

Supplementary Materials

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Supplementary Table 1. Pre-LT interventions and post-LT pathological outcomes

Variables	Milan Cohort (N = 437)	Beyond Milan Cohort (N = 153)	p-value
Pre-LT interventions			
Hepatectomy	50 (11.4%)	13 (8.5%)	0.31
Transarterial chemoembolization	214 (49.0%)	70 (45.8%)	0.49
Radiofrequency ablation	96 (22.0%)	26 (17.0%)	0.19
PEIT	38 (8.7%)	10 (6.5%)	0.40
Post-LT outcomes			
Bleeding	109 (24.9%)	32 (20.9%)	0.32
Biliary stricture	133 (30.4%)	36 (23.5%)	0.10
Biliary leak	24 (5.5%)	10 (6.5%)	0.63
Infection	82 (18.8%)	32 (20.9%)	0.56
Rejection	48 (11.0%)	17 (11.1%)	0.97
Explant GRWR	1.2 ± 0.4	1.1 ± 0.3	0.37
Explant tumor stage			<0.01
T1a	105 (24.0%)	0 (0.0%)	
T1b	74 (16.9%)	4 (2.6%)	
T2	124 (28.4%)	96 (62.7%)	
T3	0 (0.0%)	25 (16.3%)	
T4	0 (0.0%)	28 (18.3%)	
Total necrosis	134 (30.7%)	0 (0.0%)	
Explant tumor differentiation			<0.01
E-S grade I	55 (12.6%)	12 (7.9%)	
E-S grade II	108 (24.7%)	39 (25.5%)	
E-S grade III	119 (27.2%)	83 (54.2%)	
E-S grade IV	21 (4.8%)	19 (12.4%)	
Total necrosis	134 (30.7%)	0 (0.0%)	
Pre-LT PET-CT			<0.01
Isometabolic	386 (88.3%)	85 (55.6%)	
Hypermetabolic	51 (11.7%)	68 (44.4%)	
Explant number of tumors	1.5 ± 0.8	3.9 ± 2.8	<0.01
Explant biggest tumor size	2.2 ± 1.2	5.0 ± 3.5	<0.01
Explant vascular invasion			<0.01
None	405 (92.7%)	83 (54.2%)	
Microvascular	32 (7.3%)	45 (29.4%)	
Macrovascular	0 (0.0%)	25 (16.3%)	

LT, liver transplantation;

Supplementary Table 2. Integrated iAUC and overall C-index of location specific HCC recurrence predictions of both Milan and Beyond Milan cohorts

Prediction Cox Models	Milan Cohort (n = 437)				Beyond Milan Cohort (n = 153)			
	Intra-hepatic Recurrence		Extra-hepatic Recurrence		Intra-hepatic Recurrence		Extra-hepatic Recurrence	
	iAUC (95% CI)	C-index (95% CI)	iAUC (95% CI)	C-index (95% CI)	iAUC (95% CI)	C-index (95% CI)	iAUC (95% CI)	C-index (95% CI)
AFP (continuous)	0.65 (0.34-0.87)	0.73 (0.56–0.9)	0.56 (0.45-0.67)	0.61 (0.52–0.71)	0.39 (0.22-0.59)	0.41 (0.28–0.55)	0.71 (0.61-.0.8)	0.64 (0.57–0.71)
AFP≥200 (threshold)	0.55 (0.46-0.74)	0.71 (0.27–1)	0.51 (0.47-0.56)	0.71 (0.51–0.91)	0.67 (0.55-0.78)	0.79 (0.63–0.95)	0.68 (0.6-0.76)	0.75 (0.64–0.87)
PIVKA-II (continuous)	0.72 (0.57-0.88)	0.71 (0.57–0.85)	0.66 (0.57-0.75)	0.62 (0.53–0.72)	0.64 (0.47-0.78)	0.62 (0.47–0.76)	0.7 (0.59-0.79)	0.62 (0.55–0.7)
PIVKA-II≥400(threshold)	0.52 (0.51-0.53)	NA	0.5 (0.48-0.55)	0.78 (0.6–0.96)	0.58 (0.47-0.71)	0.68 (0.47–0.89)	0.65 (0.56-0.74)	0.73 (0.6–0.85)
PIVKA-II+AFP(continuous)	0.72 (0.57-0.86)	0.76 (0.65–0.86)	0.61 (0.51-0.7)	0.63 (0.54–0.72)	0.58 (0.4-0.76)	0.58 (0.43–0.74)	0.73(0.62-0.92)	0.65 (0.57–0.72)
PIVKA-II≥400 +AFP≥200 (threshold)	0.57 (0.48-0.71)	0.77 (0.46–1)	0.5 (0.46-0.57)	0.69 (0.51–0.88)	0.7 (0.57-0.82)	0.75 (0.61–0.88)	0.74 (0.64-0.92)	0.73 (0.65–0.82)
SNAPP (continuous)	0.73 (0.49-0.93)	0.81 (0.64–0.98)	0.48 (0.37-0.6)	0.49 (0.35–0.64)	0.58 (0.4-0.76)	0.57 (0.41–0.74)	0.77 (0.67-0.96)	0.73 (0.65–0.8)
SNAPP≥5 (threshold)	0.58 (0.5-0.76)	0.96(0.85–1)	0.51 (0.5-0.53)	0.81 (0.56–1)	0.63 (0.5-0.76)	0.71(0.52–0.9)	0.73 (0.65-0.9)	0.8 (0.71–0.9)
RETREAT (continuous)	0.7 (0.42-0.9)	0.76 (0.57–0.95)	0.58 (0.46-0.71)	0.67 (0.54–0.79)				
RETREAT≥5 (threshold)	0.57 (0.49-0.73)	0.93 (0.79–1)	0.51 (0.5-0.51)	NA				
MoRAL (continuous)					0.68 (0.52-0.82)	0.64 (0.51–0.78)	0.74(0.64-0.92)	0.66 (0.58–0.73)
MoRAL≥314.8 (threshold)					0.63 (0.5-0.76)	0.78 (0.61–0.94)	0.64 (0.55-0.73)	0.74(0.62–0.87)
R3-AFP (continuous)	0.82 (0.63-0.94)	0.86 (0.72–0.99)	0.6 (0.49-0.72)	0.7 (0.58–0.81)	0.68 (0.52-0.82)	0.63 (0.48–0.78)	0.83 (0.75-0.89)	0.74 (0.67–0.81)
R3-AFP≥3 (threshold)	0.64 (0.48-0.85)	0.87 (0.68–1)	0.51 (0.48-0.56)	0.7 (0.45–0.94)	0.59 (0.46-0.7)	0.57 (0.36–0.78)	0.74 (0.68-0.79)	0.86 (0.76–0.95)

