Supplementary file

Appendix 1. Search strategy

Searched on July 18, 2024

PubMed

	Search strategy	Hit
#1 Score	(ACT-FAST[tiab] OR Ambulance Clinical Triage Acute Stroke Treatment[tiab] OR CG-FAST[tiab] OR "Conveniently-Grasped Field Assessment Stroke Triage"[tiab]OR CPSS[tiab] OR "Cincinnati Prehospital Stroke Scale"[tiab] OR CPSSS[tiab] OR "Cincinnati Prehospital Stroke Severity Scale"[tiab] OR ELVO[tiab] OR "Emergent Large Vessel Occlusion"[tiab] OR FACE2AD[tiab] OR "FACE(2)AD"[tiab] OR FAST[tiab] OR "Face Arm Speech Test"[tiab] OR FAST-ED[tiab] OR "Field Assessment Stroke Triage for Emergency Destination"[tiab] OR G-FAST[tiab] OR "gaze-face-arm-speech-time"[tiab] OR GUSS[tiab] OR "Gaze-face-arm-speech-time"[tiab] OR JUST[tiab] OR "Japan Urgent Stroke Triage Score"[tiab] OR KPSS[tiab] OR "Kurashiki Prehospital Stroke Scale"[tiab] OR LAMS[tiab] OR "Los Angeles Motor Scale"[tiab] OR LAPSS[tiab] OR "Los Angeles Prehospital Stroke Screen"[tiab] OR MASS[tiab] OR Melbourne Ambulance Stroke Scale[tiab] OR “Melbourne Ambulance Stroke Screen”[tiab] OR MedPACS [tiab] OR Medic Prehospital Assessment Code Stroke[tiab] OR MPSS[tiab] OR "Maria Prehospital Stroke Scale"[tiab]OR OPSS[tiab] OR "Ontario Prehospital Stroke Screening tool"[tiab] OR OPSST [tiab] OR "Ontario Prehospital Stroke Screening Tool"[tiab] OR PASS[tiab] OR Prehospital Acute Stroke Severity scale[tiab] OR PreHAST[tiab] OR "PreHospital Ambulance Stroke Test"[tiab] OR PSSS[tiab] OR “Prehospital Acute Stroke Severity”[tiab] OR “Prehospital Acute Stroke Severity Scale”[tiab] OR RACE[tiab] OR "Rapid Arterial oCclusion Evaluation"[tiab] OR ROSIER[tiab] OR ROSIER scale [tiab] OR Recognition Stroke in the Emergency Room[tiab] OR VAN[tiab] OR "Vision, Aphasia, Neglect"[tiab] OR 3I-SS[tiab] OR "3-Item Stroke Scale"[tiab] OR RACECAT[tiab] OR TRIAGE [tiab]) OR stroke screen*[tiab] OR stroke score[tiab] OR stroke scores[tiab] OR stroke scale[tiab] OR stroke scales[tiab] OR stroke recognition[tiab] OR stroke predict*[tiab] OR stroke severity scale[tiab]	1804776
#2 Stroke	"Stroke/diagnosis"[Mesh]	43085
#3 Emergency/ prehospital	("Emergency Medical Services/standards"[Mesh] OR "Emergency Medical Technicians/standards"[Mesh] OR "Emergency Service, Hospital/standards"[Mesh] OR "Severity of Illness Index"[Mesh]) OR ("emergency medical services"[MeSH Terms:noexp] OR "emergency medical service communication systems"[MeSH Terms:noexp] OR "emergency service, hospital"[MeSH Terms:noexp] OR "emergency medicine"[MeSH Terms:noexp] OR "emergency treatment"[MeSH Terms:noexp] OR "ambulances"[MeSH Terms:noexp] OR "emergency responders"[MeSH Terms:noexp] OR "allied health personnel"[MeSH Terms:noexp])	613950

	OR ("prehospital*"[Title/Abstract] OR "pre-hospital*"[Title/Abstract] OR "ambulance*"[Title/Abstract] OR "paramedic*"[Title/Abstract] OR "EMS"[Title/Abstract]) OR ("Emergency"[Title/Abstract] AND ("medical"[Title/Abstract] OR "health"[Title/Abstract]) AND ("service*"[Title/Abstract] OR "system*"[Title/Abstract] OR "worker*"[Title/Abstract] OR "personnel*"[Title/Abstract] OR "responder*"[Title/Abstract] OR "dispatcher*"[Title/Abstract] OR "unit"[Title/Abstract] OR "units"[Title/Abstract] OR "technician*"[Title/Abstract] OR "vehicle*"[Title/Abstract])) OR ("Emergency"[Title/Abstract] AND ("physician*"[Title/Abstract] OR "staff"[Title/Abstract] OR "room*"[Title/Abstract] OR "department*"[Title/Abstract]))	
#4	#2 AND #3	5324
#5	#1 OR #4	1808304
#6 LVO	(Large-vessel[tiab] OR large-artery[tiab] OR Large-vessel occlusion[tiab] OR LVO [tiab] OR emergency large-vessel occlusion[tiab] OR ELVO [tiab])	13557
#7 Vessel	(Internal carotid artery[tiab] OR ICA[tiab] OR Internal carotid artery occlusion[tiab] OR ICAO[tiab] OR Terminal internal carotid artery[tiab] OR Middle cerebral artery[tiab] OR MCA[tiab] OR middle cerebral artery occlusion[tiab] OR MCAO[tiab] OR M1[tiab] OR M2[tiab] OR Terminal internal carotid artery[tiab] OR tMCAO[tiab] OR basilar[tiab] OR basilar artery[tiab] OR basilar artery occlusion[tiab] OR BAO [tiab] OR intracranial vertebral[tiab] OR intracranial vertebral artery[tiab] OR vertebral artery occlusion[tiab]OR VAO[tiab] Infarction, Middle Cerebral Artery[Mesh])	9586
#8 Occulusion	(Occlusion*[tiab] OR thrombus[tiab] OR thrombosis[tiab] OR thrombotic[tiab] OR embolus[tiab] OR embolism[tiab] OR embolic[tiab])	471,708
#9	#6 OR #7 OR #8	479,772
#10	#5 AND #9	23959
#11	#10 NOT (animals[mh] NOT humans[mh])	21987
#12	("sensitivity and specificity"[MeSH Terms] OR predictive value of tests[MeSH] OR "Likelihood Functions"[Mesh] OR "Probability"[Mesh:NoExp] OR "Area Under Curve"[Mesh] OR "Reproducibility of Results"[Mesh] OR sensitiv*[tiab] OR accuracy[tiab] OR accurate[tiab] OR reliable[tiab] OR reliability[tiab] OR valid[tiab] OR validity[tiab] OR Likelihood ratio[tiab] OR Area under the curve[tiab] OR receiver operator characteristic[tiab] OR roc[tiab] OR Specificity[tiab] OR True positive*[tiab] OR true negative*[tiab] OR false positive*[tiab] OR false negative*[tiab] OR diagnostic odds ratio[tiab] OR predict*[tiab])	5562577
#13	#11 AND #12	5707
#14	#13 AND ("2016/10/01"[PDat] : "3000/12/31"[PDat]) AND eng[la]	3025

*We conducted the literature search from October 2016 onward, as a previous systematic review found no eligible full-text articles conducted in prehospital settings prior to that date.

CENTRAL Date Run: 18/07/2024 09:11:53

#1 (ACT-FAST:ti,ab OR "Ambulance Clinical Triage Acute Stroke Treatment":ti,ab OR CG-FAST:ti,ab OR "Conveniently-Grasped Field Assessment Stroke TriageOR CPSS":ti,ab OR "Cincinnati Prehospital Stroke Scale":ti,ab OR CPSSS:ti,ab OR "Cincinnati Prehospital Stroke Severity Scale":ti,ab OR ELVO:ti,ab OR "Emergent Large Vessel Occlusion":ti,ab OR FACE2AD:ti,ab OR FACE(2)AD:ti,ab OR FAST:ti,ab OR "Face Arm Speech Test":ti,ab OR FAST-ED:ti,ab OR "Field Assessment Stroke Triage for Emergency Destination":ti,ab OR G-FAST:ti,ab OR gaze-face-arm-speech-time:ti,ab OR GUSS:ti,ab OR Gaze-face-arm-speech-time:ti,ab OR JUST:ti,ab OR "Japan Urgent Stroke Triage Score":ti,ab OR KPSS:ti,ab OR "Kurashiki Prehospital Stroke Scale":ti,ab OR LAMS:ti,ab OR "Los Angeles Motor Scale":ti,ab OR LAPSS:ti,ab OR "Los Angeles Prehospital Stroke Screen":ti,ab OR MASS:ti,ab OR "Melbourne Ambulance Stroke Scale":ti,ab OR "Melbourne Ambulance Stroke Screen":ti,ab OR MedPACS:ti,ab OR "Medic Prehospital Assessment Code Stroke":ti,ab OR MPSS:ti,ab OR "Maria Prehospital Stroke ScaleOR OPSS":ti,ab OR "Ontario Prehospital Stroke Screening tool":ti,ab OR OPSST:ti,ab OR "Ontario Prehospital Stroke Screening Tool":ti,ab OR PASS:ti,ab OR "Prehospital Acute Stroke Severity scale":ti,ab OR PreHAST:ti,ab OR "PreHospital Ambulance Stroke Test":ti,ab OR PSSS:ti,ab OR "Prehospital Acute Stroke Severity":ti,ab OR "Prehospital Acute Stroke Severity Scale":ti,ab OR RACE:ti,ab OR "Rapid Arterial oCclusion Evaluation":ti,ab OR ROSIER:ti,ab OR "ROSIER scale":ti,ab OR "Recognition Stroke in the Emergency Room":ti,ab OR VAN:ti,ab OR "Vision, Aphasia, Neglect":ti,ab OR 3I-SS:ti,ab OR "3-Item Stroke Scale":ti,ab OR RACECAT:ti,ab OR TRIAGE:ti,ab) OR ("stroke" NEXT screen*):ti,ab OR "stroke score":ti,ab OR "stroke scores":ti,ab OR "stroke scale":ti,ab OR "stroke scales":ti,ab OR "stroke recognition":ti,ab OR ("stroke" NEXT predict*):ti,ab OR "stroke severity scale":ti,ab 136233

