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Supplementary Table S1. PICOS search strategy.

PICOS	Inclusion	Exclusion
Population	- Oral cavity squamous carcinoma (all stages: early, locally advanced, metastatic) - Age older than 18	- Benign neoplasms - Normal oral tissue - Pre-malignant lesions such as leukoplakia, erythroplakia or lichen planus - Verrucous and minor salivary gland carcinoma
Intervention	- Artificial Intelligence to diagnose and classify OSCC from non-OSCC lesions from clinical images	- Studies which use AI to classify neoplastic (which includes OSCC and Oral Potentially Malignant Disorders) vs benign lesions from clinical images
Comparison	- Compared to current methods of diagnosis through physical examination by front-line healthcare workers and oral maxillary specialists, and histological assessment by a pathologist	
Outcome	- Accuracy of diagnosis of oral cavity cancers	
Study design	- Articles in English or translated into English - RCT, prospective & retrospective cohort studies, cross-sectional studies	- Articles not written in English/no available English translation - Systematic reviews and meta-analyses - Review articles - Case reports and series - Articles written before 2000 - Articles with only the abstract - Opinion articles - Letters to Editor

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Supplementary Table S2. Summary of characteristics of included studies in the systematic review.

S/N	Study/ Study Design	Country	Participants	Total Images	OSCC	Non-OSCC	Interventions	Reason for exclusion from pooling
1	Warin 2021/ Retrospective diagnostic study	Thailand	Total: Unknown Demographics: Unknown	700	350	350	CNN - DenseNet-121 for classification Faster R-CNN for lesion detection	-
2	Marzouk 2022/ Retrospective diagnostic study	Saudia Arabia	Total: Unknown Demographics: Unknown	131	87	44	AI with Deep Transfer Learning Driven Oral Cancer detection and Classification Model (AIDTL-OCCM) Preprocessing with fuzzy-based contrast enhancement, followed by feature extraction process by DenseNet-169, followed by tuning with Chimp Optimization Algorithm, classification by Autoencoder EfficientNet-B4 Inception-V4 DenseNet161 Ensemble ResNet-152	-
3	Warin 2022/ Retrospective diagnostic study	Thailand	Total: Unknown Demographics: Unknown	980	365	OPMD 315 Non cancer 300	CNN - DenseNet 169 CNN - ResNet 101 CNN - SqueezeNet CNN - Swin-S OMS Surgeons GPs	-
4	Kouketsu 2024/	Japan	Total: 424	1043	523	520	Single shot multi box	-

	Retrospective diagnostic study						detector	
5	Hsu 2024/ Retrospective diagnostic study	Taiwan	Total: Unknown Demographics: Unknown	6903	Unknown	Unknown	Yolov7 Yolov7-E6 Yolov7-D6	Non-histological reference
6	Lee 2024/ Retrospective diagnostic study	Korea	Total: Unknown Demographics: Patients aged > 20yo who visited the Department of OMS at Seoul National University Dental Hospital between Jan 2006-Dec 2020	1810	372	OPMD 141 Non-cancerous lesions 1297	EfficientNet with weight balancing technique EfficientNet with oversampling technique EfficientNet with mosaic-based soft labeling	-
7	Zhang 2024/ Retrospective diagnostic study	China	Total: Unknown Demographics: Unknown	131	87	44	Gated Recurrent Unit Network/Northern Goshawk Optimisation (GRU/NGO) with Levy flight and chaos theory GRU/NGO GRU with Lightweight Deep Convolutional Neural Network ResNet-101 R–CNN NNPGA TFL	Non-histological reference
8	Birur 2022/ Observational diagnostic study	India	Total: 5025 Gender: M 52%, F 48% Median Age: 53	32128	NA	NA	MobileNET vs Remote diagnosis by specialist VGG19 vs Remote diagnosis by specialist	Non-histological reference

			Tobacco/Areca Nut Chewers - 62% Tobacco Smokers - 18%					
9	Vinayahalingam 2024/ Retrospective diagnostic study	Netherlands	Total: Unknown Demographics: Unknown	4,161	Unknown	Unknown	Mask R-CNN with a Swin Transformer	-
				47 987	**> 1784**			

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Supplementary Table S3. Risk of bias and applicability assessment of included studies using the QUADAS-AI framework.