iAUC, integrated area under curve; C-index, concordance index; 95%CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SNAPP, Size and Number, AFP, PIVKA-II, PET; RETREAT, Risk Estimation of Tumor Recurrence After Transplant; MoRAL, Model for Recurrence After Liver Transplantation; R3-AFP, Recurrence-Risk Reassessment AFP

Supplementary Table 3. Prognostic score characteristics and compared populations

Prognostic Score Characteristics	Recurrence Prediction		Mortality Prediction Models	
	Milan Cohort	Beyond Milan Cohort	Milan Cohort	Beyond Milan Cohort
1. Individual tumor biological markers	AFP, PIVKA-II	AFP, PIVKA-II	AFP, PIVKA-II	AFP, PIVKA-II
2. Tumor biological markers combined	AFP + PIVKA-II	AFP + PIVKA-II MoRAL	AFP + PIVKA-II	AFP + PIVKA-II
3. Tumor biological markers + tumor morphology	-		METROTICKET 2.0 transplantability	METROTICKET 2.0 transplantability
4. Tumor biological markers + tumor morphology + vascular invasion status	R3-AFP RETREAT	R3-AFP		
5. Tumor biological markers + tumor morphology + positron emission tomography	SNAPP	SNAPP	SALT	SALT

AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; MoRAL, Model for Recurrence After Liver Transplantation; R3-AFP, Recurrence-Risk Reassessment AFP; RETREAT, Risk Estimation of Tumor Recurrence After Transplant; SNAPP, Size and Number, AFP, PIVKA-II, PET; SALT, Survival After Liver Transplantation

Supplementary Table 4. Time-dependent AUC, iAUC and C-index of Recurrence Prediction Models of Milan cohort (also shown in Figure 2A, 2C)

Time-dependent AUC (95% CI)											Integrated AUC
Prediction Models	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	(95%CI)
AFP (continuous)	0.56 (0.44–0.67)	0.59 (0.49–0.70)	0.61 (0.52–0.71)	0.60 (0.50–0.70)	0.61 (0.52–0.71)	0.61 (0.51–0.70)	0.61 (0.51–0.70)	0.60 (0.49–0.69)	0.59 (0.48–0.69)	0.56 (0.45–0.67)	0.58 (0.47–0.68)
AFP≥200 (threshold)	0.51 (0.47–0.59)	0.52 (0.47–0.58)	0.53 (0.48–0.59)	0.52 (0.48–0.58)	0.54 (0.49–0.59)	0.54 (0.49–0.60)	0.54 (0.49–0.59)	0.54 (0.49–0.59)	0.53 (0.48–0.58)	0.52 (0.48–0.57)	0.52 (0.48–0.57)
PIVKA-II	0.67 (0.59–0.76)	0.68 (0.60–0.77)	0.69 (0.61–0.77)	0.66 (0.57–0.74)	0.67 (0.59–0.76)	0.67 (0.58–0.75)	0.68 (0.60–0.76)	0.67 (0.59–0.74)	0.67 (0.59–0.75)	0.68 (0.60–0.76)	0.68(0.6–0.75)
PIVKA-II≥400	0.48 (0.47–0.49)	0.51 (0.48–0.56)	0.53 (0.48–0.58)	0.52 (0.49–0.57)	0.52 (0.48–0.57)	0.52 (0.48–0.56)	0.52 (0.48–0.56)	0.52 (0.48–0.56)	0.51 (0.48–0.56)	0.51 (0.48–0.55)	0.5 (0.48–0.53)
PIVKA-II+AFP	0.62 (0.53–0.71)	0.66 (0.57–0.74)	0.68 (0.61–0.76)	0.65 (0.56–0.73)	0.66 (0.58–0.74)	0.65 (0.57–0.74)	0.66 (0.57–0.74)	0.64 (0.56–0.72)	0.64 (0.55–0.74)	0.63 (0.53–0.72)	0.64 (0.55–0.72)
PIVKA-II≥400+AFP≥200	0.50 (0.45–0.57)	0.52 (0.47–0.58)	0.53 (0.47–0.60)	0.52 (0.47–0.58)	0.54 (0.48–0.60)	0.54 (0.48–0.60)	0.54 (0.49–0.59)	0.53 (0.48–0.59)	0.53 (0.48–0.59)	0.52 (0.47–0.58)	0.51 (0.46–0.57)
SNAPP	0.50 (0.37–0.63)	0.58 (0.46–0.68)	0.59 (0.49–0.69)	0.55 (0.46–0.65)	0.57 (0.47–0.66)	0.56 (0.46–0.66)	0.58 (0.49–0.67)	0.58 (0.49–0.67)	0.58 (0.49–0.67)	0.58 (0.49–0.67)	0.54 (0.42–0.65)
SNAPP≥5	0.52 (0.49–0.57)	0.53 (0.50–0.58)	0.53 (0.50–0.57)	0.52 (0.50–0.56)	0.52 (0.50–0.56)	0.52 (0.50–0.56)	0.52 (0.50–0.56)	0.52 (0.50–0.56)	0.52 (0.50–0.56)	0.52 (0.50–0.55)	0.52 (0.5–0.56)
RETREAT	0.58 (0.44–0.71)	0.62 (0.50–0.72)	0.63 (0.54–0.73)	0.64 (0.55–0.74)	0.65 (0.54–0.74)	0.64 (0.54–0.74)	0.64 (0.55–0.73)	0.64 (0.55–0.74)	0.64 (0.54–0.73)	0.63 (0.54–0.72)	0.6 (0.48–0.72)
RETREAT≥5	0.52 (0.49–0.57)	0.51 (0.49–0.54)	0.51 (0.49–0.54)	0.51 (0.49–0.54)	0.51 (0.49–0.54)	0.50 (0.49–0.54)	0.50 (0.49–0.53)	0.50 (0.49–0.53)	0.50 (0.48–0.53)	0.50 (0.49–0.53)	0.51 (0.49–0.55)
R3-AFP	0.63 (0.51–0.75)	0.65 (0.55–0.75)	0.66 (0.56–0.74)	0.67 (0.59–0.75)	0.68 (0.58–0.76)	0.67 (0.59–0.75)	0.69 (0.61–0.77)	0.69 (0.61–0.77)	0.68 (0.60–0.77)	0.66 (0.54–0.75)	0.64 (0.54–0.74)
R3-AFP≥3	0.55 (0.48–0.62)	0.53 (0.48–0.59)	0.54 (0.49–0.59)	0.53 (0.49–0.58)	0.55 (0.50–0.60)	0.54 (0.49–0.60)	0.54 (0.50–0.59)	0.54 (0.49–0.59)	0.54 (0.49–0.59)	0.54 (0.49–0.58)	0.54 (0.48–0.6)