#2 MeSH descriptor: [Stroke] explode all trees and with qualifier(s): [diagnosis - DI] 1271

#3 MeSH descriptor: [Emergency Medical Services] explode all trees and with qualifier(s): [standards - ST] 291

#4 MeSH descriptor: [Emergency Medical Technicians] explode all trees and with qualifier(s): [standards - ST] 31

#5 MeSH descriptor: [Emergency Service, Hospital] explode all trees and with qualifier(s): [standards - ST] 146

#6 MeSH descriptor: [Severity of Illness Index] explode all trees 26720

#7 #3 OR #4 OR #5 OR #6 27020

#8 [mh ^"emergency medical services"] OR [mh ^"emergency medical service communication systems"] OR [mh ^"emergency service, hospital"] OR [mh ^"emergency medicine"] OR [mh ^"emergency treatment"] OR [mh ^ambulances] OR [mh ^"emergency responders"] OR [mh ^"allied health personnel"] 6109

#9 (prehospital*:ti,ab OR pre-hospital*:ti,ab OR ambulance*:ti,ab OR paramedic*:ti,ab OR EMS:ti,ab) 4836

#10 (Emergency:ti,ab AND (medical:ti,ab OR health:ti,ab) AND (service*:ti,ab OR system*:ti,ab OR worker*:ti,ab OR personnel*:ti,ab OR responder*:ti,ab OR dispatcher*:ti,ab OR unit:ti,ab OR units:ti,ab OR technician*:ti,ab OR vehicle*:ti,ab)) 7163

#11 (Emergency:ti,ab AND (physician*:ti,ab OR staff:ti,ab OR room*:ti,ab OR department*:ti,ab)) 19733
#12 #7 OR #8 OR #9 OR #10 OR #11 53080
#13 #2 AND #12 212
#14 #1 OR #13 136360
#15 (Large-vessel:ti,ab OR large-artery:ti,ab OR "Large-vessel occlusion":ti,ab OR LVO:ti,ab OR "emergency large-vessel occlusion":ti,ab OR ELVO:ti,ab)
("Internal carotid artery":ti,ab OR ICA:ti,ab OR "Internal carotid artery occlusion":ti,ab OR ICAO:ti,ab OR "Terminal internal carotid artery":ti,ab OR "Middle cerebral artery":ti,ab OR MCA:ti,ab OR "middle cerebral artery occlusion":ti,ab OR MCAO:ti,ab OR M1:ti,ab OR M2:ti,ab OR "Terminal internal carotid artery":ti,ab OR tMCAO:ti,ab OR basilar:ti,ab OR "basilar artery":ti,ab OR "basilar artery occlusion":ti,ab OR BAO:ti,ab OR "intracranial vertebral":ti,ab OR "intracranial vertebral artery":ti,ab OR [mh "vertebral artery occlusionOR VAO Infarction, Middle Cerebral Artery"]) 309
#16 ("Internal carotid artery":ti,ab OR ICA:ti,ab OR "Internal carotid artery occlusion":ti,ab OR ICAO:ti,ab OR "Terminal internal carotid artery":ti,ab OR "Middle cerebral artery":ti,ab OR MCA:ti,ab OR "middle cerebral artery occlusion":ti,ab OR MCAO:ti,ab OR M1:ti,ab OR M2:ti,ab OR "Terminal internal carotid artery":ti,ab OR tMCAO:ti,ab OR basilar:ti,ab OR "basilar artery":ti,ab OR "basilar artery occlusion":ti,ab OR BAO:ti,ab OR "intracranial vertebral":ti,ab OR "intracranial vertebral artery":ti,ab OR [mh "vertebral artery occlusionOR VAO Infarction, Middle Cerebral Artery"]) 66167
#17 (Occlusion*:ti,ab OR thrombus:ti,ab OR thrombosis:ti,ab OR thrombotic:ti,ab OR embolus:ti,ab OR embolism:ti,ab OR embolic:ti,ab) 37945
#18 #15 OR #16 OR #17 102253
#19 #14 AND #18 21692
#20 #19 NOT ([mh animals] NOT [mh humans]) 21681
#21 ([mh "sensitivity and specificity"] OR [mh "predictive value of tests"] OR [mh "Likelihood Functions"] OR [mh ^Probability] OR [mh "Area Under Curve"] OR [mh "Reproducibility of Results"] OR sensitiv*:ti,ab OR accuracy:ti,ab OR accurate:ti,ab OR reliable:ti,ab OR reliability:ti,ab OR valid:ti,ab OR validity:ti,ab OR "Likelihood ratio":ti,ab OR "Area under the curve":ti,ab OR "receiver operator characteristic":ti,ab OR roc:ti,ab OR Specificity:ti,ab OR ("True" NEXT positive*):ti,ab OR ("true" NEXT negative*):ti,ab OR ("false" NEXT positive*):ti,ab OR ("false" NEXT negative*):ti,ab OR "diagnostic odds ratio":ti,ab OR predict*:ti,ab) 277927
#22 #20 AND #21 3932
#23 #22 with Cochrane Library publication date Between Oct 2016 and Jul 2024 3086

*We conducted the literature search from October 2016 onward, as a previous systematic review found no eligible full-text articles conducted in prehospital settings prior to that date.

Appendix 2. QUADAS-2 evaluation

Signaling question	Answer
Patient selection domain	
Q1. Two-Gate Design Were patients with and without LVO selected separately?	- One gate study (Cohort type) - Two-gate study (case-control type) - Unknown
Q2. Patient Selection Validity Is inappropriate patient selection likely? For example: unreasonable inclusion or exclusion criteria, biased sampling, or exclusion of a significant number of patients.	- Yes, or probably Yes - No, or probably No - Unknown (Describe reasons why you chose no or unknown, if any)
Risk of Bias Evaluation: If the study used a two-gate design (Q1) or had inappropriate patient selection (Q2), rate as **High Risk**. If information is insufficient, rate as **Unclear**.	- High Risk of bias - Low Risk of bias - Unclear
Q3. Applicability to Japanese Clinical Practice Is patient selection applicable to Japanese clinical practice or similar healthcare settings?	- Yes, or probably Yes - No, or probably No - Unknown (Describe reasons why you chose no or unknown, if any)
Applicability Evaluation: If the answer to Q3 is Yes or Probably Yes**,** rate as Low Concern**.** If No or Probably No**,** rate as High Concern**.** If unclear, rate as Unclear**.**	- Low concern - High concern - Unclear
Index test domain	
Q4. Who evaluated the index test?	- Paramedics, Emergency medical technician or equivalent - Physician - Nurse - Unknown
Q5. Was the index test influenced by the definitive diagnosis? (Was the score assigned without knowledge of the final diagnosis?) *Example: If the score was calculated after paramedics had access to MRI results (i.e., not blinded), it may have influenced the evaluation.*	- No or few influence by the definitive diagnosis - May be influenced by the definitive diagnosis (Describe the reason, if any) - Unclear
Risk of Bias Evaluation: If the index test was influenced by knowledge of the diagnosis (Q5), rate as High Risk. If the index	- High Risk of bias - Low Risk of bias - Unclear

test was unlikely to be influenced by the diagnosis, rate as Low Risk. If the information is insufficient, rate as Unclear.	
Q6. Is the score applicable in the prehospital setting in Japan or equivalent environments? *Example: If ultrasound findings are part of the score, it may not be feasible in Japan or similar settings.*	- Yes, or probably yes - No, or probably no - Unknown (Describe reasons why you chose no or unknown, if any)
Applicability Evaluation: If the answer to Q6 is Yes or Probably Yes, rate as Low Concern. If No or Probably No, rate as High Concern. If the answer to Q6 is Unclear or Q4 is unknown, rate as Unclear.	- Low concern - High concern - Unclear
Reference standard domain	
Q7. Could LVO are diagnosed accurately? If there is a specific reason why misdiagnosis or missed findings may occur (e.g., the diagnosis was made based on an MRI interpreted by a junior resident, the use of non-standard examinations, or an unspecified definition or diagnostic process for LVO).	- Yes, or probably yes. LVO are diagnosed accurately. - No or probably no. There may be some reason that could lead to misdiagnosis (Describe the reason, if any) - Unknown
Risk of Bias Evaluation: If misdiagnosis may happen (Q7), rate as High Risk. If misdiagnosis is unlikely, rate as Low Risk. If the information is insufficient, rate as Unclear.	- High Risk of bias - Low Risk of bias - Unclear
Q8. Is the diagnostic process for LVO applicable in Japan or similar settings? Example: If the diagnostic process involves devices not approved in Japan, uses non-standard or unspecified procedures, or applies an LVO definition that differs from typical Japanese clinical practice.	- Yes, or probably yes. - No or probably no. - Unknown
Applicability Evaluation: If the answer to Q8 is Yes or Probably Yes, rate as Low Concern. If No or Probably No, rate as High Concern. If the answer to Q6 is Unclear or Q4 is unknown, rate as Unclear.	- Low concern - High concern - Unclear
Clinical flow domain	
Q9. How much time elapsed between the timing of score assessment and the diagnosis of LVO?	- Yes, it seems within the typical emergency care timeframe (diagnosis made within

