Supplementary Table 1 Studies included in the systematic review "Performance Predictive Model for Hepatocellular Carcinoma Recurrence"

Ref.	Model name	Design	Origin	Purpose of the study	Cohort (12.209)	HCC recurrence (%)	Recurrence risk	Area under the receiver operating characteristic curve	Comments
Parfitt *et al*[24], 2007	Parfitt	Retrospective	Canada	Development	Training (75)	27	HCC recurrence. Low risk: < 5%, intermediate risk: 40%-65%, high risk > 95%	N/A	
Chan *et al*[19], 2008	PCRS	Retrospective	United States	Development/internal and external validation	Training (116)	17.2	HCC recurrence[1]. Low risk: 0%, moderate risk: 19.4%, high risk; 66.7%	0.91	
Agopian *et al*[21], 2015	UCLA nomogram	Retrospective	United States	Development	Training (865)	13.5		0.85	In this nomogram for each of the 8 predictors, a straight ascending line is drawn to determine the accumulated points. The cumulative points are plotted on the total points bar and a straight descending line yields the estimated risk of post-transplant recurrence at 1 year, 3 years, and 5 years
Mehta *et al*[12], 2017	RETREAT	Retrospective	United States/Canada	Development/external validation	Training (721)	11.6	5-year HCC recurrence[1]. Score 0: 2.9%, score 1: 7.7%, score 2: 10.3%, score 3:13.4%, score 4: 28.7%, score 5:	0.77	

							75.2%		
Halazun *et al*[25], 2017	MORAL	Retrospective	United States	Development	Training 14.1 (339)		5-year RFS. Post-MORAL. Lower risk: 97.4%, medium risk: 75.1%, high risk: 49.9%, very high risk: 22.1%. Combo MORAL. Lower risk: > 95%, medium risk: > 65%, high risk: < 30%, very high risk: < 10%	Post MORAL: 0.87. Combo MORAL: 0.91	
Costentin *et al*[13], 2017	Decaesns, up to 7, PCRS, Iwatsuki	Retrospective	France	Validation	372		5-year HCC recurrence	Up to 7: 0.79, decaens: 0.74, iwatsuki: 0.70, PCRS: 0.68	
Mehta *et al*[14], 2018	RETREAT	Retrospective	United States	Validation	3276	4.4	3-year HCC recurrence. Score 0: 1.6%, score 1: 5.0%, score 2: 5.6%, score 3: 8.4%, score 4: 20.3%, score ≥ 5: 29.0%	0.75	
Mirón Fernández *et al*[15], 2019	PCRS, decaens, up to 7	Retrospective	Spain	Validation	105	10.5	5-year HCC recurrence	PCRS: 0.81, decaens: 0.67, up to 7: 0.48	
Feng *et*	Feng	Retrospective	China	Development/internal	Training	29.7	3-year HCC	0.84	Immunohistochemical results

al[26], 2019				validation	(101)		recurrence. Low risk: 5.1%, high risk: 64.3%		are part of the model
Sánchez Segura *et al*[27], 2020	Combo MORAL, up to 7, NLR, PLR	Retrospective	Spain	Validation	99		3-year RFS	Combo MORAL: 0.68, up to 7: 0.60, NLR: 0.54, PLR: 0.45	
Hasan *et al*[28], 2021	RETREAT, CCFSS	Retrospective	United States	Validation	52	7.6		Sensitivity: 75% (both scores), specificity: RETREAT: 95.8%, CCFSS: 60.4%	Due to the small sample size and low incidence of recurrence, the usual statistical methods were not used
Ma *et al*[29], 2021	Fudan University nomogram	Retrospective	China	Development/internal validation	Training (140)	29.5		0.79	In this prognostic nomogram for each of the 6 predictors, a straight ascending line is drawn to determine the accumulated points. The cumulative points are plotted on the total points bar and a straight descending line yields the estimated risk of post-transplant recurrence at 1, and 2 years
Abdelfattah *et al*[11], 2021	RETREAT	Retrospective	Saudi Arabia	Validation	73	16.4	5-year HCC recurrence. Score 0: 0%, score 1-2: 0%, score 3-5: 30.8%, score > 5: 66.7%		
Åberg *et al*[16], 2021	RETREAT	Retrospective	Sweden	Validation	169	20.1	5-year HCC recurrence. Score 0-	0.76	

