinent keywords related to "ROSIER" and "Stroke" were selected using MeSH and Emtree terms, guided by input from field experts and reviews of relevant articles. Furthermore, a manual search was performed on Google and Google Scholar search engines. The search strategy is provided in Supplementary table 1.

2.2. Selection criteria

Inclusion criteria involved articles investigating the utility of ROSIER in stroke detection among suspected stroke patients. Exclusion criteria were reviews, studies involving pediatric patients (under 18 years old), studies lacking non-stroke control groups, those using a score cut-off other than ≥ 1 , studies with no required data, and duplicate publications.

2.3. Data collection

After removing duplicates, two reviewers independently examined the retrieved records. The screening process involved two stages: first, evaluating titles and abstracts, and then conducting full-text screening to determine article inclusion based on predefined criteria. Data from selected articles were extracted and summarized in a checklist following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (18). This checklist included information about the study, such as the first author's surname, publication year, study design, age and gender dis-

tribution of patients, sample size, and the number of patients with stroke.

Diagnostic performance metrics of ROSIER, including true positive (TP), false positive (FP), true negative (TN), and false negative (FN), were also extracted using the specified cutoff. These values were calculated from the reported sensitivity and specificity if required.

2.4. Quality assessment and certainty of evidence

Both authors independently assessed the quality and risk of bias in the included articles using the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) tool (19), reaching unanimous decisions. QUADAS-2 evaluates the risk of bias and applicability under subsections related to patient setting, index test, reference standard, and flow and timing, with each subsection scored as high risk, unclear risk, or low risk. Certainty of evidence was determined using the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) approach (20).

2.5. Statistical analysis

Statistical analyses were conducted using STATA v17.0 statistical software, employing the "midas" package. The collected TP, TN, FP, and FN were utilized to compute the diagnostic accuracy of ROSIER. The findings were presented as sensitivity, specificity, the area under the receiver operating characteristic curve (AUC), diagnostic odds ratio (DOR), positive likelihood ratio (PLR), and negative likelihood ratio (NLR). Subgroup analysis was employed to classify the studies based on their design, the setting in which they were conducted, and assessor specialties. Publication bias was investigated using Deek's funnel plot asymmetry test.

3. Results

3.1. Study characteristics

Our systematic search yielded 216 non-duplicate records. Seventy possibly relevant articles were chosen for further evaluation, from which 31 met the inclusion criteria of this study. Three relevant articles were included by manual search, and ultimately, 34 articles were included in our review (Figure 1) (6,12–17,21–46). Eighteen articles were conducted in China, 6 articles in the United Kingdom, and 2 articles in Iran. The remaining studies each originated from one of these geographic locations: Italy, Turkey, Germany, Ireland, India, Egypt, Malaysia, and Korea. All included studies were designed as observational studies. Twenty-nine articles had a prospective design, while 4 employed a retrospective design. The included studies had a cumulative sample size of 9,535 suspected stroke patients (44.7% male), comprising 5885 patients with a final diagnosis of stroke. The age of the included patients ranged from 40 to 85 years. All studies utilized

ROSIER with a cut-off of ≥ 1 . Emergency department (ED) physicians and neurologists assessed ROSIER in 26 articles, while emergency medical services (EMS) and ED paramedic staff assessed ROSIER in 6 studies. The assessor's specialty was unspecified in two publications. ROSIER was used in prehospital settings in 25 studies and in emergency department settings in 8 studies; one study did not specify the setting. Table 1 provides the characteristics of the included studies.

3.2. Meta-analysis

3.2.1. Diagnostic value of ROSIER in detection of stroke

In our study, the AUC of ROSIER in detection of stroke in suspected stroke patients was calculated to be 0.91 (95% confidence interval (CI): 0.86 to 0.92) (Figure 2) and the sensitivity and specificity of ROSIER were 0.89 (95% CI: 0.86 to 0.92) and 0.76 (95% CI: 0.69 to 0.81), respectively (Figure 3). The diagnostic odds ratio for ROSIER was determined to be 25.41 (95% CI: 17.2 to 37.54). Additionally, the PLR and NLR were calculated as 3.6 (95% CI: 2.9 to 4.6) and 0.14 (95% CI: 0.11 to 0.18), respectively (Figure 4).

3.2.2. Subgroup analysis

There was notable heterogeneity among the studies ($I^2 = 100.0\%$). Consequently, we conducted meta-regression, showing that the most probable factors contributing to this heterogeneity across the studies were the study settings and the specialties of the assessors.

Subgroup analysis revealed significant sensitivity and specificity variations based on settings and assessors. Pre-hospital sensitivity was higher (0.92; 95% CI: 0.88–0.96) than in the emergency department (0.88; 95% CI: 0.85–0.92) ($p < 0.001$). Sensitivity was higher when administered by emergency physicians and neurologists (0.89; 95% CI: 0.85–0.92) than other staff (0.92; 95% CI: 0.87–0.97) ($p < 0.01$).

Prospective studies had higher sensitivity (0.90; 95% CI: 0.87–0.93), while retrospective designs had slightly lower sensitivity (0.85; 95% CI: 0.75–0.96), with no significant difference ($p = 0.08$). On the other hand, specificity showed differences between the emergency department (0.77; 95% CI: 0.71–0.84) and pre-hospital settings (0.71; 95% CI: 0.58–0.84) ($p = 0.02$), as well as between emergency physicians/neurologists (0.78; 95% CI: 0.72–0.84) and other staff (0.62; 95% CI: 0.45–0.78) ($p = 0.01$).

Prospective studies demonstrated specificity of 0.76 (95% CI: 0.70–0.82), while retrospective designs showed specificity of 0.69 (95% CI: 0.51–0.88), with no significant difference ($p = 0.59$) (Figure 5).

Notably, despite these variations, all groups exhibited excellent diagnostic accuracies when assessing the AUC. For the setting groups (prehospital and emergency department), the AUCs were 0.90 (95% CI: 0.88–0.93) and 0.93 (95% CI: 0.9–0.95), respectively. Similarly, for the assessor groups

(physicians/neurologists and EMS/ED paramedic staff), the AUCs were 0.91 (95% CI: 0.88–0.93) and 0.90 (95% CI: 0.87–0.92), respectively.

3.3. Publication bias

The Deek's funnel asymmetry test demonstrated no evidence of publication bias or asymmetry ($P = 0.17$) (Figure 5).