Was it within the typical emergency care timeframe (e.g., diagnosis within 1–2 hours after scoring), or was it a situation where more than 3 hours likely passed from scoring to diagnosis?	approximately 1–2 hours after scoring) - Not reported, unclear, or likely outside the standard timeframe (please specify below)
Q10. Were there any patient dropouts between scoring and diagnosis? Example: The score was calculated by EMS, but 20% of the patients were excluded from analysis because they were transferred to another hospital and no definitive diagnosis was available.	- Likely none, or only a small number - Likely present, or unclear / unable to determine (please describe below)
Risk of Bias Evaluation: If both Q9 and Q10 show no major issues, rate as Low Risk. If either one has an issue, rate as high risk. If the information for either is insufficient, rate as Unclear.	- High Risk of bias - Low Risk of bias - Unclear

Appendix 3. GRADE evaluation

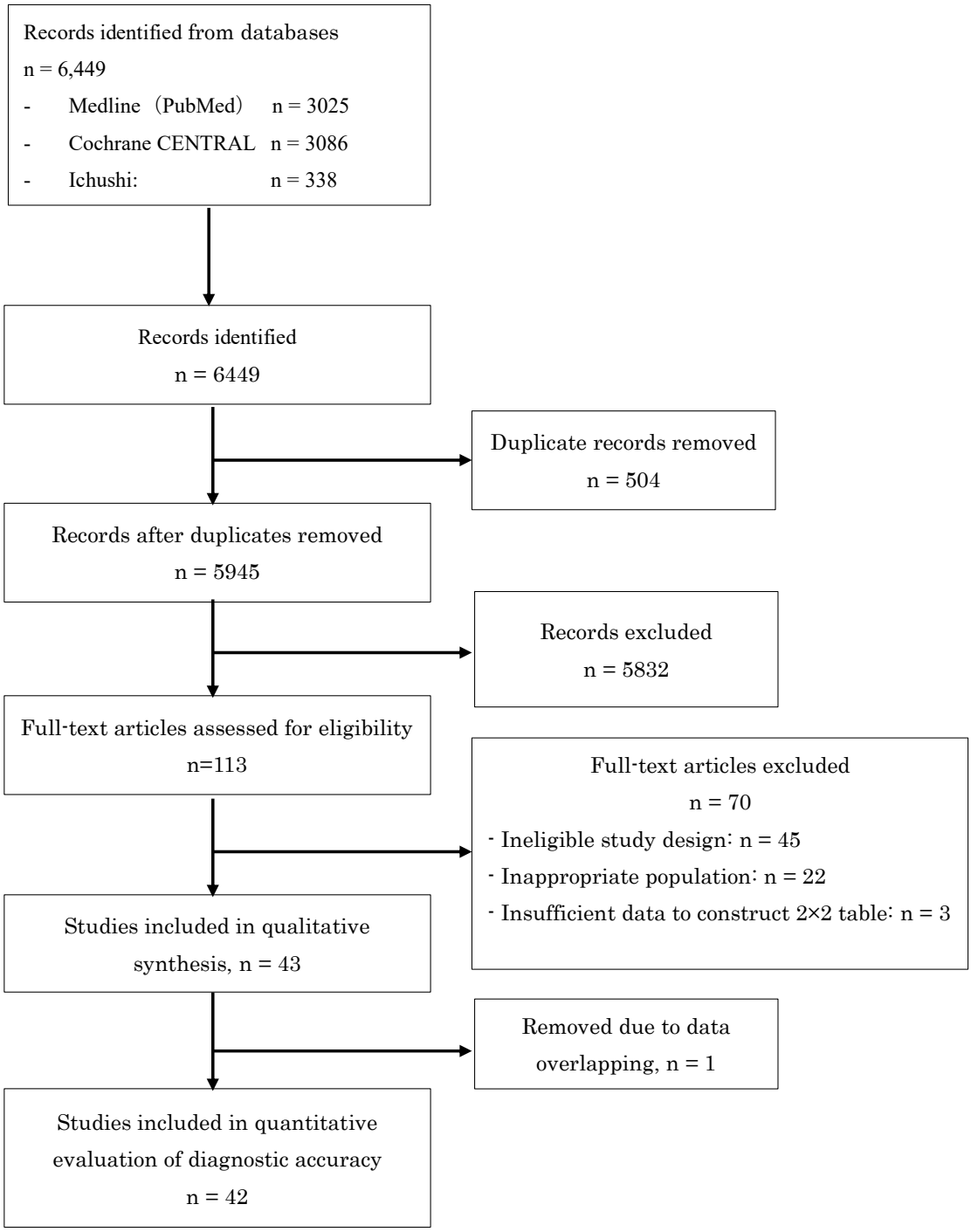
Summary of GRADE Evaluation Approach

The certainty of evidence for the diagnostic accuracy of prehospital stroke screening scores is assessed using the GRADE framework. The evaluation followed these domains:

Risk of Bias	The risk of bias is evaluated using the **QUADAS-2** tool, focusing on four domains. Overall judgment is made using the following criteria: • Not serious: When all four domains have a proportion of high or unclear risk that is approximately one-third or less. • Very serious: When two or more domains have a proportion of high or unclear risk that is approximately two-thirds or more. • Serious: All other cases not meeting the above definitions.
Indirectness	First, we evaluate whether there is a discrepancy between the ideal PICOT (Population, Intervention, Comparator, Outcome, Timing) intended for clinical decision-making and the practical PICOT applied in conducting the systematic review. If a substantial mismatch is identified, we judge that a discrepancy existed. Second, we assess applicability concerns using the QUADAS-2 framework across three domains: target population, index test, and reference standard. If two or more of these domains have 50% or more of the included studies rated as high or unclear concern, we judge that a discrepancy in applicability existed. • Not serious: When neither a discrepancy in PICOT nor a discrepancy in applicability is identified. • Very serious: When both a discrepancy in PICOT and a discrepancy in applicability are identified. • Serious: When a discrepancy is identified in either PICOT or applicability, but not both.
Inconsistency	Heterogeneity in sensitivity and specificity across studies is visually assessed using forest plots. If the variation between studies is substantial or unexplained, inconsistency is considered "serious." Otherwise, it is judged "not serious."
Imprecision	Imprecision is assessed using a net benefit framework, based on the assumption that up to 10 false positives are acceptable for each true positive (i.e., false positives are weighted as 0.1). Net benefit was calculated under assumed prevalences of 5%, 10%, and 20%.

	• If the net benefit exceeds that of both the “no testing” and “treat all” strategies, the test is deemed clinically useful (“yes, useful”). Otherwise, it is considered not useful (“no”). • To assess precision, we compare the point estimate with the lower bound and with the upper bound of the confidence intervals separately at each prevalence level. • If the judgment for both the point estimate and the corresponding bound was the same (“yes” or “no”), that comparison is considered consistent; otherwise, inconsistent. • If 2 or 3 of the 6 comparisons shows inconsistency, imprecision is rated as “serious.” • If 4 or more comparisons are inconsistent, imprecision is rated as “very serious.”
Final GRADE Rating	The total number of downgrades determines the final rating as follows: • No downgrading: High certainty • 1 downgraded: Moderate certainty • 2 downgraded: Low certainty • 3 or more downgraded: Very low certainty

Appendix 4. PRISMA Flow diagram



*We conducted the literature search from October 2016 onward, as a previous systematic review found no eligible full-text articles conducted in prehospital setting prior to the date.

Appendix 5. Details of included studies

				Desing			Inclusion			Exclusion	Index			Reference		Modality				LVO definition							
Author	Year	Sex Male(%)	Age*1	Derivation cohort	Validation cohort	Setting	Description	Inclusion Criteria Scale	Time Since Onset		Setting	Examiner	Score	Setting	Examiner	CTA	MRI	Angiography	TCD	ICA	MCA (M1)	MCA (M2)	BA	ACA	VA	PCA	Other
Carrera D	2017	53.4	70±13	NA	Pro	Spain	SAS	NR	NR	Data missing	Scene	Paramedic	RACE	ED	NR	Y	Y	Y	Y	+	+	-	+	-	-	-	-
McMullan JT	2017	52.0	63[53-75]	NA	Pro	USA	SAS	FAST test positive	NR	FAST negative, Data missing, Not transported	Scene	Paramedic	C-STAT	ED	Neurologist	Y	N	N	N	NR	NR	NR	NR	NR	NR	NR	NR
Vaclavik D	2018	51.0	73±12	Pro	NA	Czech	SAS	FAST test positive	<12h	More than 12 hours after onset	In-ambulance	Paramedic	FAST PLUS	ED	Neurologist	Y	N	N	N	+	+	+	-	-	-	-	-
Richards CT	2018	51.9	69[58-81]	NA	Retro	USA	SAS	CPSS>=1	<6h	Data missing, inhospital case	Scene	Paramedic	CPSS	ED	Neurologist	N	N	Y	N	+	+	+	+	-	-	-	-
Suzuki K	2018	57.0	74±13	Pro	NA	Japan	SAS	NR	NR	NR	Scene, In-ambulance	Paramedic	ELVO screen	ED	NR	N	Y	N	N	+	+	+	+	-	-	-	+
Dickson RL	2019	49.3	70[59-81]	NA	Retro	USA	SAS	STATS Positive	NR	Data missing, Under 16yo	In-ambulance	Paramedic	RACE	ED	Emergency physician	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Gropen TI	2019	46.9	63±14	NA	Pro	USA	SAS	NR	NR	AVPU unresponsive	Scene	Paramedic	EMSA	ED	Emergency physician	Y	Y	N	Y	+	+	-	+	-	-	-	-
Lawner BJ	2019	NR	NR	NA	Retro	USA	SAS	CPSS>=1	NR	Data missing	Scene	Paramedic	CPSS, m RACE	NR	NR	NR	NR	NR	NR	+	+	+	+	+	+	+	-
Taqi MA	2019	NR	NR	NA	Retro	USA	SAS	CPSS>=1	NR	Data Missing, Transfer from hospital	Scene, In-ambulance	Paramedic	VES	ED	Neurologist, Emergency Physician	Y	N	N	N	+	+	+	-	+	-	-	+
Carrera D	2019	NR	NR	NA	Pro	Spain	SAS	NR	NR	No imaging performed	In-ambulance	Paramedic, Nurse, Physician	RACE	ED	NR	Y	Y	N	Y	+	+	+	+	-	-	-	+
Li JL	2020	46.7	68±15*2	NA	Pro	USA	SAS	CPSS>=1	<24h	Data missing	Scene, In-ambulance	Paramedic	C-STAT	ED	NR	Y	N	N	N	+	+	-	-	-	-	-	-
Guillory BC	2020	NR	73±18*3	NA	Pro	USA	SAS	NR	<24h	NR	Scene	Paramedic, Physician	FAST-ED	ED	Emergency physician	Y	N	N	N	+	+	+	+	-	-	-	-
Okuno Y	2020	59.0	71±14	Retro	Pro	Japan	SAS	NR	<24h	No imaging performed	Scene, In-ambulance	Paramedic	FACE2AD	ED	Neurologist, Radiologist	Y	Y	Y	N	+	+	+	+	-	-	-	-