Dynamic C-index (95% CI)										
Prediction Models	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year
AFP	0.47 (0.33–0.62)	0.46 (0.34–0.58)	0.44 (0.33–0.56)	0.48 (0.37–0.59)	0.47 (0.36–0.57)	0.59 (0.5–0.67)	0.62 (0.54–0.7)	0.63 (0.55–0.71)	0.64 (0.55–0.72)	0.64 (0.56–0.72)
AFP≥200	0.75 (0.5–1)	0.66 (0.36–0.95)	0.58 (0.29–0.88)	0.62 (0.36–0.89)	0.55 (0.27–0.82)	0.57 (0.34–0.8)	0.56 (0.34–0.79)	0.61 (0.4–0.83)	0.67 (0.47–0.87)	0.71 (0.53–0.9)
PIVKA-II	0.5 (0.36–0.63)	0.47 (0.34–0.59)	0.46 (0.36–0.56)	0.51 (0.42–0.61)	0.48 (0.39–0.57)	0.59 (0.51–0.67)	0.6 (0.52–0.68)	0.65 (0.57–0.73)	0.65 (0.57–0.73)	0.64 (0.57–0.72)
PIVKA-II≥400	NA (NA–NA)	0.22 (0.21–0.24)	0.29 (0.18–0.4)	0.36 (0.25–0.47)	0.41 (0.31–0.52)	0.7 (0.64–0.76)	0.61 (0.37–0.84)	0.68 (0.46–0.89)	0.73 (0.53–0.92)	0.73 (0.52–0.93)
PIVKA-II+AFP	0.51 (0.38–0.64)	0.45 (0.34–0.57)	0.42 (0.32–0.53)	0.48 (0.38–0.59)	0.46 (0.36–0.56)	0.61 (0.53–0.7)	0.62 (0.54–0.7)	0.66 (0.59–0.74)	0.66 (0.58–0.73)	0.66 (0.58–0.73)
PIVKA-II≥400+AFP≥200	0.73 (0.48–0.99)	0.54 (0.26–0.82)	0.52 (0.28–0.77)	0.57 (0.35–0.79)	0.53 (0.3–0.75)	0.59 (0.4–0.78)	0.54 (0.34–0.74)	0.6 (0.4–0.79)	0.65 (0.47–0.84)	0.68 (0.5–0.86)
SNAPP	0.48 (0.28–0.67)	0.39 (0.23–0.54)	0.42 (0.27–0.56)	0.5 (0.35–0.64)	0.49 (0.35–0.63)	0.57 (0.45–0.69)	0.54 (0.42–0.66)	0.56 (0.44–0.68)	0.57 (0.45–0.69)	0.57 (0.45–0.7)
SNAPP≥5	NA (NA–NA)	0.65 (0.2–1)	0.71 (0.34–1)	0.74 (0.4–1)	0.76 (0.46–1)	0.87 (0.72–1)	0.8 (0.53–1)	0.84 (0.62–1)	0.86 (0.68–1)	0.88 (0.72–1)
RETREAT	0.52 (0.37–0.67)	0.52 (0.39–0.64)	0.51 (0.38–0.64)	0.51 (0.39–0.64)	0.53 (0.4–0.65)	0.66 (0.55–0.78)	0.68 (0.57–0.79)	0.68 (0.57–0.8)	0.69 (0.58–0.8)	0.69 (0.58–0.8)
RETREAT≥5	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	0.77 (0.29–1)	0.81 (0.39–1)	0.84 (0.47–1)	0.75 (0.3–1)
R3-AFP	0.5 (0.3–0.71)	0.51 (0.34–0.67)	0.54 (0.39–0.69)	0.55 (0.4–0.69)	0.56 (0.42–0.7)	0.7 (0.59–0.81)	0.71 (0.6–0.82)	0.72 (0.62–0.82)	0.74 (0.64–0.84)	0.74 (0.64–0.83)
R3-AFP≥3	0.74 (0.32–1)	0.82 (0.53–1)	0.69 (0.36–1)	0.72 (0.42–1)	0.63 (0.31–0.94)	0.81 (0.66–0.96)	0.74 (0.55–0.93)	0.76 (0.58–0.93)	0.77 (0.6–0.94)	0.76 (0.58–0.93)

AUC, area under curve; C-index, concordance index; 95% CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SNAPP, Size and Number, AFP, PIVKA-II, PET; RETREAT, Risk Estimation of Tumor Recurrence After Transplant; R3-AFP, Recurrence-Risk Reassessment AFP