3.4. Risk of bias assessment

The quality of the included articles was assessed using QUADAS-2 guidelines. In the domain of patient selection, 5 articles had an unclear risk due to unclear exclusion criteria. Additionally, 20 articles were deemed to have an unclear risk in the reference standard domain due to no mention of the blinding of the reference standard's assessor. Two articles presented a high risk of bias in the flow and timing section because not all patients underwent the same reference standard, and not all consecutive patients were included in analysis. Another 22 articles had an unclear risk in the flow and timing bias domain since there was no clear mention of proper interval between the index test and the reference standard test, or proper inclusion of all data related to consecutive patients in the final analysis. Regarding the reference standard's applicability, two studies were categorized as having a high risk of bias due to their definition of the stroke group, which solely encompassed ischemic stroke patients without mentioning the TIA group. Also, 12 studies were deemed to have unclear risk in this aspect, because they did not distinctly define the stroke group (Table 2).

3.5. Certainty of evidence

The certainty of the evidence in the included articles was assessed using the GRADE guidelines. These articles were designed as observational accuracy studies, and according to GRADE guidelines, the initial level of evidence was classified as low. However, studies displayed notable risk of bias and high heterogeneity, each reducing the level of evidence by one. Analysis revealed a very large magnitude of effect increasing the level of evidence by two. We also judged possible confounders to be present, increasing the level of evidence by one. As a result, the level of evidence for the outcomes related to the predictive value of the ROSIER scale in strokes and TIAs was classified as moderate (Table 3).

4. Discussion

The objective of this study was to assess the diagnostic efficacy of the ROSIER scale in detecting stroke and TIA. Our findings underscore the potential of the ROSIER scale in distinguishing stroke and TIA from stroke mimics, with a sensitivity of 0.89, specificity of 0.76, and AUC of 0.91, reflecting excellent diagnostic accuracy.

Introduced by Nor and colleagues in 2005, the ROSIER scale serves as a straightforward and accurate clinical tool for stroke assessment in emergency settings. Comprising seven factors, including consciousness level, seizure activity, asymmetric weakness, speech impairment, and visual field defects, the ROSIER scale intentionally avoids complex items for ease of use in the ED. The scale's simplicity and impressive accuracy prove invaluable in rapidly distinguishing stroke, aligning well with the increasing demand for prompt detection and thrombolytic therapy initiation. While its primary aim isn't to distinguish stroke types, the ROSIER scale significantly aids in identifying potential stroke cases, reducing non-stroke referrals, and optimizing healthcare resource allocation, considering the high prevalence of stroke mimics (6,11,47).

An earlier umbrella review reported a sensitivity of 0.88 and a specificity of 0.67 in data extracted from 18 articles. Our sensitivity aligns with the findings of the umbrella review, however, the review exhibited comparatively lower specificity. The mentioned study also demonstrated that as a result of ROSIER's simplicity and remarkable sensitivity and specificity levels, it is recommended as a valuable tool for stroke identification among other screening methods. In another meta-analysis on 14 studies, Han et al. reported results similar to the umbrella review. However, our study addresses the limitations of previous articles. Firstly, we included a larger number of studies in our analysis. Additionally, we focused on adult population and excluded pediatric studies. Although, in comparison to other screening tools, the ROSIER scale exhibits higher sensitivity and comparable or better specificity, it should be noted that supplementary brain imaging or biomarker assessments could enhance performance (11,48–50).

In Mohd Nor's study, the ROSIER scale was originally developed and assessed within the emergency department, and was validated by emergency physicians (6). Although, our study's subgroup analysis revealed sensitivity and specificity variations across settings and assessors, the ROSIER scale exhibited excellent accuracy in diverse clinical settings, including prehospital and ED, and when administered by various assessors, such as physicians, neurologists, and EMS/ED paramedic staff, highlighting its broad applicability.

While the ROSIER assessment tool holds value in stroke recognition, it is not without limitations. Heterogeneities across studies possibly due to factors like geographical location and settings can affect the results. ROSIER's effectiveness in identifying stroke subtypes, especially posterior circulation infarcts (POCI), is hindered as POCI's distinct symptoms aren't fully covered and examined in ROSIER scale. This can lead to up to 50% of POCI cases being missed. Additionally, seizures decrease ROSIER score by one, which can contribute to false negatives, raising the risk of recognition

failure, particularly within the pediatric population where seizure presentations can occur alongside stroke in 29% of cases. Additionally, the tool's accuracy diminishes in non-alert or unconscious patients due to its reliance on patient cooperation and feedback (22,24,51,52).

5. Conclusion

A moderate level of evidence shows that the ROSIER scale is considered an excellent tool for identifying strokes and TIAs. As a valid method for identifying strokes, it holds applicability across diverse settings and can be effectively used by assessors with different specialties.

6. Declarations

6.1. Acknowledgments

The completion of this article would not have been possible without the valuable contributions and expertise of Dr. Mahmoud Yousefifard. We appreciate his collaboration and guidance throughout the research process.

6.2. Conflict of interest

None.

6.3. Research Funding

None

6.4. Using artificial intelligence chatbots statement

We hereby declare that we employed ChatGPT (GPT-3.5) solely for the purpose of conducting final language editing of our text.

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Table 1: Characteristics of the included studies