Jumaa MA	2020	44.5	73[63-82]	NA	Pro	USA	SAS	CPSS>=1	<24h	NR	In-ambulance	Paramedic	RACE	ED	Radiologist	Y	N	N	N	+	+	-	-	-	-	-
Birnbaum L	2021	NR	59*4	Pro	NA	USA	SAS	CPSS>=1	<6h	NR	Scene, In-ambulance	Paramedic	VAN	ED	Emergency physician, Neurologist	Y	N	N	N	+	+	-	+	-	+	-	-
Mulkerin WD	2021	48.0	62±12	Pro	NA	USA	SAS, stable state	English speaker	NR	Non-English Speakers, Cognitive Impairments, Vulnerable Subjects	In-ambulance	Paramedic	modified NIHSS	ED	Neurologist	Y	N	N	N	+	+	+	-	-	-	-	-
Puolakka T	2021	NR	NR	NA	Retro	Finland	SAS	NR	<9h	Transfer from hospital	Scene, In-ambulance	Paramedic	FAST-ED	ED	Radiologist	Y	N	N	N	+	+	+	+	-	-	-	-
Almqvist T	2021	51.1	77[67-86] 75[64-83]*5	Pro	NA	Sweden	SAS	NR	NR	NR	In-ambulance	Paramedic, Nurse	SSTS	ED	Radiologist	Y	N	N	N	+	+	+	+	+	+	+	+
MHC Duvekot	2021	54.0	72[61-81]	NA	Pro	Netherlands	SAS	FAST test positive	<6h	More than 6 hours after onset	Scene, In-ambulance	Paramedic	C-STAT, CG-FAST, CPSS, FAST-PLUS, G-FAST, LAMS, PASS, RACE	ED	Emergency physician, Neurologist	Y	Y	Y	N	+	+	+	+	+	+	+	+
T.T.M. Nguyen	2021	50.9	71±15	NA	Pro	Netherlands	SAS	NR	NR	NR	Scene, In-ambulance	Paramedic	C-STAT, FAST-ED, G-FAST, LAMS, PASS, RACE	ED	Neurosurgeon, Neurologist	NR	NR	NR	NR	+	+	+	-	+	-	-	-
Behnke SC	2021	50.3	78[68-85]	NA	Pro	Germany	SAS	NR	NR	Non-EMS Referrals, Critical Illness Requiring Immediate ICU Transfer	Scene	Paramedic	LAMS	ED	NR	NR	NR	NR	NR	+	+	-	+	-	-	-	-
Frank B	2021	NR	NR	NA	Pro	Germany	SAS	NR	<24h	More than 24 hours after onset	In-ambulance	Paramedic	FAST-ED	ED	Radiologist	Y	N	N	Y	+	+	+	+	-	-	-	-
Zhao H	2021	50.2	72±16	NA	Pro	Australia	SAS	NR	<24h	NR	Scene	Paramedic	ACT-FAST	NR	NR	Y	N	N	N	+	+	-	+	-	-	-	-
Daly M	2021	54.7	7.±16	NA	Pro	USA	SAS	CPSS>=1	<24h	NR	Scene	Paramedic	FAST-ED	NR	NR	Y	N	N	N	NR	NR	NR	NR	NR	NR	NR	NR
Uchida K	2021	54.0	73[63-82]	Mixed	Pro	Japan	SAS	NR	NR	No imaging performed	Scene, In-ambulance	Paramedic	JUST-7	ED	Neurosurgeon,	Y	Y	Y	N	NR	NR	NR	NR	NR	NR	NR	NR

			76[66-84]*6											Neurologist											
Crowe RP	2021	44.0	71[58-82]	NA	Retro	USA	SAS	NR	NR	NR	Scene, In-ambulance	Unknown	CPSS, RACE, LAMS, VAN	ED	Emergency physician, Neurologist	Y	Y	N	N	+	+	-	-	-	-	-	-
Bhatt NR	2021	47.4	63[56-75]	NA	Pro	USA	SAS	NR	NR	NR	Scene	Paramedic	FAST-ED	ED	Vascular neurology expert	NR	NR	NR	NR	+	+	+	+	-	-	-	+
Dowbiggin PL	2022	43.7	69±16	NA	Pro	USA	SAS	CPSS>=1	NR	Trauma	Scene	Paramedic	FAST-ED	ED	NR	Y	N	N	N	+	+	+	+	-	-	-	-
Mohamed GA	2022	47.1	70±16*7	NA	Retro	USA	SAS	NR	NR	Transfer from hospital	Scene, In-ambulance	Paramedic	CPSS	ED	NR	Y	Y	N	N	NR	NR	NR	NR	NR	NR	NR	NR
Ganesh A	2022	54.0	72[61-81]	NA	Pro	Netherlands	SAS	FAST test positive	<6h	NR	Scene, In-ambulance	Paramedic	CPSS, FAST-PLUS, G-FAST, LAMS, PASS, RACE	ED	Neurologist, Radiologist	Y	Y	Y	N	+	+	+	-	-	-	-	+
Glober NK	2022	56.1	58[50-67]	NA	Retro	USA	SAS	NR	NR	NR	Scene	Paramedic	RACE	ED	Neurologist, Radiologist	Y	N	N	N	+	+	+	-	-	-	-	-
Carbonera LA	2022	56.8	68*8	NA	Pro	Brazil	SAS	NR	NR	Data missing	In-ambulance	Paramedic	FAST-ED	ED	NR	Y	N	N	N	+	+	-	+	-	-	-	-
El Koussa R	2022	54.6	70±15	Pro	NA	USA	SAS	NR	NR	NR	Scene	Paramedic	mG-FAST	ED	NR	Y	N	N	N	+	+	+	+	+	-	-	-
Gude MF	2022	45.1	70±14	NA	Pro	Denmark	SAS	NR	NR	With coma	Scene	Paramedic	PreSS	ED	Neurologist, Radiologist	Y	Y	Y	N	+	+	+	+	-	-	-	-
Krebs S	2022	42.2	76[64-82] 73[60-80]*9	NA	Pro	Australia	SAS	NR	<5h	Prestroke mRS >4	In-ambulance	Paramedic	APSS	ED	Radiologist	Y	Y	N	N	-	+	+	+	+	-	+	+
Nehme A	2022	47.0	75±15	NA	Pro	Canada	SAS	CPSS=3	NR	NR	In-ambulance	Paramedic	C-STAT	ED	Neurologist	Y	N	N	N	+	+	+	-	-	-	-	-
Wasyliw S	2022	53.0	75[16-105]	NA	Pro	Canada	SAS	NR	NR	No imaging performed	Scene, In-ambulance	Paramedic	FAST VAN	ED	Neurologist, Radiologist	Y	N	N	N	+	+	+	-	-	-	-	-
Thavarajah S	2022	50.0	69±15	NA	Retro	USA	SAS	NR	NR	No imaging performed	Scene	Paramedic	RACE	ED	Vascular neurology expert	Y	N	N	N	+	+	+	+	-	-	-	+
C Garcia-Esperon	2023	58.1	76[65-83]	Pro	Pro	Australia	SAS	FAST test positive	<24h	Prestroke mRS >3	Scene, In-ambulance	Paramedic	The Hunter-8 Scale	ED	Neurologist	Y	N	N	N	+	+	+	+	-	-	-	-
Ollikainen J	2023	NR	77[74-	NA	Pro	Finland	SAS	NR	<6h	No CTA, Contraindications to	Scene	Paramedic	FPSS	ED	Neurologist	Y	N	N	N	+	+	+	+	+	-	-	-

			80]*10							recanalization therapy																
Leto N	2024	48.9	77[67-84]*10	NA	Retro	Norway	SAS	NR	NR	Data missing	Scene	Paramedic	G-FAST	ED	Emergency physician, Neurologist, Radiologist	Y	Y	N	N	+	+	+	+	+	-	-	+
Ali M	2024	52.8	73[61-81]	NA	Pro	Netherlands	SAS	NR	<6h	Unknown onset time, More than 6 hours after onset	In-ambulance	Paramedic	CG-FAST, CPSS, C-STAT, FAST-PLUS, G-FAST, LAMS, PASS, RACE	ED	Neurologist, Radiologist	Y	N	N	N	+	+	+	-	+	-	-	-
Takahashi Y	2024	54.9	75*11	NA	Retro	Japan	SAS	NR	NR	NR	Scene, In-ambulance	Paramedic	ELVO screen	ED	Neurologist	Y	N	N	N	+	+	+	-	-	-	-	-

Note: SAS: Suspected Acute Stroke, NA: No assessment, NR: No record

*1: Age is presented as mean ± standard deviation (SD) when available; otherwise, it is shown as median [interquartile range (IQR)].