Supplementary Table 5. Time-dependent AUC, iAUC and C-index of Recurrence Prediction Models of Beyond Milan cohort (also shown in Figure 2B, 2D)

Prediction Models	Time-dependent AUC (95% CI)										Integrated AUC (95%CI)
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.73 (0.62–0.83)	0.67 (0.57–0.77)	0.64 (0.55–0.74)	0.61 (0.51–0.70)	0.62 (0.51–0.70)	0.60 (0.50–0.69)	0.60 (0.49–0.69)	0.61 (0.50–0.71)	0.59 (0.47–0.68)	0.59 (0.47–0.68)	0.69 (0.61–0.79)
AFP≥200	0.69 (0.61–0.78)	0.68 (0.62–0.75)	0.66 (0.59–0.73)	0.64 (0.58–0.70)	0.65 (0.59–0.72)	0.64 (0.58–0.70)	0.65 (0.60–0.71)	0.65 (0.59–0.71)	0.66 (0.59–0.71)	0.66 (0.60–0.72)	0.68 (0.61–0.75)
PIVKA-II	0.70 (0.59–0.80)	0.66 (0.57–0.74)	0.68 (0.59–0.77)	0.67 (0.57–0.75)	0.69 (0.59–0.77)	0.68 (0.58–0.76)	0.68 (0.59–0.77)	0.68 (0.58–0.76)	0.69 (0.59–0.78)	0.69 (0.59–0.78)	0.68 (0.58–0.78)
PIVKA-II≥400	0.67 (0.58–0.76)	0.59 (0.52–0.67)	0.62 (0.55–0.69)	0.61 (0.55–0.68)	0.62 (0.55–0.69)	0.61 (0.54–0.68)	0.60 (0.53–0.68)	0.60 (0.52–0.67)	0.61 (0.53–0.68)	0.62 (0.54–0.69)	0.63 (0.56–0.78)
PIVKA-II+AFP	0.73 (0.63–0.83)	0.69 (0.61–0.78)	0.71 (0.63–0.79)	0.70 (0.62–0.78)	0.72 (0.63–0.80)	0.71 (0.62–0.79)	0.71 (0.61–0.79)	0.70 (0.60–0.77)	0.71 (0.61–0.81)	0.72 (0.61–0.80)	0.72 (0.62–0.8)
PIVKA-II≥400+AFP≥200	0.76 (0.67–0.84)	0.71 (0.64–0.79)	0.72 (0.64–0.79)	0.70 (0.63–0.77)	0.71 (0.64–0.78)	0.69 (0.61–0.76)	0.70 (0.62–0.77)	0.69 (0.61–0.76)	0.70 (0.62–0.78)	0.72 (0.64–0.78)	0.74 (0.65–0.82)
SNAPP	0.75 (0.63–0.85)	0.70 (0.61–0.79)	0.71 (0.62–0.79)	0.69 (0.60–0.77)	0.70 (0.60–0.78)	0.68 (0.58–0.76)	0.69 (0.60–0.78)	0.68 (0.59–0.77)	0.68 (0.58–0.76)	0.69 (0.59–0.78)	0.72 (0.63–0.82)
SNAPP≥5	0.72 (0.64–0.81)	0.69 (0.61–0.75)	0.70 (0.63–0.77)	0.68 (0.61–0.75)	0.69 (0.62–0.75)	0.68 (0.60–0.74)	0.68 (0.62–0.75)	0.68 (0.61–0.75)	0.68 (0.60–0.74)	0.69 (0.61–0.75)	0.73 (0.65–0.81)
MoRAL	0.74 (0.64–0.84)	0.71 (0.62–0.79)	0.72 (0.64–0.80)	0.71 (0.63–0.80)	0.72 (0.64–0.80)	0.71 (0.62–0.80)	0.72 (0.61–0.80)	0.71 (0.61–0.79)	0.72 (0.61–0.80)	0.73 (0.62–0.82)	0.65 (0.58–0.73)
MoRAL≥314.8	0.68 (0.60–0.76)	0.61 (0.53–0.68)	0.62 (0.56–0.69)	0.62 (0.55–0.68)	0.63 (0.56–0.70)	0.61 (0.55–0.68)	0.60 (0.53–0.67)	0.60 (0.53–0.67)	0.62 (0.54–0.68)	0.61 (0.54–0.68)	0.65 (0.58–0.73)
R3-AFP	0.82 (0.74–0.90)	0.75 (0.67–0.83)	0.78 (0.70–0.85)	0.78 (0.71–0.85)	0.78 (0.70–0.85)	0.76 (0.68–0.83)	0.75 (0.66–0.83)	0.75 (0.66–0.83)	0.76 (0.67–0.83)	0.77 (0.67–0.85)	0.79 (0.71–0.86)
R3-AFP≥3	0.70 (0.62–0.76)	0.69 (0.61–0.76)	0.70 (0.63–0.77)	0.70 (0.63–0.77)	0.70 (0.63–0.77)	0.68 (0.60–0.75)	0.67 (0.59–0.75)	0.67 (0.59–0.76)	0.68 (0.58–0.76)	0.69 (0.58–0.77)	0.7 (0.63–0.76)