Study	QUADAS-2 Domains (Risk of Bias)				QUADAS-2 Domains (Applicability)				QUADAS-AI Extensions		
	Patient Selection	Index Test	Reference Standard	Flow & Timing	Patient Selection	Index Test	Reference Standard	Clinical Concern	Data Partition	Model Transparency	Training/ Test Split
Warin 2021	Unclear	Low	Low	Low	Unclear	Low	Low	Unclear	Unclear	Unclear	Unclear
Marzouk 2022	High	Low	Low	Unclear	High	Low	Low	High	High	Unclear	High
Warin 2022	Unclear	Low	Low	Low	Unclear	Low	Low	Unclear	Unclear	Low	Unclear
Koukets u 2024	Unclear	Low	Low	Unclear	Unclear	Low	Low	Unclear	Low	Low	Low
Hsu 2024	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Lee 2024	Unclear	Low	Low	Unclear	Unclear	Low	Low	Unclear	Unclear	Unclear	Unclear
Zhang 2024	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Birur 2022	High	Low	Unclear	High	High	Low	Unclear	High	High	Unclear	High
Vinayah alingam 2024	Low	Low	Low	Unclear	Low	Low	Low	Unclear	Low	Low	Low

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Supplementary Table S4. Summary of pooled models included in meta-analysis.

	Studies	**Pooled model**	**2x2 data**	**Analysis level**	**External validation performed**
1	Kouketsu 2024	Single-shot multi-box detector	Refer to Table 4	Image	NIL
2	Vinayahalingam 2024	Mask R-CNN with a Swin Transformer	Refer to Table 5	Image	NIL
3	Lee 2024	EfficientNet with mosaic-based soft labelling	Refer to Table 6	Image	NIL
4	Marzouk 2022	AI with Deep Transfer Learning Driven Oral Cancer Detection and Classification Model (AIDTL-OCCM)	Refer to Table 7	Image	NIL
5	Warin 2021	DenseNet-121	Refer to Table 8	Image	NIL
6	Warin 2022	DenseNet 169	Refer to Table 9	Image	NIL

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Supplementary Table S5. Kouketsu 2024 — 2x2 contingency table.

	OSCC Present (n=66)	OSCC Absent (n=405)	Total
AI Positive	62 (TP)	76 (FP)	138
AI Negative	4 (FN)	329 (TN)	333
Total	66	405	471

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Supplementary Table S6. Vinayahalingam 2024 — 2x2 contingency table.

	OSCC Present (126)	OSCC Absent (698)	Total
AI Positive	106	17	123
AI Negative	20	681	701
Total	126	698	824

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Supplementary Table S7. Lee 2024 — 2x2 contingency table.

	OSCC Present (372)	OSCC Absent (1438)	Total
AI Positive	342	61	403
AI Negative	30	1377	1407
Total	372	1438	1810

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Supplementary Table S8. Marzouk 2022 — 2x2 contingency table.

	OSCC Present (87)	OSCC Absent (44)	Total
AI Positive	77	10	87
AI Negative	10	34	44
Total	87	44	131

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Supplementary Table S9. Warin 2021 — 2x2 contingency table.