*2: The overall mean ± SD was calculated using weighted means and pooled variance from the three groups: Acute ischemic stroke, Non-ischemic stroke, and Non-stroke.

*3: The mean ± SD was approximated using the reported 95% confidence interval and the number of subjects (n=135).

*4: Only an approximate mean age was reported (59 years); SD and CI were not available.

*5: Median ages for late-presenting and early-presenting patients are presented separately, as a combined median could not be calculated without access to individual-level data.

*6: Medians are shown separately for development and validation cohorts, as reported in the original data.

*7: The overall mean ± SD was calculated by pooling the two groups (Pre-Protocol and Post-Protocol) using weighted means and pooled variance.

*8: Median reported without interquartile range in the original source.

*9: Median ages for the Before and After groups are presented separately, as both were reported independently with interquartile ranges (IQRs) in the original source

*10: As the original publication presented age data separately for multiple subgroups and provided only median and interquartile ranges (IQRs), the values for patients with LVO (large vessel occlusion) are shown here for clarity. A combined summary could not be calculated.

*11: The overall mean age was calculated as a weighted average based on the number of patients in each hospital group.

Appendix 6. Risk of bias and applicability (QUDAS-2 tool)

		Patient Selection		Index test		Reference standard		Clinical Flow
Author	Year	Bias	Applicability	Bias	Applicability	Bias	Applicability	Bias
Carrera D et al	2017	Low	Low	Low	Low	Low	Low	Low
McMullan JT et al	2017	High*1	Low	Low	Low	High*2	High*2	Low
Vaclavik D et al	2018	Low	Low	Low	Low	Low	Low	Low
Richards CT et al	2018	Low	Low	Low	Low	Low	Low	Low
Suzuki K et al	2018	Low	Low	Low	Low	Low	Low	High *3
Dickson RL et al	2019	Low	Low	Low	Low	High*4	High*4	Low
Gropen TI et al	2019	High*5	Low	Low	Low	Low	Low	Low
Lawner BJ et al	2019	Low	Low	Low	Low	Low	Low	High *6
Taqi MA et al	2019	Low	Low	Low	Low	Low	Low	Low
Carrera D et al	2019	High*7	Low	Low	Low	Low	Low	Low
Li JL et al	2020	Low	Low	Low	Low	Low	Low	Low
Guillory BC et al	2020	Low	Low	Low	Low	Low	Low	Low
Okuno Y et al	2020	Low	Low	Low	Low	Low	Low	Low
Jumaa MA et al	2020	Low	High *8	Low	Low	Low	Low	Low
Birnbaum L et al	2021	Low	High *9	Low	Low	Low	Low	High *10
Mulkerin WD et al	2021	Low	Low	Low	Low	Low	Low	Low
Puolakka T et al	2021	Low	Low	Low	Low	Low	Low	Low
Almqvist T et al	2021	Low	Low	Low	Low	Low	Low	Low
MHC Duvekot et al	2021	Low	Low	Low	Low	Low	Low	High *11
T.T.M. Nguyen et al	2021	Low	Low	Low	Low	Low	Low	High *12
Behnke SC et al	2021	Low	Low	Low	Low	Low	Low	Low
Frank B et al	2021	High*13	High*13	Low	Low	Low	Low	Low
Zhao H et al	2021	Low	Low	Low	Low	Low	Low	Low
Daly M et al	2021	Low	Low	Low	Low	Low	Low	Low
Uchida K et al	2021	Low	Low	Low	Low	Low	Low	Low
Crowe RP et al	2021	High*14	Low	Low	Low	Low	Low	Low
Bhatt NR et al	2021	High*15	High*16	Low	Low	Low	Low	Low
Dowbiggin PL et al	2022	Low	Low	Low	Low	Low	Low	Low
Mohamed GA et al	2022	Low	Low	Low	Low	High*2	Low	Low
Ganesh A et al	2022	Low	Low	Low	Low	Low	Low	Low
Glober NK et al	2022	Low	Low	Low	Low	Low	Low	Low
Carbonera LA et al	2022	Low	Low	Low	Low	Low	Low	Low
El Koussa R et al	2022	Low	High *17	Low	Low	Low	Low	Low
Gude MF et al	2022	Low	Low	Low	High *18	Low	Low	Low
Krebs S et al	2022	Low	Low	Low	Low	Low	Low	High *19

Nehme A et al	2022	High*20	Low	Low	Low	Low	Low	Low
Wasyliw S et al	2022	High*21	Low	Low	Low	Low	Low	Low
Thavarajah S et al	2022	Low	Low	Low	Low	Low	Low	Low
C Garcia-Esperon et al	2023	Low	Low	Low	Low	Low	Low	Low
Ollikainen J et al	2023	Low	Low	Low	Low	Low	Low	Low
Leto N et al	2024	High*22	Low	Low	Low	High*23	Low	Low
Ali M et al	2024	Low	Low	Low	Low	Low	Low	Low
Takahashi Y et al	2024	Low	Low	Low	Low	Low	Low	Low

*1: Patients with incomplete FAST (n = 5), incomplete C-STAT (n = 19) or transported to non-Comprehensive Stroke Center(CSC) facilities (n = 48) were excluded.

*2: Definition of Large vessel occlusion (LVO) not specified.

*3: Exclusion criteria not specified.

*4: Diagnostic process for LVO not described.

*5: 101 patients were excluded because EMSA was not recorded.

*6: Data was unavailable for 67 cases.

*7: Excluding the 556 Emergency Medical Service (EMS) stroke-code activations without a documented RACE score, 1,822 of 2,378 consecutive cases (76.6%) remained for analysis.

*8: Due to the regional specificity of the emergency medical system (One EMS agency covers eight hospitals, with the study network consisting of two Endovascular Capable centers (ECCs)—one CSC and one interventional Primary Stroke Center (PCS)—and three non-interventional PSCs).

*9: Blood glucose measurement performed.

*10: Data was unavailable for 96 cases.

*11: 274 patients: arrival > 6 h after symptom onset. 1 patient: age < 18 years

*12: 805 (29 %) were excluded—752 because the app was not used and 53 for missing electronic records.

*13: Due to the regional specificity of the emergency medical system (EMS is designed as a two-tiered system including paramedic staffed Advanced Life Support (ALS) -Ambulances and physician staffed response units).

*14: Insufficient detail on patient flow.

*15: Nineteen patients were transferred to another hospital, and scores were not calculated for 46.

*16: All consecutive patients transported to the CSC by a mobile stroke unit (MSU) equipped with an 8-slice CT scanner and staffed by an EMT driver, emergency-medicine registered nurse, paramedic, and CT technician were included.

*17: Due to the regional specificity of the emergency medical system(EMS assigns an mG-FAST score to every suspected stroke (LKN < 24 h or unknown); a score ≥ 1 triggers code-stroke team activation and transport to the nearest mothership (MS) or drip-and-ship (DS) hospital, while a score = 3 diverts patients to a DS if the closest MS is > 15 min away, otherwise to that MS.).

*18: Combined PreSS part 1 positive—defined as PreSS ≥ 1 with stroke confirmed via mandatory teleconsultation with a vascular neurologist or resident—results in direct transport to the nearest PSC/CSC, bypassing closer EDs.

*19: Fifteen patients (16 % of LVO cases) were ineligible for treatment.

*20: Thirty of the 218 patients were excluded because the score was not performed.