Prediction Models	Dynamic C-index (95%CI)									
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year
AFP	0.59 (0.5–0.67)	0.61 (0.53–0.69)	0.63 (0.57–0.7)	0.65 (0.59–0.72)	0.64 (0.58–0.71)	0.65 (0.59–0.7)	0.64 (0.58–0.69)	0.62 (0.57–0.68)	0.63 (0.57–0.68)	0.63 (0.57–0.68)
AFP≥200	0.64 (0.47–0.81)	0.64 (0.51–0.78)	0.71 (0.59–0.83)	0.74 (0.64–0.85)	0.72 (0.61–0.84)	0.77 (0.68–0.87)	0.75 (0.65–0.85)	0.76 (0.67–0.86)	0.77 (0.67–0.86)	0.76 (0.66–0.86)
PIVKA-II	0.6 (0.5–0.7)	0.61 (0.54–0.69)	0.59 (0.52–0.67)	0.6 (0.52–0.68)	0.59 (0.51–0.66)	0.62 (0.55–0.69)	0.62 (0.55–0.68)	0.63 (0.56–0.69)	0.62 (0.55–0.69)	0.62 (0.55–0.69)
PIVKA-II≥400	0.71 (0.55–0.86)	0.78 (0.66–0.9)	0.68 (0.54–0.82)	0.69 (0.56–0.82)	0.67 (0.54–0.81)	0.73 (0.62–0.85)	0.74 (0.63–0.85)	0.75 (0.65–0.86)	0.72 (0.6–0.83)	0.71 (0.6–0.83)
PIVKA-II+AFP	0.62 (0.51–0.72)	0.62 (0.55–0.69)	0.61 (0.53–0.68)	0.61 (0.54–0.69)	0.6 (0.53–0.68)	0.64 (0.57–0.71)	0.64 (0.57–0.71)	0.65 (0.58–0.72)	0.64 (0.58–0.71)	0.64 (0.58–0.71)
PIVKA-II≥400+AFP≥200	0.66 (0.53–0.79)	0.69 (0.59–0.78)	0.69 (0.61–0.77)	0.71 (0.64–0.79)	0.7 (0.61–0.78)	0.75 (0.68–0.83)	0.74 (0.66–0.81)	0.75 (0.68–0.83)	0.74 (0.66–0.82)	0.73 (0.66–0.81)
SNAPP	0.56 (0.43–0.69)	0.63 (0.56–0.7)	0.63 (0.56–0.7)	0.65 (0.58–0.72)	0.64 (0.58–0.71)	0.69 (0.63–0.76)	0.68 (0.61–0.75)	0.69 (0.62–0.76)	0.69 (0.62–0.76)	0.68 (0.61–0.76)
SNAPP≥5	0.64 (0.47–0.81)	0.69 (0.57–0.82)	0.67 (0.55–0.8)	0.72 (0.61–0.83)	0.71 (0.6–0.82)	0.77 (0.67–0.86)	0.76 (0.66–0.85)	0.77 (0.68–0.86)	0.78 (0.69–0.87)	0.78 (0.69–0.87)
MoRAL	0.62 (0.52–0.72)	0.63 (0.55–0.7)	0.61 (0.54–0.69)	0.62 (0.55–0.7)	0.61 (0.54–0.69)	0.65 (0.58–0.72)	0.65 (0.58–0.71)	0.66 (0.59–0.72)	0.65 (0.59–0.72)	0.65 (0.59–0.72)
MoRAL≥314.8	0.69 (0.53–0.85)	0.76 (0.64–0.89)	0.7 (0.57–0.84)	0.7 (0.57–0.84)	0.69 (0.55–0.82)	0.74 (0.63–0.86)	0.77 (0.66–0.87)	0.78 (0.68–0.88)	0.74 (0.63–0.85)	0.75 (0.65–0.86)
R3-AFP	0.5 (0.4–0.6)	0.64 (0.58–0.7)	0.62 (0.55–0.69)	0.63 (0.56–0.7)	0.64 (0.57–0.71)	0.71 (0.64–0.77)	0.71 (0.64–0.77)	0.72 (0.65–0.78)	0.71 (0.65–0.77)	0.71 (0.64–0.77)
R3-AFP≥3	0.65 (0.52–0.79)	0.65 (0.51–0.79)	0.66 (0.53–0.8)	0.69 (0.56–0.82)	0.7 (0.57–0.82)	0.78 (0.68–0.88)	0.79 (0.69–0.88)	0.78 (0.69–0.88)	0.78 (0.68–0.87)	0.77 (0.67–0.87)

AUC, area under curve; C-index, concordance index; 95% CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SNAPP, Size and Number, AFP, PIVKA-II, PET; R3-AFP, MoRAL, Model for Recurrence After Liver Transplantation; R3-AFP, Recurrence-Risk Reassessment AFP

Supplementary Table 6. Time-dependent AUC, iAUC and C-index of Mortality Prediction Models of Milan cohort (also shown in Figure 3A, 3C)