Author	Setting	Investigator	Design	Sample size	Male (n)	Mean age	Stroke (n)	Non-stroke (n)	References	Stroke group definition
Aaron, 2020, India	Emergency Department	Emergency physicians	Prospective	904	619	55.82	590	314	MRI / CT	AIS+HS+TIA
Abdelaati, 2022, Egypt	Emergency Department	Emergency physicians	Prospective	92	37	55.09	60	32	CT	AIS+HS+TIA
Benjamin, 2013, UK	NR	Neurologist	Retrospective	56	15	38.8	18	38	MRI / CT	AIS+HS+TIA
Byrne, 2011, UK	Emergency Department	Trained nurses	Prospective	100	63	69.88	78	28	MRI / CT	AIS+HS+TIA
Chen, 2016, China	Pre-hospital	NR	Prospective	114	NR	46.25	65	49	NR	NR
Chen, 2017, China	Emergency Department	Emergency physicians	Prospective	160	NR	75.4	100	60	CT	NR
Chen, 2018, China	Pre-hospital	Emergency physicians	Prospective	80	NR	NR	50	30	NR	NR
Deng, 2015, China	Emergency department	NR	NR	127	NR	NR	86	41	NR	NR
Fothergill, 2013, UK	Pre-hospital	Ambulance clinicians	Prospective	295	156	65	177	118	MRI / CT	AIS+HS+TIA
Ginting, 2017, Malaysia	Emergency Department	Emergency physicians	Prospective	66	36	55.41	63	3	CT	AIS+HS+TIA
He, 2017, China	Emergency Department	General Practitioners	Prospective	468	276	67.54	332	136	MRI / CT	AIS+HS+TIA
He, 2012, China	Pre-hospital	Emergency physicians	Prospective	540	365	63	379	161	MRI / CT	AIS+HS+TIA
He, 2011, China	Pre-hospital	Emergency physicians	Prospective	108	NR	62	70	38	NR	NR
Huang, 2018, China	Emergency Department	Emergency physicians	Prospective	200	NR	52.7	100	100	NR	NR
Jackson, 2008, Ireland	Emergency Department	Emergency physicians	Prospective	50	24	73	46	4	MRI / CT	NR
Ji, 2017, China	Emergency Department	Emergency physicians	Prospective	120	NR	NR	84	36	NR	NR
Jiang, 2014, China	Emergency Department	Trained, specialist stroke nurses or a consultant in emergency medicine	Prospective	715	382	70.55	371	344	MRI / CT	AIS+HS+TIA
Lee, 2015, Korea	Emergency Department	Emergency physicians	Prospective	312	141	59.7	113	199	MRI / CT	AIS+HS+TIA
Li, 2012, China	Emergency Department	Emergency physicians	Prospective	90	NR	NR	58	32	NR	NR
Li, 2013, China	Emergency Department	Neurologists	Prospective	216	NR	62	140	76	NR	NR
Li, 2016, China	Pre-hospital	General Practitioners	Prospective	219	NR	65.2	172	47	NR	NR
Mao, 2016, China	Emergency Department	Emergency physicians	Prospective	416	247	69.38	358	58	MRI / CT	AIS+HS+TIA
Nor, 2005 a, UK	Emergency Department	Emergency physicians	Prospective	343	165	70.48	176	167	MRI / CT	AIS+HS+TIA
Nor, 2005 b, UK	Emergency Department	Emergency physicians	Prospective	160	94	71.36	101	59	MRI / CT	AIS+HS+TIA
Purrucker, 2015, Germany	Emergency Department	Staff and emergency physicians	Retrospective	658	357	61.7	191	467	MRI / CT	AIS+HS+TIA
Saberian, 2021, Iran	Emergency Department	Emergency medicine resident and three emergency medicine specialists	Retrospective	805	463	66.9	562	243	MRI	AIS

Table 1: Characteristics of the included studies

Author	Setting	Investigator	Design	Sample size	Male (n)	Mean age	Stroke (n)	Non-stroke (n)	References	Stroke group definition
Sahin, 2021, Turkey	Emergency Department	Emergency medicine specialist or the senior emergency medical assistant	Prospective	335	167	NR	178	157	MRI / CT	AIS+HS+TIA
Sang, 2015, China	Emergency Department	Emergency physicians	Prospective	237	NR	66.23	177	60	NR	NR
Sun, 2012, China	Pre-hospital	General Practitioners	Prospective	100	NR	NR	62	38	NR	NR
Terzoni, 2021, Italy	Emergency Department	Emergency nurses	Prospective	539	300	73	424	115	MRI / CT	AIS+HS+TIA
Whiteley, 2011, UK	Emergency Department	Neurologists	Prospective	356	173	72	246	110	MRI	AIS+HS+TIA
Yang, 2015, China	Pre-hospital	Emergency physicians	Prospective	114	NR	63.12	65	49	MRI / CT	AIS+HS+TIA
Yu, 2018, China	Emergency Department	Neurologists, Emergency nurses	Prospective	84	NR	52.83	48	36	MRI / CT	NR
Zangi, 2021, Iran	Emergency Department	Emergency physicians	Retrospective	356	186	65.2	151	205	MRI	AIS

AIS: Acute Ischemic Stroke, HS: Hemorrhagic Stroke, TIA: Transient Ischemic Attack, NR: Not Reported, MRI: Magnetic Resonance Imaging; CT: Computed Topography. All studies used the cutoff point 1 for ROSIER.

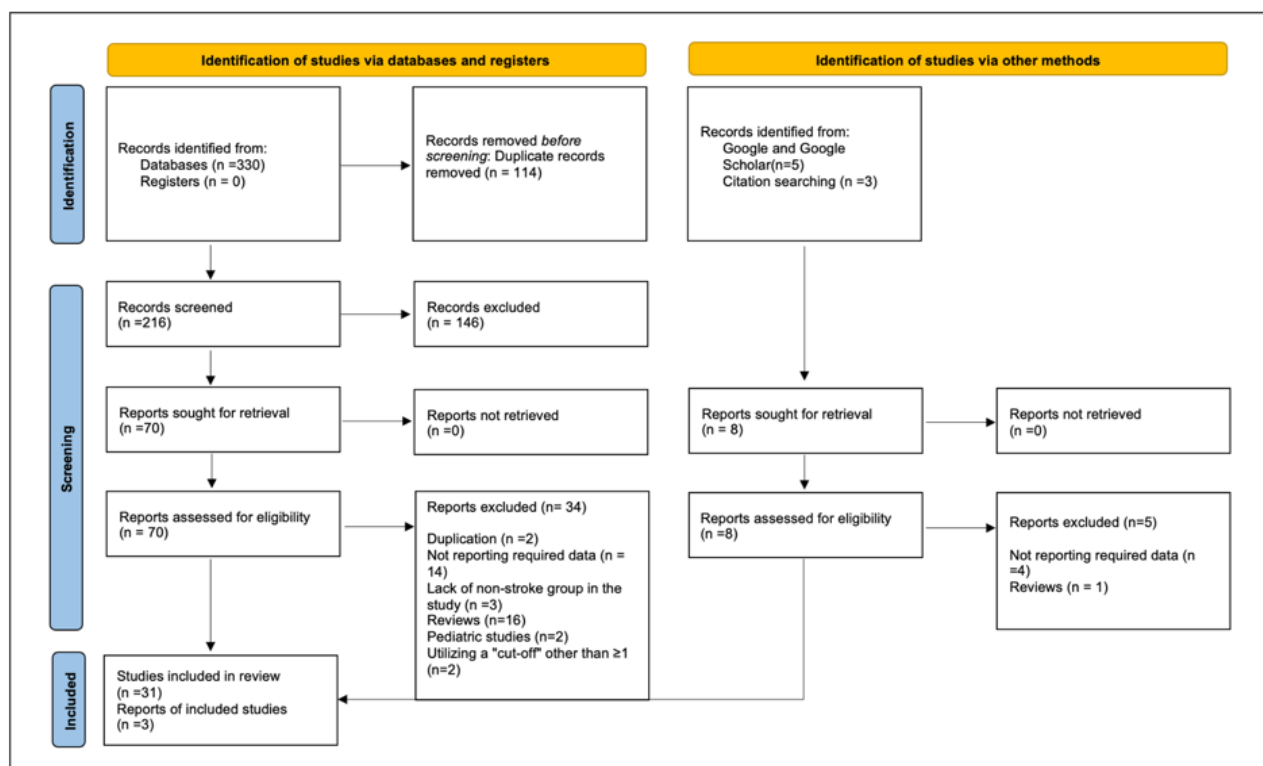
**Figure 1:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart of the study.