	OSCC Present (70)	OSCC Absent (70)	Total
AI Positive	69	0	69
AI Negative	1	70	71
Total	70	70	140

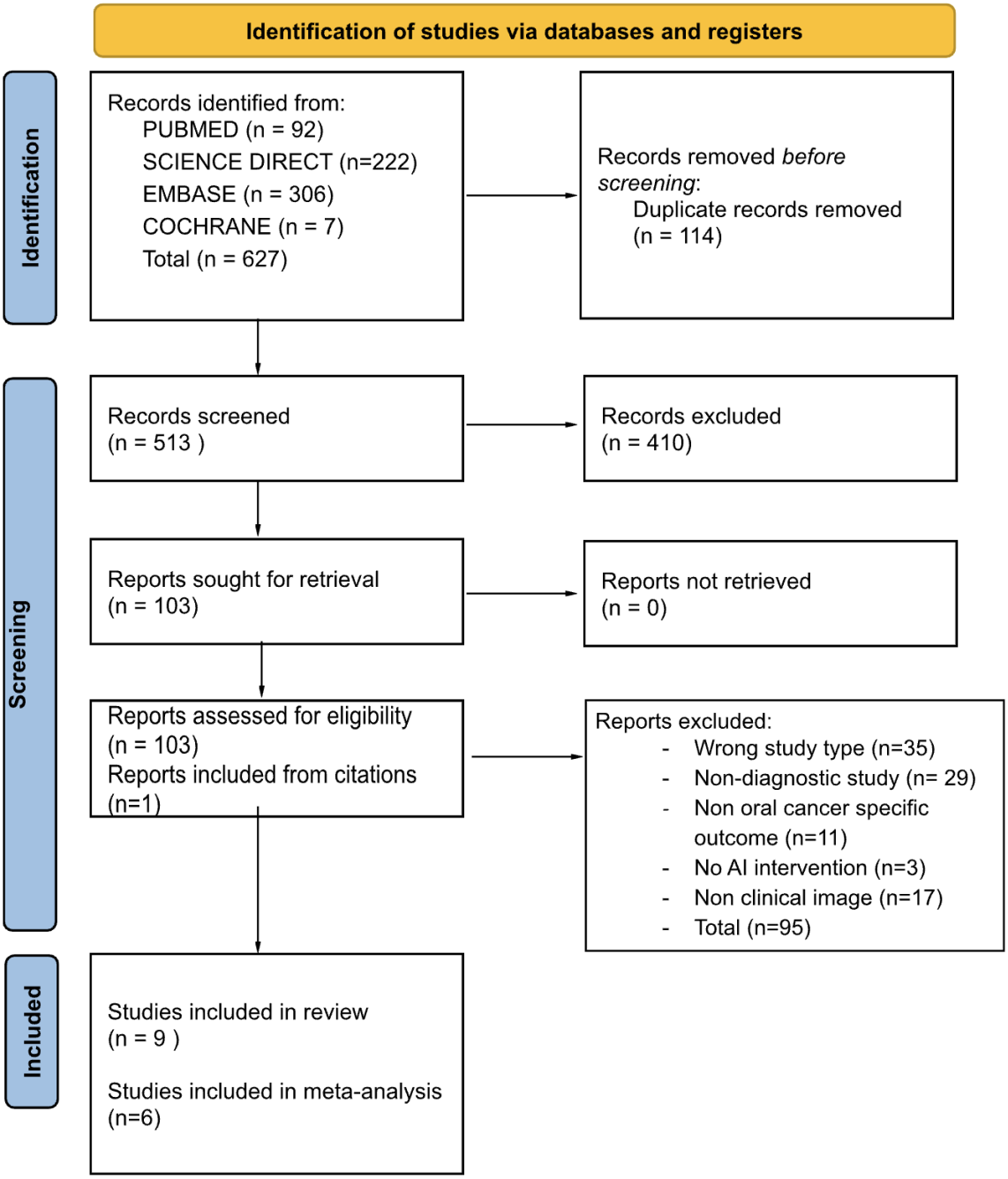
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Supplementary Table S10. Warin 2022 — 2x2 contingency table.

	OSCC Present (365)	OSCC Absent (615)	Total
AI Positive	361	6	367
AI Negative	4	609	613
Total	365	615	980

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Supplementary Fig. S1. PRISMA flow diagram.



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Supplementary Fig. S2. Deeks' funnel plot