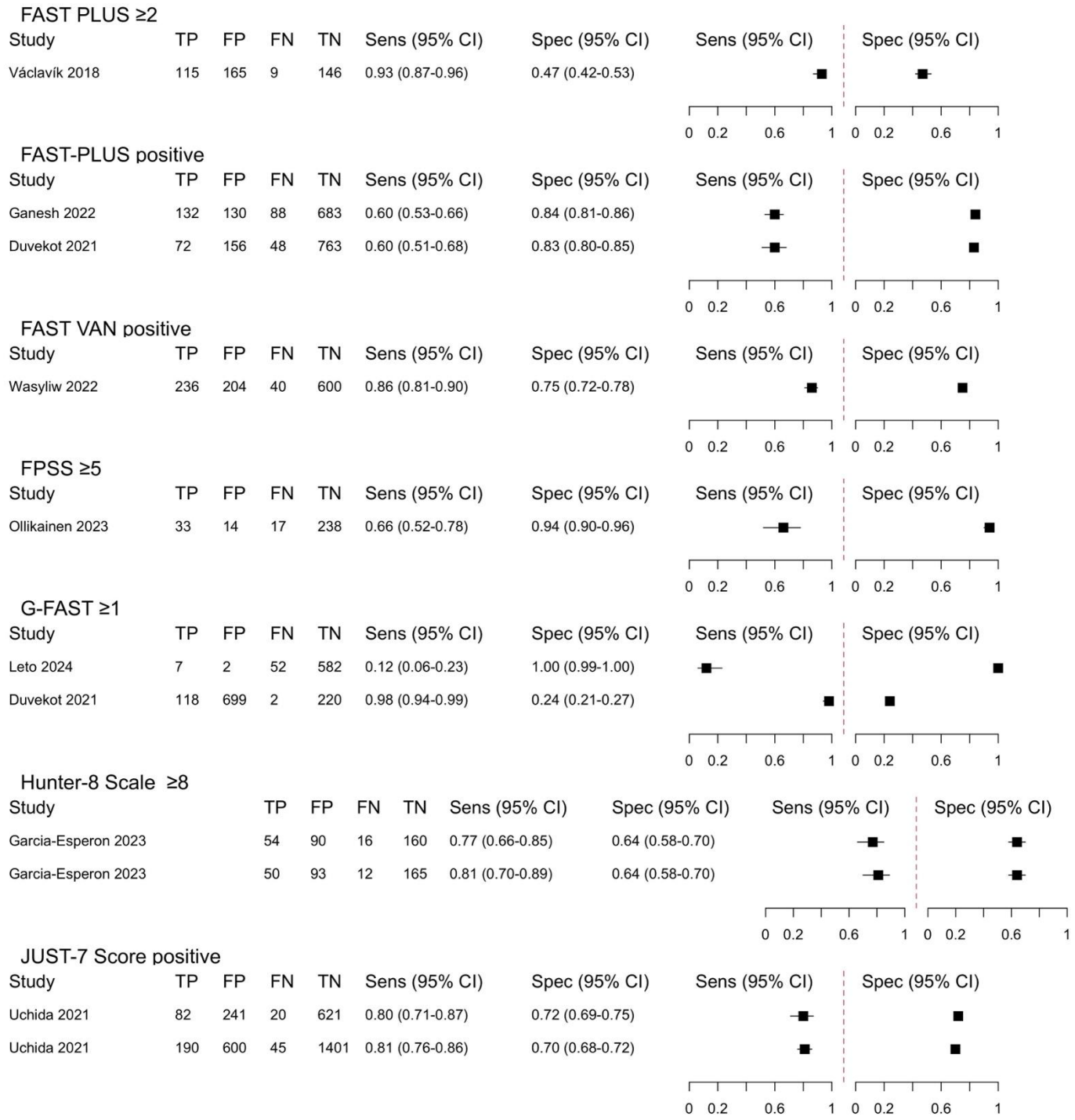
*21: Of the 1,915 patients, 653 were excluded because the score was not assessed.

*22: Of 1,681 patients, 1,038 were excluded because G-FAST was not performed or requisite data were missing.

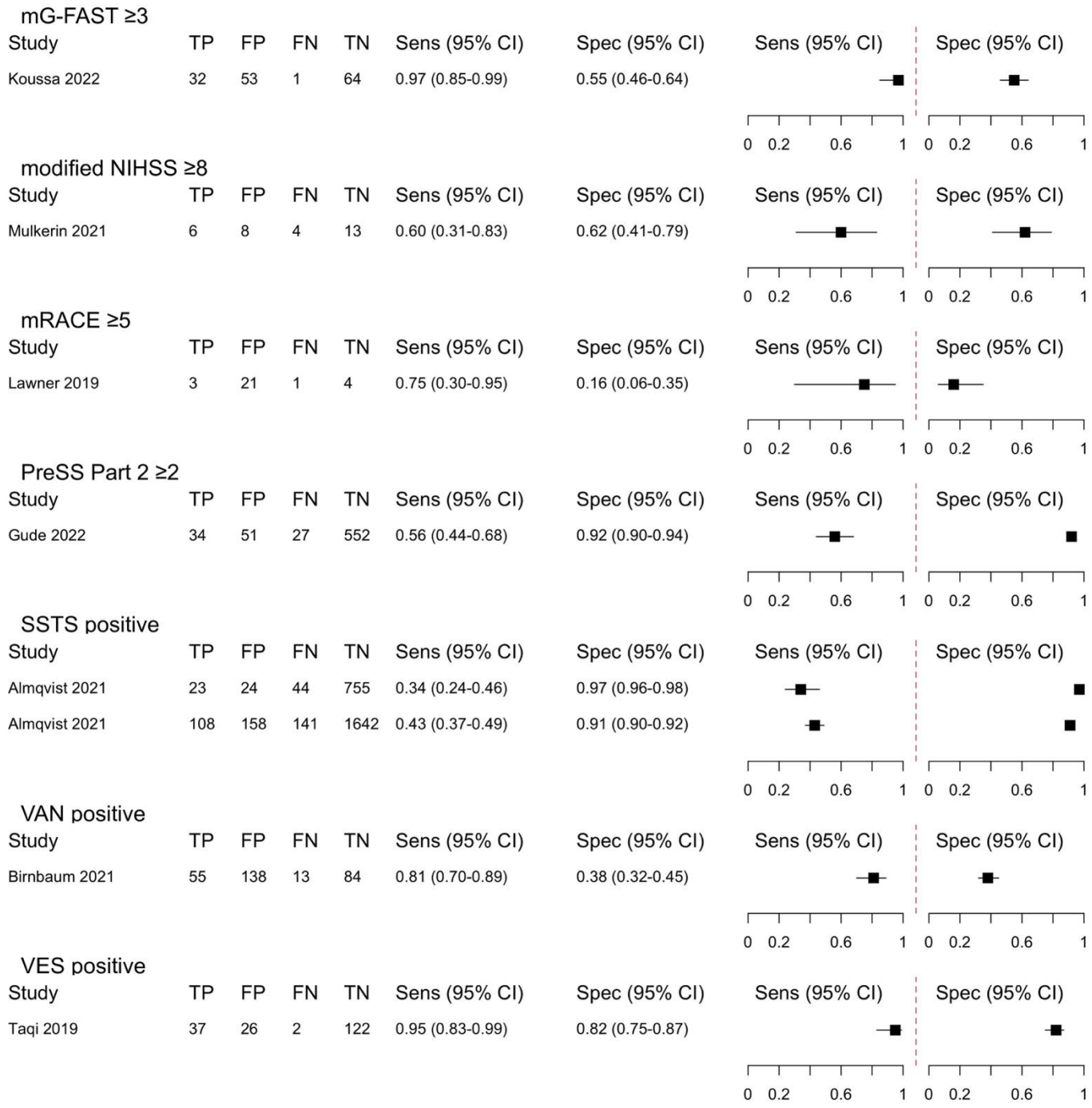
*23: Transport distances between PSCs and CSCs are in general large (median 120 km, range 1–278 km), except from the city of Bergen, where one PSC is located close (1 km) to a CSC.

Appendix 7. Forest Plot for Scores Evaluated in Two or Fewer Studies

TP, true-positive, FP, false-positive, FN, false-negative, TN, true-negative, Sens, sensitivity, Spec, Specificity, CI, confidence interval. Der, derivation cohort, Val, validation cohort.



TP, true-positive, FP, false-positive, FN, false-negative, TN, true-negative, Sens, sensitivity, Spec, Specificity, CI, confidence interval.



TP, true-positive, FP, false-positive, FN, false-negative, TN, true-negative, Sens, sensitivity, Spec, Specificity, CI, confidence interval. Der, derivation cohort, Val, validation cohort.

Appendix 8. Detailed results of GRADE evaluation

C-STAT Score（Cutoff C-STAT ≥2）

Summary estimates: ：Sensitivity 0.62 (95%CI: 0.52, 0.71) Specificity 0.74 (95%CI: 0.61, 0.84)

Outcome	N of studies N of patients	Study design	Quality assessment					The number of patients per 1,000 patients tested			Certainty of Evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Pre-test Probability 5%	Pre-test Probability 10%	Pre-test Probability 20%	
True-Positive	6 Studies 4,427Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	31 (26 to 36)	62 (52 to 71)	124 (105 to 142)	⨁⨁⨁◯ Moderate
False-Negative								19 (14 to 24)	38 (29 to 48)	76 (58 to 95)	
True-Negative	6 Studies 4,427Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	705 (579 to 798)	667 (549 to 756)	593 (488 to 672)	⨁⨁⨁◯ Moderate
False-Positive								245 (152 to 371)	233 (144 to 351)	207 (128 to 312)	

Explanation
True Positive: Patients correctly predicted to have ischemic stroke with large vessel occlusion (LVO). False Negative: Patients incorrectly predicted not to have LVO despite actually having it. True Negative: Patients correctly predicted not to have LVO. False Positive: Patients incorrectly predicted to have LVO despite not having it.

Definition of Outcome
All included studies defined occlusion of the internal carotid artery (ICA) and the M1 segment of the middle cerebral artery (MCA) as “positive.” Five out of six studies also included the M2 segment. Only one study included the basilar artery, vertebral artery, or posterior cerebral artery in the target condition, and two studies included the anterior cerebral artery.

Risk of Bias
Risk of bias for the sensitivity and specificity of the score was assessed using the QUADAS-2 tool. The proportion of studies rated as high or unclear risk was: Patient selection: 2/6, Index test: 0/6, Reference standard: 1/6, Flow and timing: 2/6. Since in all four domains the proportion of high or unclear risk was approximately one-third or less, the risk of bias was judged as not serious.

Indirectness
Applicability was assessed using QUADAS-2. The number of studies rated as high concern or unclear for sensitivity and specificity were: Target population: 0/6, Index test: 0/6, Reference standard: 1/6. As none of the domains had 50% or more of studies rated as high concern or unclear, applicability was judged to be preserved. Thus, indirectness was judged as not serious.

Inconsistency
Heterogeneity among study results included in the systematic review was visually assessed using a forest plot. Based on this, inconsistency was judged as not serious.

Imprecision
Imprecision was judged as serious under the assumption mentioned as above. (Please see the way of evaluation in the Appendix)

Publication Bias
Not assessed.

Final Assessment
Based on the above, the certainty of the evidence was downgraded by one level and assessed as having moderate certainty.