Table 2: Performance values of NEXUS and CCR in detection of CSI

Study	Risk of bias				Applicability		
	Patient selection	Index test	Reference standard	Flow & timing	Patient selection	Index test	Reference standard
Aaron, 2020	L	L	U	U	L	L	L
Abdelaati, 2022	L	L	U	L	L	L	L
Benjamin 2013	L	L	L	L	L	L	L
Byrne, 2011	L	L	L	L	L	L	L
Chen, 2016	U	L	U	U	L	L	U
Chen, 2017	L	L	L	U	L	L	U
Deng, 2015	L	L	U	U	L	L	U
Fothergill, 2013	L	L	U	L	L	L	L
Ginting, 2017	L	L	U	U	L	L	L
He, 2011	U	L	U	U	L	L	U
He, 2012	L	L	L	U	L	L	L
He, 2017	L	L	L	L	L	L	L
Huang, 2018	L	L	U	U	L	L	U
Jackson, 2008	L	L	U	U	L	L	L
Ji, 2017	L	L	U	U	L	L	U
Jiang, 2014	L	L	U	U	L	L	L
Lee, 2015	L	L	U	H	L	L	L
Li, 2012	U	L	U	U	L	L	U
Li, 2013	U	L	U	U	L	L	U
Li, 2016	U	L	U	U	L	L	U
Mao, 2016	L	L	U	U	L	L	L
Nor, 2005	L	L	L	U	L	L	L
Purrucker ,2015	L	L	L	H	L	L	L
Saberian, 2021	L	L	L	H	L	L	L
Sahin, 2021	L	L	U	U	L	L	L
Sang, 2015	L	L	U	U	L	L	U
Sun, 2012	L	L	U	U	L	L	U
Terzoni, 2021	L	L	L	L	L	L	L
Whiteley, 2011	L	L	L	L	L	L	L
Yang, 2015	L	L	L	U	L	L	L
Yu, 2018	L	L	U	U	L	L	U
Zangi, 2021	L	L	L	U	L	L	H

L: Low risk, U: Unclear risk, H: High risk.

Table 3: Certainty of evidence for performance of Recognition of Stroke in the Emergency Room (ROSIER) scale in detection of strokes and transient ischemic attacks (TIAs)

Outcome	Sample size Event rate (%)	Risk of bias	Heterogeneity (I ² value)	Indirectness	Imprecision	Publication bias	Other considerations
Stroke	9535 5913 (62.01)	Serious	Serious Sens: 91.87% Spec: 94.90% OR: 100%	Not serious	Not serious	Not present	Very large magnitude of effect Plausible confounders

Sens: sensitivity; Spec: specificity; OR: Odds ratio.

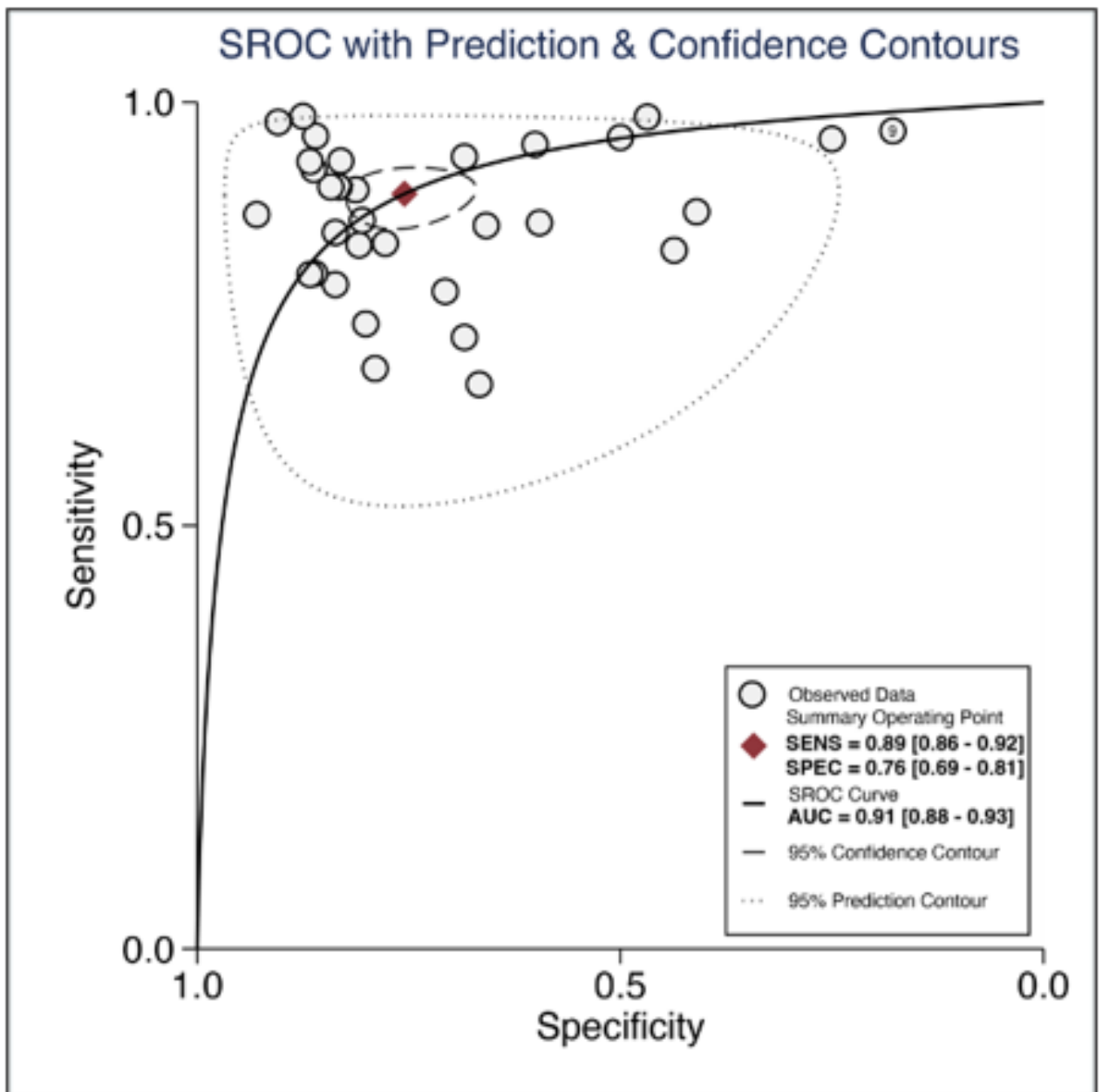


Figure 2: The area under the curve (AUC) of Recognition of Stroke in the Emergency Room (ROSIER) in detection of stroke and transient ischemic attack (TIA) in suspected patients.