							1: 0%, score 2-4: 11-22%, score 5-8: 65%	
Aziz *et al*[30], 2021	Aziz	Retrospective	Canada	Development	Training (124)	12	5-year HCC recurrence. Low risk: 4.3%, intermediate risk: 28.5%, high risk: 50%	
Costentin *et al*[22], 2022	R3-AFP	Retrospective	European and Latin American cohorts	Development/external validation	Training (1359)	19.6	5-year HCC recurrence. Very low risk: 5.5%, low risk: 15.1%, high risk: 39.1%, very high risk: 73.9%	0.76
Reddy *et al*[17], 2022	RETREAT	Retrospective	United Kingdom	Validation	313	8.9	5- year RFS. Score 0: 85.3%, score 1: 83.6%, score 2: 80.9%, score 3: 70.4%, score 4: 77.4%, score ≥ 5: 52.6%	0.76
Van Hooff *et al*[18], 2022	RETREAT	Retrospective	The Netherlands	Validation	203	13.3	5-year HCC recurrence. Score 0: 0%, score 1: 5.96%, score 2: 5.96%, score 3: 55,15%, score 4: 46.0%, score ≥ 5: 77.5%	
Brandão *et al*[32], 2024	R3-AFP, AFP	Retrospective	Brazil	Validation	381	8.4		R3-AFP: 0.78, AFP model: 0.76, UCLA nomogram: 0.76,

	model, UCLA nomogram, MORAL, RETREAT, PLR							pre-MORAL: 0.69, post-MORAL: 0.73, Combo-MORAL: 0.74, RETREAT: 0.74, PLR: 0.56
Cuadrado *et al*[31], 2023	MORAL, RETREAT	Retrospective	Spain	Validation	66	13.6	Combo MORAL [hazard ratio (95%CI)]: Medium risk: 3.96 (0.44–36.09), high risk: 14.44 (1.37–152.42), very high risk: 35.54 (2.02–626.65)	
Tran *et al*[23], 2023	Recurrent liver cancer prediction score	Retrospective	United States	Development/Internal and external validation	Training (3260)		5-year HCC recurrence. Low risk: 5.7%, medium risk: 29.2%, high risk: 54.2%	0.78

[1]In evaluation-only studies, "n" refers to the size of the cohort being studied.

AFP: Alpha-fetoprotein; CCFSS: Cleveland Clinic Floria Scoring System; HCC: Hepatocellular carcinoma; MORAL: Model of recurrence after liver transplantation; N/A: Not available; NLR: neutrophil-lymphocyte ratio; PCRS: Predicting Cancer Recurrence Score; PLR: platelet lymphocyte ratio; RETREAT: Risk estimation of tumor recurrence after transplant; RFS: Recurrence-free survival; UCLA: University of California, Los Angeles.

Supplementary Table 2 Risk of bias analysis of articles included in the meta-analysis

Ref.	Patient selection	Index test	Reference standard	Flow and timing
Abdelfattah *et al*[20], 2022	A	A	A	A
Abdelfattah *et al*[11], 2021	A	A	A	A
Åberg *et al*[16], 2021	A	A	A	A
Agopian *et al*[21], 2015	A	A	A	A
Aziz *et al*[30], 2021	A	A	A	A
Brandão *et al*[32], 2024	A	A	A	A
Chan *et al*[19], 2008	A	A	A	A
Costentin *et al*[13], 2017	A	A	A	A
Costentin *et al*[22], 2022	A	A	A	A
Cuadrado *et al*[31], 2023	A	A	A	A
Feng *et al*[26], 2019	A	A	A	C
Halazun *et al*[25], 2017	A	A	A	A
Hasan *et al*[28], 2021	A	A	A	A
Ma *et al*[29], 2021	A	A	A	A
Mehta *et al*[12], 2017	A	A	A	A
Mehta *et al*[14], 2018	A	A	A	A
Mirón Fernández *et al*[15], 2019	A	A	A	A
Parfitt *et al*[24], 2007	A	A	A	A
Reddy *et al*[17], 2022	A	A	A	A
Sánchez Segura *et al*[27], 2020	A	A	A	A
Tran *et al*[23], 2023	A	A	C	C
Van Hooff *et al*[18], 2022	A	A	A	A

Risk of bias: A: Low risk; B: High risk; C: Unclear risk.

Supplementary Table 3 Performance of Prognostic Scores: Positive and Negative Predictive Values

Score	PPV	PPV 95%CI	NPV	NPN 95%CI
RETREAT ≥ 3	0.273	0.201-0.359	0.958	0.935-0.973
RETREAT ≥ 4	0.371	0.255-0.504	0.944	0.925-0.959
RETREAT ≥ 5	0.514	0.326-0.698	0.925	0.905-0.942
PCRS ≥ 1	0.457	0.365-0.553	0.927	0.756-0.981
PCRS ≥ 3	0.657	0.488-0.794	0.846	0.668-0.937
DECAENS ≥ 4	0.497	0.415-0.578	0.889	0.815-0.936

NPV: Negative predictive value; PCRS: Predicting Cancer Recurrence Score; PPV: Positive predictive value; RETREAT: Risk estimation of tumor recurrence after transplant.