CPSS Score （Cutoff CPSS ≥2）

Summary estimates: ：Sensitivity0.74 (95%CI: 0.57, 0.86) Specificity 0.70 (95%CI: 0.59, 0.79)

Outcome	N of studies N of patients	Study design	Quality assessment					The number of patients per 1,000 patients tested			Certainty of Evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Pre-test Probability 5%	Pre-test Probability 10%	Pre-test Probability 20%	
True-Positive	3 Studies 12,493 Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	37 (28 to 43)	74 (57 to 86)	149 (114 to 173)	⨁⨁⨁◯ Moderate
False-Negative								13 (7 to 22)	26 (14 to 43)	51 (27 to 86)	
True-Negative	3 Studies 12,493 Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	664 (556 to 753)	629 (527 to 713)	559 (468 to 634)	⨁⨁⨁◯ Moderate
False-Positive								286 (197 to 394)	271 (187 to 373)	241 (166 to 332)	

Explanation
True Positive: Patients correctly predicted to have ischemic stroke with large vessel occlusion (LVO). False Negative: Patients incorrectly predicted not to have LVO despite actually having it. True Negative: Patients correctly predicted not to have LVO. False Positive: Patients incorrectly predicted to have LVO despite not having it.

Definition of Outcome
In most of the included studies, occlusions of the internal carotid artery (ICA) and the M1 segment of the middle cerebral artery (MCA) were defined as “positive.” Two out of three studies also included the M2 segment and the basilar artery. Only one study included the anterior cerebral artery (ACA), vertebral artery, or posterior cerebral artery (PCA) in the definition of the outcome.

Risk of Bias
Risk of bias for the sensitivity and specificity of the score was assessed using the QUADAS-2 tool. The proportion of studies judged to have high or unclear risk of bias was:
Patient selection: 1/3, Index test: 0/3, Reference standard: 0/3, Flow and timing: 1/3. Since all four domains had high or unclear risk in approximately one-third or fewer of the included studies, risk of bias was judged as not serious.

Indirectness
Applicability was assessed using the QUADAS-2 tool. The proportion of studies judged to have high concern or unclear applicability for sensitivity and specificity was:
Target population: 0/3, Index test: 0/3, Reference standard: 0/3. As none of the domains had ≥50% of studies with high concern or unclear applicability, the overall applicability was considered adequate. Therefore, indirectness was judged as not serious.

Inconsistency
Heterogeneity among study results included in the systematic review was visually assessed using a forest plot. Based on this, inconsistency was judged as not serious.

Imprecision
Imprecision was judged as serious under the assumption mentioned as above. (Please see the way of evaluation in the Appendix)

Publication Bias:
Not assessed.

Final Assessment
Based on the above, the certainty of the evidence was downgraded by three level and assessed as having moderate certainty.

CPSS Score （Cutoff CPSS ≥3）

Summary estimates: ：Sensitivity0.53 (95%CI: 0.33, 0.71) Specificity 0.87 (95%CI: 0.76, 0.93)

Outcome	N of studies N of patients	Study design	Quality assessment					The number of patients per 1,000 patients tested			Certainty of Evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Pre-test Probability 5%	Pre-test Probability 10%	Pre-test Probability 20%	
True-Positive	4 Studies 3,134 Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	26 (17 to 36)	53 (33 to 71)	105 (67 to 142)	⨁⨁⨁◯ Moderate
False-Negative								24 (14 to 33)	47 (29 to 67)	95 (58 to 133)	
True-Negative	4 Studies 3,134 Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	825 (721 to 886)	782 (683 to 840)	695 (607 to 746)	⨁⨁⨁◯ Moderate
False-Positive								125 (64 to 229)	118 (60 to 217)	105 (54 to 193)	

Explanation
True Positive: Patients correctly predicted to have ischemic stroke with large vessel occlusion (LVO). False Negative: Patients incorrectly predicted not to have LVO despite actually having it. True Negative: Patients correctly predicted not to have LVO. False Positive: Patients incorrectly predicted to have LVO despite not having it.

Definition of Outcome
In three out of four included studies, occlusions of the internal carotid artery (ICA), the M1 segment of the middle cerebral artery (MCA), and the M2 segment of the MCA were defined as positive. The basilar artery was included as a target condition in two studies. Only one study included the anterior cerebral artery (ACA), vertebral artery, or posterior cerebral artery (PCA).
In one of the four studies, the definition of the target condition was not clearly described.

Risk of Bias
Risk of bias for the sensitivity and specificity of the score was assessed using the QUADAS-2 tool. Among the four included studies, none were judged to be at high or unclear risk in patient selection or index test domains. One study was judged as having high or unclear risk in the reference standard domain, and one in the flow and timing domain. Since the proportion of high or unclear risk was approximately one-third or less in all four domains, risk of bias was judged as not serious.

Indirectness
Applicability was assessed using the QUADAS-2 tool. None of the four studies were judged to have high concern or unclear applicability in the domains of target population, index test, or reference standard. As none of the domains reached the threshold of 50% or more with high concern or unclear applicability, the overall applicability was considered to be preserved.
Therefore, indirectness was judged as not serious.

Inconsistency
Heterogeneity among study results included in the systematic review was visually assessed using a forest plot. Based on this, inconsistency was judged as not serious.

Imprecision
Imprecision was judged as serious under the assumption mentioned as above. (Please see the way of evaluation in the Appendix)

Publication Bias:
Not assessed.

Final Assessment
Based on the above, the certainty of the evidence was downgraded by three level and assessed as having moderate certainty.

FAST-ED Score（Cutoff FAST-ED ≥4）

Summary estimates: ：Sensitivity0.53 (95%CI: 0.33, 0.71) Specificity 0.87 (95%CI: 0.76, 0.93)

Outcome	N of studies N of patients	Study design	Quality assessment					The number of patients per 1,000 patients tested			Certainty of Evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Pre-test Probability 5%	Pre-test Probability 10%	Pre-test Probability 20%	
True-Positive	7 Studies 4,177 Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	35 (31 to 39)	71 (61 to 78)	141 (123 to 157)	⨁⨁⨁◯ Moderate
False-Negative								15 (11 to 19)	29 (22 to 39)	59 (43 to 77)	
True-Negative	7 Studies 4,177 Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	712 (610 to 792)	675 (578 to 750)	600 (514 to 667)	⨁⨁⨁◯ Moderate
False-Positive								238 (158 to 340)	225 (150 to 322)	200 (133 to 286)	

Explanation
True Positive: Patients correctly predicted to have ischemic stroke with large vessel occlusion (LVO). False Negative: Patients incorrectly predicted not to have LVO despite actually having it. True Negative: Patients correctly predicted not to have LVO. False Positive: Patients incorrectly predicted to have LVO despite not having it.

Definition of Outcome:
In most of the included studies, occlusions of the internal carotid artery (ICA), the M1 and M2 segments of the middle cerebral artery (MCA), and the basilar artery were defined as “positive.” Only one study included the anterior cerebral artery (ACA) as part of the outcome. In one out of seven studies, the definition of the outcome was not clearly described.

Risk of Bias:
The risk of bias for the sensitivity and specificity of the score was assessed using the QUADAS-2 tool. Among the seven included studies, one was judged to have high or unclear risk in the patient selection domain and one in the flow and timing domain. No studies were judged to have high or unclear risk in the index test or reference standard domains. Since the proportion of studies with high or unclear risk was approximately one-third or less across all four domains, the overall risk of bias was judged as not serious.

Indirectness:
Applicability was assessed using the QUADAS-2 tool. For both sensitivity and specificity, one study was judged to have high concern or unclear applicability in the target population domain, and none in the index test or reference standard domains. As no domain had 50% or more of studies rated as high concern or unclear, applicability was considered to be preserved. Therefore, indirectness was judged as not serious.

Inconsistency
Heterogeneity among study results included in the systematic review was visually assessed using a forest plot. Based on this, inconsistency was judged as not serious.

Imprecision
Imprecision was judged as serious under the assumption mentioned as above. (Please see the way of evaluation in the Appendix)

Publication Bias:
Not assessed.

Final Assessment
Based on the above, the certainty of the evidence was downgraded by one level and assessed as having moderate certainty.

G-FAST Score （Cutoff G-FAST ≥3）

Summary estimates: ：Sensitivity 0.65 (95%CI: 0.60, 0.70) Specificity 0.83 (95%CI: 0.81, 0.84)

Outcome	N of studies N of patients	Study design	Quality assessment					The number of patients per 1,000 patients tested			Certainty of Evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Pre-test Probability 5%	Pre-test Probability 10%	Pre-test Probability 20%	
True-Positive	3 Studies 4,079 Patients	Cohort study	Serious	Not Serious	Not Serious	Not Serious	Not assessed	32 (30 to 35)	65 (60 to 70)	130 (119 to 140)	⨁⨁⨁◯ Moderate
False-Negative								18 (15 to 20)	35 (30 to 40)	70 (60 to 81)	
True-Negative	3 Studies 4,079 Patients	Cohort study	Serious	Not Serious	Not Serious	Not Serious	Not assessed	787 (771 to 802)	745 (730 to 760)	663 (649 to 675)	⨁⨁⨁◯ Moderate
False-Positive								163 (148 to 179)	155 (140 to 170)	137 (125 to 151)	

Explanation
True Positive: Patients correctly predicted to have ischemic stroke with large vessel occlusion (LVO). False Negative: Patients incorrectly predicted not to have LVO despite actually having it. True Negative: Patients correctly predicted not to have LVO. False Positive: Patients incorrectly predicted to have LVO despite not having it.

Definition of Outcome:
All included studies defined occlusion of the internal carotid artery (ICA), the M1 segment of the middle cerebral artery (MCA), and the M2 segment of the MCA as “positive.” The anterior cerebral artery (ACA) was included in two out of three studies. Only one study included the basilar artery, vertebral artery, or posterior cerebral artery (PCA) as part of the outcome definition.