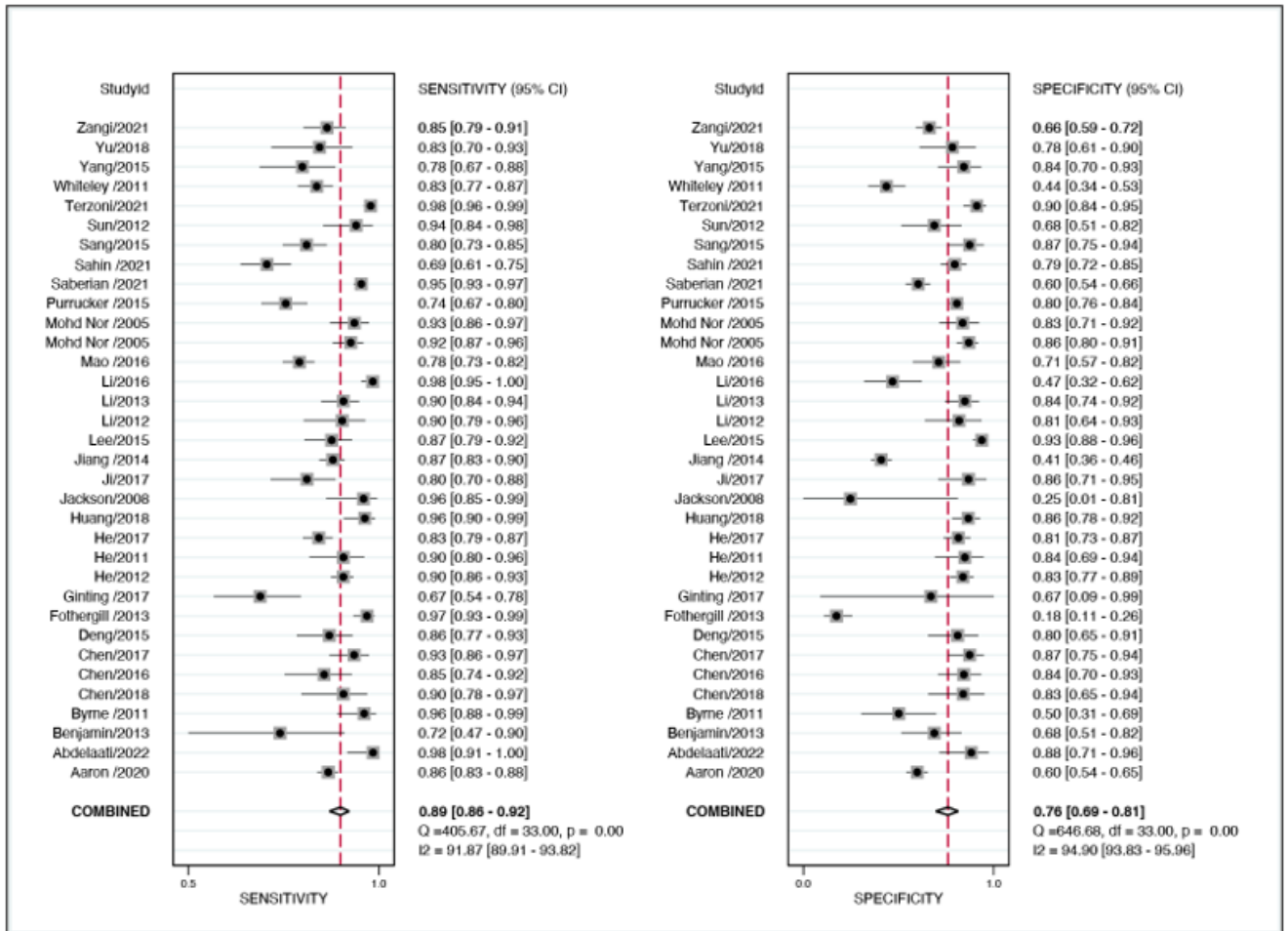


Figure 3: Sensitivity and specificity forest plot of Recognition of Stroke in the Emergency Room (ROSIER) in detection of stroke and transient ischemic attack (TIA) in suspected patients.