Prediction Models	Time-dependent AUC (95% CI)										Integrated AUC (95%CI)
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.44 (0.28–0.62)	0.53 (0.40–0.66)	0.58 (0.47–0.68)	0.57 (0.47–0.67)	0.57 (0.47–0.65)	0.57 (0.48–0.67)	0.56 (0.46–0.66)	0.58 (0.49–0.67)	0.56 (0.46–0.65)	0.54 (0.45–0.64)	0.53 (0.44–0.64)
AFP≥200	0.55 (0.47–0.67)	0.56 (0.49–0.65)	0.55 (0.49–0.61)	0.54 (0.49–0.60)	0.53 (0.49–0.58)	0.54 (0.50–0.59)	0.54 (0.50–0.59)	0.53 (0.49–0.58)	0.53 (0.49–0.57)	0.52 (0.48–0.56)	0.54 (0.49–0.61)
PIVKA-II	0.71 (0.55–0.84)	0.73 (0.63–0.81)	0.74 (0.66–0.81)	0.73 (0.65–0.80)	0.70 (0.63–0.78)	0.69 (0.61–0.76)	0.69 (0.61–0.76)	0.67 (0.58–0.74)	0.68 (0.58–0.76)	0.67 (0.56–0.75)	0.71 (0.62–0.78)
PIVKA-II≥400	0.52 (0.48–0.62)	0.53 (0.48–0.60)	0.53 (0.48–0.58)	0.52 (0.49–0.58)	0.52 (0.48–0.56)	0.53 (0.49–0.57)	0.54 (0.50–0.59)	0.53 (0.49–0.57)	0.52 (0.49–0.57)	0.52 (0.49–0.56)	0.53 (0.49–0.57)
PIVKA-II+AFP	0.63 (0.46–0.79)	0.67 (0.56–0.77)	0.70 (0.61–0.78)	0.68 (0.59–0.75)	0.66 (0.57–0.74)	0.67 (0.60–0.75)	0.68 (0.60–0.76)	0.67 (0.60–0.76)	0.68 (0.60–0.75)	0.66 (0.57–0.75)	0.66 (0.57–0.75)
PIVKA-II≥400+AFP>200	0.57 (0.46–0.70)	0.57 (0.48–0.66)	0.55 (0.48–0.62)	0.54 (0.48–0.61)	0.53 (0.48–0.58)	0.55 (0.50–0.61)	0.56 (0.51–0.62)	0.55 (0.50–0.60)	0.54 (0.49–0.59)	0.53 (0.48–0.58)	0.55 (0.49–0.62)
SALT	0.62 (0.48–0.76)	0.62 (0.52–0.73)	0.66 (0.57–0.75)	0.67 (0.58–0.75)	0.64 (0.55–0.73)	0.66 (0.57–0.75)	0.66 (0.58–0.75)	0.67 (0.60–0.75)	0.68 (0.61–0.76)	0.67 (0.58–0.75)	0.65 (0.56–0.73)
SALT≥4.07	0.53 (0.49–0.63)	0.54 (0.50–0.61)	0.54 (0.50–0.60)	0.54 (0.50–0.59)	0.53 (0.50–0.57)	0.53 (0.50–0.57)	0.53 (0.50–0.56)	0.52 (0.50–0.55)	0.52 (0.50–0.55)	0.52 (0.50–0.55)	0.53 (0.5–0.59)
METRTK 2.0	0.51 (0.47–0.60)	0.52 (0.47–0.59)	0.54 (0.49–0.60)	0.55 (0.49–0.61)	0.54 (0.49–0.59)	0.56 (0.51–0.61)	0.56 (0.51–0.61)	0.55 (0.51–0.60)	0.55 (0.50–0.59)	0.54 (0.50–0.58)	0.53 (0.49–0.58)
Prediction Models	Dynamic C-index (95%CI)										
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	–	0.34 (0.26–0.43)	0.36 (0.27–0.45)	0.41 (0.31–0.52)	0.44 (0.34–0.54)	0.57 (0.49–0.65)	0.6 (0.52–0.67)	0.6 (0.52–0.68)	0.6 (0.53–0.68)	0.6 (0.53–0.68)	
AFP≥200	–	0.33 (0.04–0.62)	0.5 (0.3–0.71)	0.55 (0.36–0.74)	0.62 (0.46–0.78)	0.6 (0.38–0.82)	0.55 (0.34–0.77)	0.61 (0.41–0.82)	0.67 (0.48–0.86)	0.72 (0.54–0.89)	
PIVKA-II	–	0.51 (0.36–0.66)	0.52 (0.4–0.63)	0.56 (0.45–0.67)	0.58 (0.47–0.69)	0.65 (0.58–0.73)	0.64 (0.57–0.72)	0.68 (0.61–0.75)	0.68 (0.61–0.75)	0.66 (0.59–0.73)	
PIVKA-II≥400	–	0.4 (0–0.94)	0.48 (0.18–0.79)	0.53 (0.25–0.81)	0.6 (0.36–0.84)	0.73 (0.57–0.9)	0.66 (0.46–0.86)	0.74 (0.58–0.9)	0.79 (0.65–0.93)	0.79 (0.65–0.93)	
PIVKA-II+AFP	–	0.48 (0.33–0.63)	0.47 (0.37–0.57)	0.52 (0.41–0.63)	0.53 (0.43–0.64)	0.64 (0.56–0.72)	0.65 (0.57–0.72)	0.68 (0.61–0.75)	0.68 (0.61–0.75)	0.67 (0.61–0.74)	
PIVKA-II≥400+AFP>200	–	0.43 (0.13–0.74)	0.56 (0.35–0.77)	0.6 (0.41–0.79)	0.66 (0.49–0.83)	0.63 (0.46–0.81)	0.57 (0.39–0.74)	0.64 (0.48–0.8)	0.7 (0.55–0.84)	0.72 (0.59–0.86)	
SALT	–	0.45 (0.32–0.58)	0.41 (0.31–0.52)	0.43 (0.33–0.52)	0.48 (0.38–0.58)	0.63 (0.56–0.7)	0.65 (0.58–0.72)	0.67 (0.6–0.74)	0.66 (0.59–0.74)	0.66 (0.59–0.73)	
SALT≥4.07	–	0.29 (0–0.66)	0.39 (0.12–0.65)	0.44 (0.2–0.69)	0.52 (0.31–0.74)	0.78 (0.68–0.88)	0.85 (0.78–0.92)	0.88 (0.83–0.94)	0.91 (0.86–0.95)	0.86 (0.72–1)	
METRTK 2.0	–	0.29 (0–0.66)	0.34 (0.13–0.56)	0.31 (0.11–0.52)	0.42 (0.24–0.6)	0.64 (0.5–0.79)	0.63 (0.46–0.79)	0.63 (0.46–0.81)	0.7 (0.54–0.85)	0.74 (0.6–0.88)	

AUC, area under curve; C-index, concordance index; 95% CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SALT, Survival After Liver Transplantation; METRK 2.0, METROTICKET 2.0 transplantability

Supplementary Table 7. Time-dependent AUC, iAUC and C-index of Mortality Prediction Models of Beyond Milan cohort (also shown in Figure 3B, 3D)