Risk of Bias:
Risk of bias for the sensitivity and specificity of the score was assessed using the QUADAS-2 tool. Among the three included studies, none were judged to have high or unclear risk in the domains of patient selection, index test, or reference standard. However, two out of three studies were rated as high or unclear risk in the domain of flow and timing. As one domain had a proportion of high or unclear risk at or above two-thirds, the overall risk of bias was judged as serious.

Indirectness:
Applicability was assessed using the QUADAS-2 tool. For both sensitivity and specificity, none of the three studies were judged to have high concern or unclear applicability in the domains of target population, index test, or reference standard. As no domain had 50% or more of studies rated as high concern or unclear, the overall applicability was considered to be preserved. Therefore, indirectness was judged as not serious.

Inconsistency
Heterogeneity among study results included in the systematic review was visually assessed using a forest plot. Based on this, inconsistency was judged as not serious.

Imprecision
Imprecision was judged as not serious under the assumption mentioned as above. (Please see the way of evaluation in the Appendix)

Publication Bias:
Not assessed.

Final Assessment
Based on the above, the certainty of the evidence was downgraded by one level and assessed as having moderate certainty.

LAMS Score （Cutoff LAMS ≥4）

Summary estimates: ：Sensitivity 0.58 (95%CI: 0.44, 0.71) Specificity 0.87 (95%CI: 0.82, 0.91)

Outcome	N of studies N of patients	Study design	Quality assessment					The number of patients per 1,000 patients tested			Certainty of Evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Pre-test Probability 5%	Pre-test Probability 10%	Pre-test Probability 20%	
True-Positive	4 Studies 5,047 Patients	Cohort study	Serious	Not Serious	Not Serious	Not Serious	Not assessed	29 (22 to 35)	58 (44 to 71)	116 (88 to 141)	⨁⨁⨁◯ Moderate
False-Negative								21 (15 to 28)	42 (29 to 56)	84 (59 to 112)	
True-Negative	4 Studies 5,047 Patients	Cohort study	Serious	Not Serious	Not Serious	Not Serious	Not assessed	829 (775 to 868)	786 (735 to 823)	698 (653 to 731)	⨁⨁⨁◯ Moderate
False-Positive								121 (82 to 175)	114 (77 to 165)	102 (69 to 147)	

Explanation
True Positive: Patients correctly predicted to have ischemic stroke with large vessel occlusion (LVO). False Negative: Patients incorrectly predicted not to have LVO despite actually having it. True Negative: Patients correctly predicted not to have LVO. False Positive: Patients incorrectly predicted to have LVO despite not having it.

Definition of Outcome:
In most of the included studies, occlusions of the internal carotid artery (ICA), the M1 segment of the middle cerebral artery (MCA), and the M2 segment of the MCA were defined as “positive.” The basilar artery and the anterior cerebral artery (ACA) were included in 2 out of 4 studies. Only one study included the vertebral artery and posterior cerebral artery (PCA) as part of the outcome.

Risk of Bias:
The risk of bias for the sensitivity and specificity of the score was assessed using the QUADAS-2 tool. Among the four included studies, none were judged to have high or unclear risk in the domains of patient selection, index test, or reference standard. However, two out of four studies were rated as high or unclear risk in the domain of flow and timing. Since one domain had a proportion of high or unclear risk at or above approximately one-half, the overall risk of bias was judged as serious.

Indirectness:
Applicability was assessed using the QUADAS-2 tool. For both sensitivity and specificity, none of the four studies were judged to have high concern or unclear applicability in the domains of target population, index test, or reference standard. As no domain had 50% or more of studies rated as high concern or unclear, the overall applicability was considered to be preserved. Therefore, indirectness was judged as not serious.

Inconsistency
Heterogeneity among study results included in the systematic review was visually assessed using a forest plot. Based on this, inconsistency was judged as not serious.

Imprecision
Imprecision was judged as not serious under the assumption mentioned as above. (Please see the way of evaluation in the Appendix)

Publication Bias:
Not assessed.

Final Assessment
Based on the above, the certainty of the evidence was downgraded by one level and assessed as having moderate certainty.

PASS Score （Cutoff PASS ≥2）

Summary estimates: ：Sensitivity 0.58 (95%CI: 0.54, 0.62) Specificity 0.83 (95%CI: 0.82, 0.84)

Outcome	N of studies N of patients	Study design	Quality assessment					The number of patients per 1,000 patients tested			Certainty of Evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Pre-test Probability 5%	Pre-test Probability 10%	Pre-test Probability 20%	
True-Positive	3 Studies 4,079 Patients	Cohort study	Serious	Not Serious	Not Serious	Not Serious	Not assessed	29 (27 to 31)	58 (54 to 62)	116 (108 to 125)	⨁⨁⨁◯ Moderate
False-Negative								21 (19 to 23)	42 (38 to 46)	84 (75 to 92)	
True-Negative	3 Studies 4,079 Patients	Cohort study	Serious	Not Serious	Not Serious	Not Serious	Not assessed	789 (777 to 800)	747 (736 to 758)	664 (654 to 674)	⨁⨁⨁◯ Moderate
False-Positive								161 (150 to 173)	153 (142 to 164)	136 (126 to 146)	

Explanation
True Positive: Patients correctly predicted to have ischemic stroke with large vessel occlusion (LVO). False Negative: Patients incorrectly predicted not to have LVO despite actually having it. True Negative: Patients correctly predicted not to have LVO. False Positive: Patients incorrectly predicted to have LVO despite not having it.

Definition of Outcome
All included studies defined occlusion of the internal carotid artery (ICA), the M1 segment of the middle cerebral artery (MCA), and the M2 segment of the MCA as “positive.” The anterior cerebral artery (ACA) was included in one out of three studies. Only one study included the basilar artery, vertebral artery, or posterior cerebral artery (PCA) in the outcome definition.

Risk of Bias
Risk of bias for the sensitivity and specificity of the score was assessed using the QUADAS-2 tool. Across the three included studies, none were judged to have high or unclear risk in the domains of patient selection or index test. One study was judged as having high or unclear risk in the reference standard domain, and one study in the flow and timing domain. As two domains showed a proportion of high or unclear risk at approximately one-third, risk of bias was judged as serious.

Indirectness
None of the three studies were judged to have high concern or unclear applicability in the domains of target population or index test. One study was judged as having high concern or unclear applicability in the reference standard domain. As none of the domains reached 50% or more with high concern or unclear applicability, overall applicability was considered adequate. Therefore, indirectness was judged as not serious.

Inconsistency
Heterogeneity among study results included in the systematic review was visually assessed using a forest plot. Based on this, inconsistency was judged as not serious.

Imprecision
Imprecision was judged as not serious under the assumption mentioned as above. (Please see the way of evaluation in the Appendix)

Publication Bias:
Not assessed.

Final Assessment
Based on the above, the certainty of the evidence was downgraded by one level and assessed as having moderate certainty.

RACE Score （Cutoff RACE ≥5）

Summary estimates: ：Sensitivity 0.75 (95%CI: 0.68, 0.81) Specificity 0.76 (95%CI: 0.68, 0.84)

Outcome	N of studies N of patients	Study design	Quality assessment					The number of patients per 1,000 patients tested			Certainty of Evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	Pre-test Probability 5%	Pre-test Probability 10%	Pre-test Probability 20%	
True-Positive	9 Studies 7,115 Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	37 (34 to 40)	75 (68 to 81)	149 (135 to 161)	⨁⨁⨁◯ Moderate
False-Negative								13 (10 to 16)	25 (19 to 32)	51 (39 to 65)	
True-Negative	9 Studies 7,115 Patients	Cohort study	Not Serious	Not Serious	Not Serious	Serious	Not assessed	727 (642 to 794)	688 (609 to 752)	612 (541 to 668)	⨁⨁⨁◯ Moderate
False-Positive								223 (156 to 308)	212 (148 to 291)	188 (132 to 259)	

Explanation
True Positive: Patients correctly predicted to have ischemic stroke with large vessel occlusion (LVO). False Negative: Patients incorrectly predicted not to have LVO despite actually having it. True Negative: Patients correctly predicted not to have LVO. False Positive: Patients incorrectly predicted to have LVO despite not having it.

Definition of Outcome:
In 7 out of 9 studies, the internal carotid artery (ICA) and the M1 segment of the middle cerebral artery (MCA) were defined as “positive.” The M2 segment of the MCA was included in 6 out of 9 studies, the basilar artery in 4 out of 9 studies, and the anterior cerebral artery (ACA) in 2 out of 9 studies. Only one study included the vertebral artery and posterior cerebral artery (PCA) as part of the outcome. In 2 out of 9 studies, the definition was not clearly described.

Risk of Bias:
The proportion of studies judged to be high risk or unclear was patient selection in 1 out of 7 studies, index test in 0 out of 7, reference standard in 1 out of 7, and flow and timing in 2 out of 7. Since the proportion of studies with high or unclear risk was approximately one-third or less across all four domains, the risk of bias was judged as not serious.

Indirectness:
Applicability was assessed using the QUADAS-2 tool. The proportion of studies judged to have high concern or unclear applicability for sensitivity and specificity was 0 out of 7 for the target population, 0 out of 7 for the index test, and 0 out of 7 for the reference standard. Since no domain had 50% or more of studies rated as high concern or unclear, applicability was considered to be preserved. Therefore, indirectness was judged as not serious.

Inconsistency
Heterogeneity among study results included in the systematic review was visually assessed using a forest plot. Based on this, inconsistency was judged as not serious.

Imprecision
Imprecision was judged as serious under the assumption mentioned as above. (Please see the way of evaluation in the Appendix)

Publication Bias:
Not assessed.

Final Assessment
Based on the above, the certainty of the evidence was downgraded by one level and assessed as having moderate certainty.