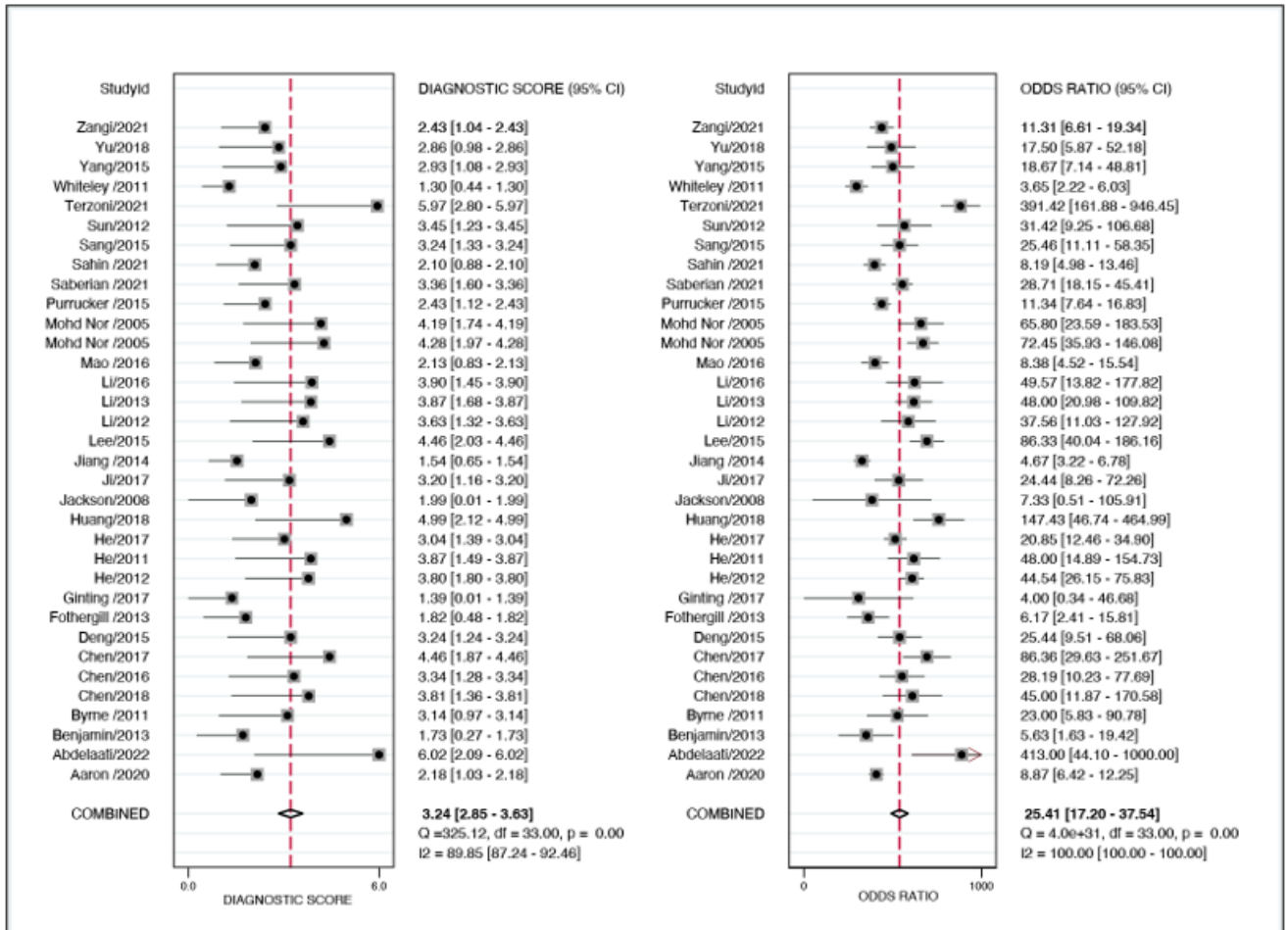


Figure 4: Diagnostic odds ratio of Recognition of Stroke in the Emergency Room (ROSIER) in detection of stroke and transient ischemic attack (TIA) in suspected patients.

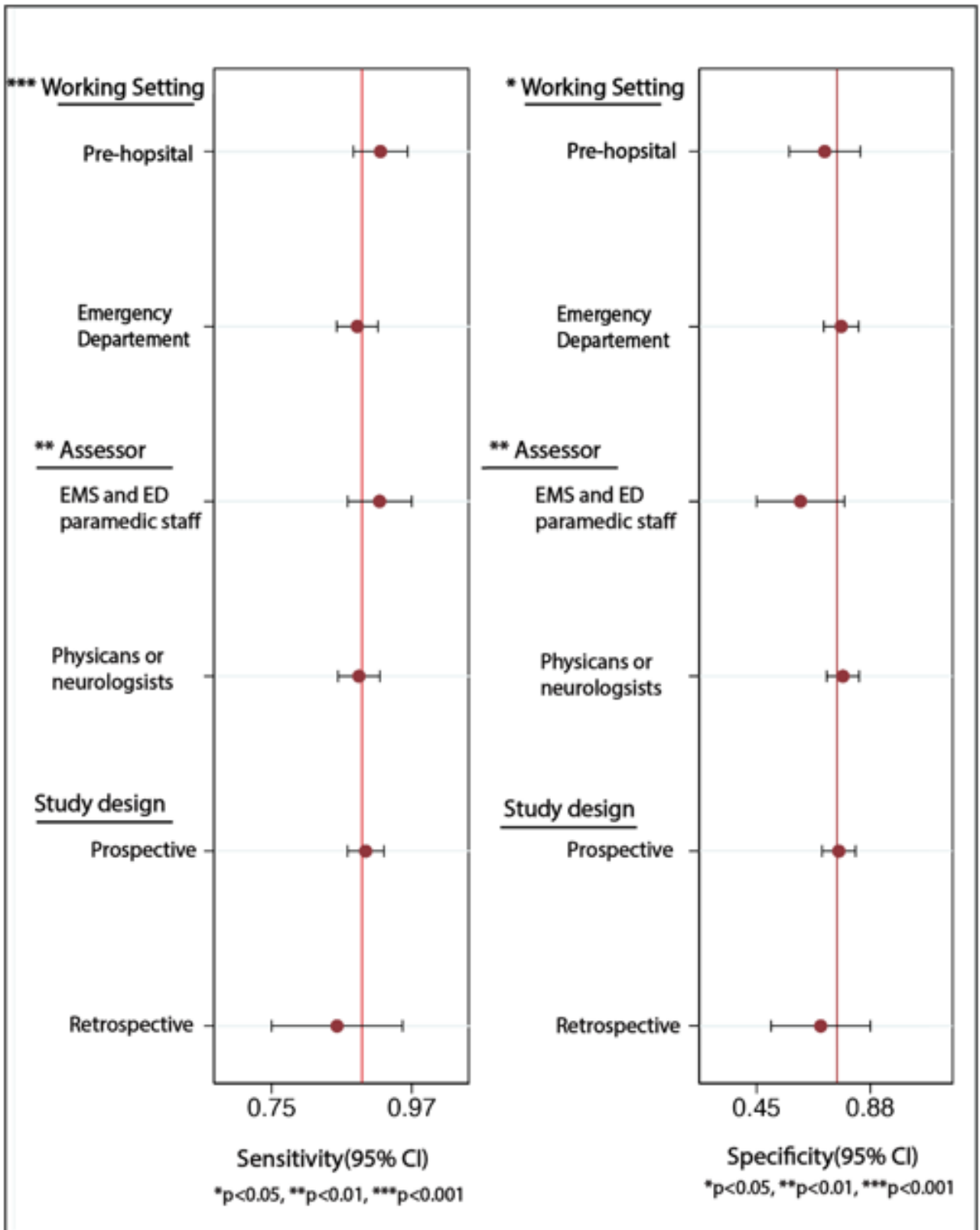


Figure 5: The forest plot for subgroup analysis, focusing on examining variations in the combined sensitivity and specificity of the Recognition of Stroke in the Emergency Room (ROSIER) scale.