Prediction Models	Time-dependent AUC (95% CI)										Integrated AUC (95%CI)
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.76 (0.63–0.90)	0.68 (0.56–0.79)	0.64 (0.54–0.73)	0.58 (0.48–0.68)	0.58 (0.49–0.69)	0.59 (0.48–0.69)	0.61 (0.51–0.71)	0.62 (0.52–0.72)	0.63 (0.52–0.73)	0.61 (0.50–0.71)	0.66 (0.57–0.76)
AFP≥200	0.72 (0.57–0.87)	0.64 (0.56–0.73)	0.65 (0.57–0.72)	0.63 (0.56–0.70)	0.62 (0.55–0.69)	0.63 (0.56–0.70)	0.65 (0.59–0.72)	0.65 (0.58–0.72)	0.65 (0.58–0.72)	0.65 (0.58–0.71)	0.66 (0.58–0.74)
PIVKA-II	0.70 (0.51–0.87)	0.72 (0.59–0.83)	0.66 (0.56–0.76)	0.66 (0.57–0.75)	0.66 (0.56–0.75)	0.67 (0.58–0.75)	0.69 (0.60–0.78)	0.68 (0.58–0.76)	0.69 (0.59–0.78)	0.69 (0.58–0.78)	0.69 (0.58–0.78)
PIVKA-II≥400	0.70 (0.56–0.84)	0.68 (0.59–0.77)	0.62 (0.54–0.70)	0.62 (0.55–0.69)	0.62 (0.54–0.69)	0.61 (0.53–0.69)	0.62 (0.55–0.70)	0.61 (0.54–0.69)	0.63 (0.56–0.70)	0.63 (0.55–0.70)	0.65 (0.57–0.73)
PIVKA-II+AFP	0.74 (0.57–0.88)	0.73 (0.61–0.83)	0.68 (0.58–0.77)	0.68 (0.59–0.77)	0.67 (0.58–0.77)	0.68 (0.59–0.77)	0.71 (0.63–0.80)	0.69 (0.60–0.78)	0.71 (0.62–0.80)	0.71 (0.61–0.80)	0.71 (0.61–0.8)
PIVKA-II≥400+AFP>200	0.83 (0.70–0.91)	0.71 (0.62–0.81)	0.69 (0.60–0.78)	0.69 (0.61–0.77)	0.67 (0.59–0.75)	0.68 (0.60–0.76)	0.71 (0.63–0.78)	0.69 (0.62–0.77)	0.71 (0.63–0.78)	0.71 (0.62–0.78)	0.72 (0.64–0.81)
SALT	0.78 (0.63–0.91)	0.73 (0.60–0.84)	0.69 (0.59–0.79)	0.70 (0.61–0.79)	0.69 (0.58–0.78)	0.70 (0.61–0.79)	0.71 (0.62–0.80)	0.71 (0.62–0.79)	0.71 (0.61–0.79)	0.70 (0.58–0.79)	0.72 (0.63–0.82)
SALT≥4.07	0.73 (0.59–0.86)	0.71 (0.61–0.80)	0.68 (0.60–0.75)	0.65 (0.57–0.72)	0.64 (0.57–0.72)	0.65 (0.57–0.72)	0.65 (0.58–0.73)	0.64 (0.56–0.72)	0.65 (0.58–0.73)	0.64 (0.55–0.71)	0.69 (0.61–0.77)
METRTK 2.0	0.64 (0.54–0.71)	0.63 (0.55–0.70)	0.63 (0.56–0.69)	0.61 (0.54–0.68)	0.62 (0.55–0.69)	0.63 (0.55–0.70)	0.62 (0.54–0.69)	0.62 (0.53–0.69)	0.62 (0.53–0.69)	0.63 (0.53–0.71)	0.63 (0.56–0.69)
Dynamic C-index (95%CI)											
Prediction Models	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	–	0.64 (0.57–0.71)	0.65 (0.57–0.73)	0.67 (0.59–0.74)	0.66 (0.59–0.73)	0.64 (0.58–0.69)	0.61 (0.56–0.67)	0.6 (0.54–0.66)	0.6 (0.54–0.66)	0.61 (0.55–0.66)	
AFP≥200	–	0.76 (0.61–0.91)	0.67 (0.52–0.82)	0.71 (0.58–0.84)	0.73 (0.6–0.85)	0.74 (0.63–0.86)	0.71 (0.59–0.82)	0.73 (0.62–0.84)	0.73 (0.62–0.84)	0.73 (0.62–0.84)	
PIVKA-II	–	0.55 (0.44–0.67)	0.6 (0.52–0.68)	0.59 (0.51–0.67)	0.59 (0.52–0.67)	0.62 (0.55–0.7)	0.61 (0.54–0.69)	0.63 (0.55–0.7)	0.62 (0.55–0.69)	0.62 (0.55–0.69)	
PIVKA-II≥400	–	0.67 (0.47–0.86)	0.76 (0.63–0.89)	0.71 (0.57–0.84)	0.72 (0.59–0.85)	0.77 (0.67–0.88)	0.76 (0.65–0.87)	0.78 (0.68–0.88)	0.74 (0.63–0.85)	0.74 (0.63–0.85)	
PIVKA-II+AFP	–	0.56 (0.46–0.67)	0.61 (0.53–0.69)	0.6 (0.52–0.68)	0.61 (0.53–0.68)	0.64 (0.57–0.71)	0.63 (0.56–0.7)	0.64 (0.58–0.71)	0.64 (0.57–0.71)	0.64 (0.57–0.71)	
PIVKA-II≥400+AFP>200	–	0.72 (0.58–0.85)	0.69 (0.6–0.78)	0.69 (0.61–0.77)	0.71 (0.63–0.79)	0.75 (0.67–0.82)	0.72 (0.63–0.8)	0.74 (0.66–0.82)	0.73 (0.64–0.81)	0.73 (0.65–0.81)	
SALT	–	0.6 (0.54–0.66)	0.63 (0.57–0.69)	0.62 (0.55–0.69)	0.63 (0.56–0.7)	0.67 (0.6–0.74)	0.66 (0.6–0.73)	0.67 (0.6–0.74)	0.67 (0.6–0.74)	0.67 (0.61–0.74)	
SALT≥4.07	–	0.72 (0.54–0.9)	0.72 (0.58–0.85)	0.76 (0.64–0.88)	0.77 (0.66–0.89)	0.79 (0.7–0.89)	0.78 (0.68–0.88)	0.8 (0.71–0.89)	0.78 (0.69–0.88)	0.8 (0.71–0.89)	
METRTK 2.0	–	0.71 (0.5–0.91)	0.72 (0.53–0.9)	0.74 (0.58–0.89)	0.7 (0.55–0.86)	0.73 (0.6–0.86)	0.75 (0.63–0.87)	0.76 (0.65–0.88)	0.76 (0.64–0.88)	0.74 (0.62–0.86)	