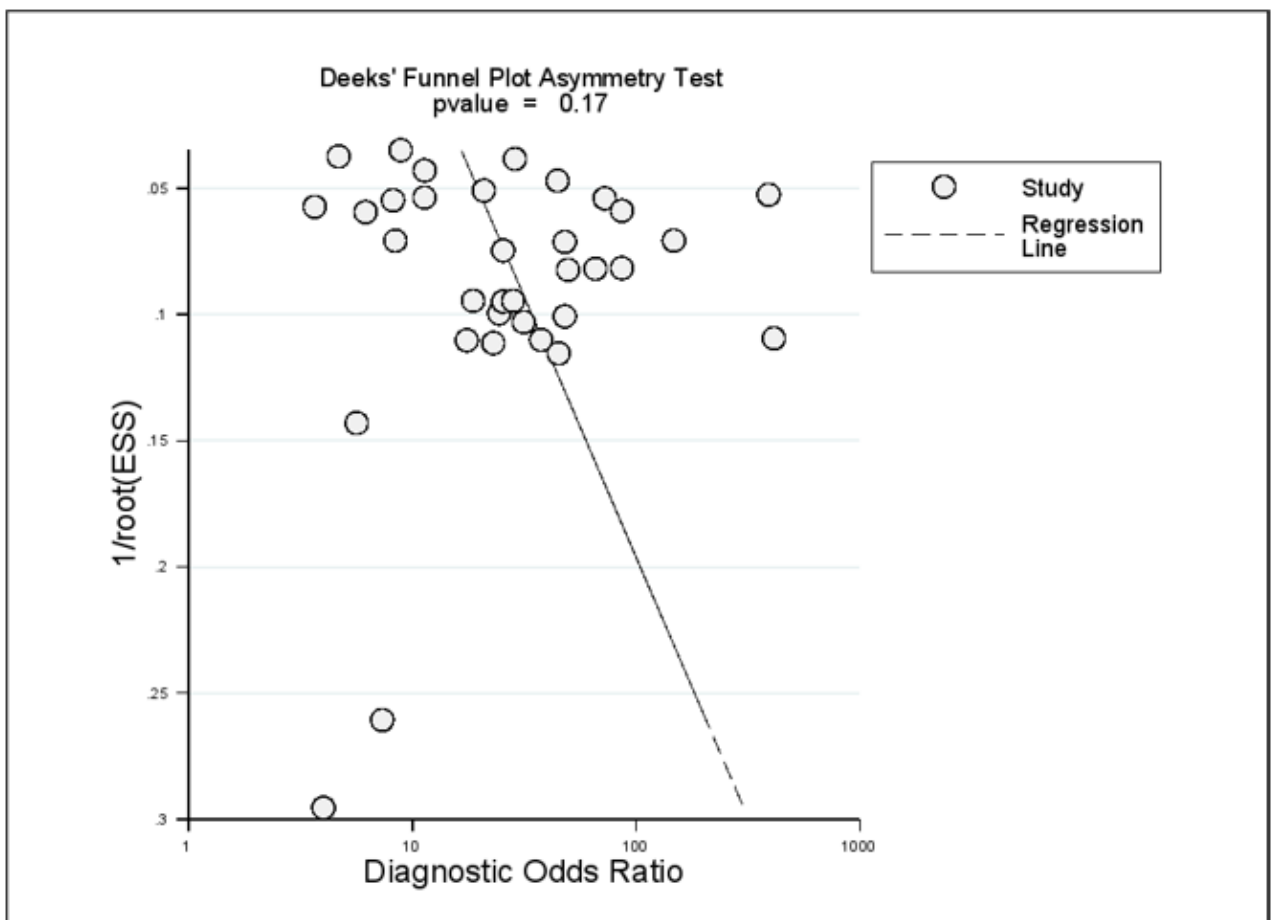


Figure 6: Publication bias of the included studies.

Supplementary table 1: Search strategy

<p>PubMed: "Stroke"[mh] OR "Ischemic Stroke"[mh] OR "Embolic Stroke"[mh] OR "Cerebral Infarction"[mh] OR "Infarction, middle cerebral artery"[mh] OR "Brain infarction"[mh] OR "Stroke, Lacunar"[mh] OR "Thrombotic Stroke"[mh] OR "Brain Stem Infarctions"[mh] OR "Infarction, Anterior Cerebral Artery"[mh] OR "Cerebral Infarction"[mh] OR "Hypoxia-Ischemia, Brain"[mh] OR "Brain Ischemia"[mh] OR "Arterial Occlusive Diseases"[mh] OR Stroke[tiab] OR Cerebral Infarction[tiab] OR Brain infarction[tiab] OR middle cerebral artery infarct*[tiab] OR middle cerebral artery occlusion[tiab] OR Cerebral Infarct*[tiab] OR Brain Infarct*[tiab] OR Hemorrhagic Strokes[tiab] OR Stroke[tiab] OR Cerebrovascular Accident[tiab] OR Cerebrovascular Accident, [tiab] OR Apoplexy[tiab] OR Brain Vascular Accident*[tiab] OR Cryptogenic Embolism[tiab] OR Cerebral Infarct*[tiab] OR Subcortical Infarction[tiab] OR Choroidal Artery Infarction [tiab] OR MCA Infarction[tiab] OR Cerebral Artery Infarction[tiab] OR Cerebral Artery Embol*[tiab] OR Cerebral Artery Occlusion[tiab] OR Cerebral Artery Thromb*[tiab] OR Brain Venous Infarction[tiab] OR cerebral ischemia reperfusion injury[tiab] OR brain ischemia reperfusion injury[tiab] OR brain ischemic reperfusion injury[tiab] OR brain ischemia/reperfusion[tiab] OR cerebral ischemia/reperfusion[tiab] OR cerebral reperfusion injury[tiab] OR reperfusion brain injury[tiab] OR acute cerebrovascular lesion[tiab] OR acute focal cerebral vasculopathy[tiab] OR brain vascular accident[tiab] OR cerebrovascular injury[tiab] OR cortical infarction[tiab] OR hemisphere infarct*[tiab] OR hemispheric infarct*[tiab] OR brain stem infarction*[tiab] OR brainstem infarction[tiab] OR cerebellar infarction[tiab] OR brain ischemia[tiab] OR brain ischaemic attack[tiab] OR brain ischemic attack[tiab] OR Cerebrovascular Stroke[tiab] OR Arterial Occlusive Disease[tiab] OR Arterial Obstructive Diseases[tiab] OR Arterial Obstructive Disease[tiab] OR peripheral occlusive artery disease[tiab] OR hypoxic ischemic encephalopathy [tiab] OR stroke patient[tiab] OR peripheral occlusive artery disease[tiab] OR hypoxic ischemic encephalopathy[tiab] AND Recognition of Stroke in the Emergency Room[tiab] OR ROSIER[tiab]</p>
<p>Embase: 'cerebral ischemia reperfusion injury'/exp OR 'cerebrovascular accident'/exp OR 'cardioembolic stroke'/exp OR 'brain infarction'/exp OR 'brain stem infarction'/exp OR 'cerebellum infarction'/exp OR 'brain ischemia'/exp OR 'transient ischemic attack'/exp OR 'stroke patient'/exp OR 'peripheral occlusive artery disease'/exp OR 'hypoxic ischemic encephalopathy'/exp OR 'Stroke':ab,ti OR 'Cerebral Infarction':ab,ti OR 'Brain infarction':ab,ti OR 'middle cerebral artery infarct*':ab,ti OR 'middle cerebral artery occlusion':ab,ti OR 'Cerebral Infarct*':ab,ti OR 'Brain Infarct*':ab,ti OR 'Hemorrhagic Strokes':ab,ti OR 'Stroke':ab,ti OR 'Cerebrovascular Accident':ab,ti OR 'Cerebrovascular Accident,':ab,ti OR 'Apoplexy':ab,ti OR 'Brain Vascular Accident*':ab,ti OR 'Cryptogenic Embolism':ab,ti OR 'Cerebral Infarct*':ab,ti OR 'Subcortical Infarction':ab,ti OR 'Choroidal Artery Infarction':ab,ti OR 'MCA Infarction':ab,ti OR 'Cerebral Artery Infarction':ab,ti OR 'Cerebral Artery Embol*':ab,ti OR 'Cerebral Artery Occlusion':ab,ti OR 'Cerebral Artery Thromb*':ab,ti OR 'Brain Venous Infarction':ab,ti OR 'cerebral ischemia reperfusion injury':ab,ti OR 'brain ischemia reperfusion injury':ab,ti OR 'brain ischemic reperfusion injury':ab,ti OR 'brain ischemia/reperfusion':ab,ti OR 'cerebral ischemia/reperfusion':ab,ti OR 'cerebral reperfusion injury':ab,ti OR 'reperfusion brain injury':ab,ti OR 'acute cerebrovascular lesion':ab,ti OR 'acute focal cerebral vasculopathy':ab,ti OR 'brain vascular accident':ab,ti OR 'cerebrovascular injury':ab,ti OR 'cortical infarction':ab,ti OR 'hemisphere infarct*':ab,ti OR 'hemispheric infarct*':ab,ti OR 'brain stem infarction*':ab,ti OR 'brainstem infarction':ab,ti OR 'cerebellar infarction':ab,ti OR 'brain ischemia':ab,ti OR 'brain ischaemic attack':ab,ti OR 'brain ischemic attack':ab,ti OR 'stroke patient':ab,ti OR 'peripheral occlusive artery disease':ab,ti OR 'hypoxic ischemic encephalopathy':ab,ti OR 'Infarction, Anterior Cerebral Artery':ab,ti OR 'Cerebral Infarction':ab,ti OR 'Hypoxia-Ischemia, Brain':ab,ti OR 'Brain Ischemia':ab,ti OR 'Arterial Occlusive Diseases':ab,ti AND 'Recognition of Stroke in the Emergency Room':ab,ti OR 'ROSIER':ab,ti</p>
<p>SCOPUS: TITLE-ABS-KEY ("Stroke" OR "Cerebral Infarction" OR "Brain infarction" OR "middle cerebral artery infarct*" OR "middle cerebral artery occlusion" OR "Cerebral Infarct*" OR "Brain Infarct*" OR "Hemorrhagic Strokes" OR "Stroke" OR "Cerebrovascular Accident" OR "Cerebrovascular Accident," OR "Apoplexy" OR "Brain Vascular Accident*" OR "Cryptogenic Embolism" OR "Cerebral Infarct*" OR "Subcortical Infarction" OR "Choroidal Artery Infarction" OR "MCA Infarction" OR "Cerebral Artery Infarction" OR "Cerebral Artery Embol*" OR "Cerebral Artery Occlusion" OR "Cerebral Artery Thromb*" OR "Brain Venous Infarction" OR "cerebral ischemia reperfusion injury" OR "brain ischemia reperfusion injury" OR "brain ischemic reperfusion injury" OR "brain ischemia/reperfusion" OR "cerebral ischemia/reperfusion" OR "cerebral reperfusion injury" OR "reperfusion brain injury" OR "acute cerebrovascular lesion" OR "acute focal cerebral vasculopathy" OR "brain vascular accident" OR "cerebrovascular injury" OR "cortical infarction" OR "hemisphere infarct*" OR "hemispheric infarct*" OR "brain stem infarction*" OR "brainstem infarction" OR "cerebellar infarction" OR "brain ischemia" OR "brain ischaemic attack" OR "brain ischemic attack" OR "Infarction, Anterior Cerebral Artery" OR "Cerebral Infarction" OR "Hypoxia-Ischemia, Brain" OR "Brain Ischemia" OR "Arterial Occlusive Diseases" OR "peripheral occlusive artery disease" OR "hypoxic ischemic " OR "stroke patient" OR "peripheral occlusive artery disease" OR "hypoxic ischemic encephalopathy") AND TITLE-ABS-KEY ("Recognition of Stroke in the Emergency Room" OR "ROSIER")</p>
<p>WEB OF SCIENCE: ALL=("Stroke" OR "Cerebral Infarction" OR "Brain infarction" OR "middle cerebral artery infarct*" OR "middle cerebral artery occlusion" OR "Cerebral Infarct*" OR "Brain Infarct*" OR "Hemorrhagic Strokes" OR "Stroke" OR "Cerebrovascular Accident" OR "Cerebrovascular Accident," OR "Apoplexy" OR "Brain Vascular Accident*" OR "Cryptogenic Embolism" OR "Cerebral Infarct*" OR "Subcortical Infarction" OR "Choroidal Artery Infarction" OR "MCA Infarction" OR "Cerebral Artery Infarction" OR "Cerebral Artery Embol*" OR "Cerebral Artery Occlusion" OR "Cerebral Artery Thromb*" OR "Brain Venous Infarction" OR "cerebral ischemia reperfusion injury" OR "brain ischemia reperfusion injury" OR "brain ischemic reperfusion injury" OR "brain ischemia/reperfusion" OR "cerebral ischemia/reperfusion" OR "cerebral reperfusion injury" OR "reperfusion brain injury" OR "acute cerebrovascular lesion" OR "acute focal cerebral vasculopathy" OR "brain vascular accident" OR "cerebrovascular injury" OR "cortical infarction" OR "hemisphere infarct*" OR "hemispheric infarct*" OR "brain stem infarction*" OR "brainstem infarction" OR "cerebellar infarction" OR "brain ischemia" OR "brain ischaemic attack" OR "brain ischemic attack" OR "Infarction, Anterior Cerebral Artery" OR "Cerebral Infarction" OR "Hypoxia-Ischemia, Brain" OR "Brain Ischemia" OR "Arterial Occlusive Diseases" OR "peripheral occlusive artery disease" OR "hypoxic ischemic " OR "stroke patient" OR "peripheral occlusive artery disease" OR "hypoxic ischemic encephalopathy") AND ALL=("Recognition of Stroke in the Emergency Room" OR "ROSIER")</p>