AUC, area under curve; C-index, concordance index; 95% CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SALT, Survival After Liver Transplantation; METRK 2.0, METROTICET 2.0 transplantability

Supplementary Table 8. Time-dependent AUC, iAUC and C-index of Intra-Hepatic Recurrence Prediction Models of Milan cohort (also shown in Figure 4A, 4C)

Model	Time-dependent AUC (95% CI)										Integrated AUC (95%CI)
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.58 (0.00–0.96)	0.69 (0.48–0.84)	0.70 (0.48–0.85)	0.70 (0.49–0.85)	0.70 (0.49–0.85)	0.69 (0.48–0.86)	0.72 (0.51–0.86)	0.71 (0.50–0.86)	0.70 (0.53–0.86)	0.69 (0.49–0.84)	0.65 (0.34–0.87)
AFP≥200	0.59 (0.46–0.97)	0.52 (0.46–0.65)	0.53 (0.46–0.65)	0.53 (0.46–0.64)	0.53 (0.47–0.65)	0.53 (0.47–0.64)	0.53 (0.47–0.63)	0.52 (0.47–0.62)	0.52 (0.46–0.63)	0.52 (0.46–0.63)	0.55 (0.46–0.74)
PIVKA-II	0.72 (0.49–0.95)	0.73 (0.56–0.88)	0.73 (0.56–0.87)	0.73 (0.56–0.87)	0.74 (0.57–0.88)	0.74 (0.57–0.87)	0.72 (0.59–0.85)	0.71 (0.57–0.84)	0.71 (0.57–0.85)	0.72 (0.59–0.85)	0.72 (0.57–0.88)
PIVKA-II≥400	0.52 (0.51–0.53)	0.52 (0.51–0.53)	0.52 (0.51–0.53)	0.52 (0.51–0.52)	0.52 (0.51–0.53)	0.52 (0.51–0.53)	0.52 (0.51–0.52)	0.52 (0.51–0.53)	0.52 (0.51–0.53)	0.52 (0.51–0.54)	0.52 (0.51–0.53)
PIVKA-II+AFP	0.68 (0.42–0.96)	0.75 (0.64–0.85)	0.75 (0.65–0.86)	0.75 (0.64–0.85)	0.75 (0.65–0.86)	0.75 (0.62–0.84)	0.76 (0.66–0.86)	0.75 (0.62–0.84)	0.75 (0.65–0.85)	0.74 (0.63–0.83)	0.72 (0.57–0.86)
PIVKA-II≥400+AFP≥200	0.61 (0.48–0.97)	0.54 (0.48–0.65)	0.54 (0.48–0.65)	0.54 (0.48–0.65)	0.54 (0.48–0.66)	0.55 (0.48–0.66)	0.54 (0.48–0.64)	0.54 (0.49–0.65)	0.54 (0.49–0.64)	0.54 (0.48–0.64)	0.57 (0.48–0.71)
SNAPP	0.68 (0.21–0.99)	0.76 (0.57–0.92)	0.77 (0.57–0.91)	0.76 (0.58–0.92)	0.76 (0.57–0.92)	0.76 (0.58–0.92)	0.75 (0.58–0.88)	0.75 (0.58–0.90)	0.75 (0.59–0.89)	0.74 (0.59–0.87)	0.73 (0.49–0.93)
SNAPP≥5	0.62 (0.49–0.87)	0.55 (0.50–0.67)	0.55 (0.50–0.65)	0.55 (0.50–0.66)	0.55 (0.50–0.69)	0.55 (0.50–0.66)	0.55 (0.50–0.65)	0.55 (0.50–0.64)	0.55 (0.50–0.65)	0.55 (0.50–0.65)	0.58 (0.5–0.76)
RETREAT	0.69 (0.07–0.99)	0.70 (0.50–0.86)	0.71 (0.51–0.86)	0.71 (0.50–0.86)	0.71 (0.51–0.87)	0.70 (0.51–0.87)	0.71 (0.53–0.85)	0.71 (0.51–0.84)	0.71 (0.52–0.84)	0.71 (0.54–0.85)	0.7 (0.42–0.9)
RETREAT≥5	0.61 (0.49–0.99)	0.55 (0.49–0.66)	0.55 (0.49–0.66)	0.55 (0.49–0.68)	0.55 (0.49–0.66)	0.55 (0.49–0.65)	0.54 (0.49–0.64)	0.54 (0.49–0.65)	0.54 (0.48–0.64)	0.54 (0.48–0.63)	0.57 (0.49–0.73)
R3-AFP	0.89 (0.65–1.00)	0.77 (0.59–0.91)	0.77 (0.58–0.93)	0.77 (0.58–0.91)	0.78 (0.60–0.91)	0.77 (0.60–0.92)	0.79 (0.64–0.91)	0.79 (0.63–0.92)	0.79 (0.63–0.91)	0.79 (0.64–0.91)	0.82 (0.63–0.94)
R3-AFP≥3	0.73 (0.48–0.98)	0.59 (0.48–0.73)	0.59 (0.48–0.74)	0.59 (0.48–0.74)	0.59 (0.48–0.74)	0.59 (0.48–0.74)	0.58 (0.48–0.72)	0.58 (0.48–0.71)	0.58 (0.48–0.72)	0.58 (0.48–0.71)	0.64 (0.48–0.85)
Dynamic C-index (95%CI)											
Prediction Models	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.76 (0.54–0.99)	0.61 (0.36–0.87)	0.53 (0.28–0.78)	0.56 (0.34–0.79)	0.55 (0.32–0.77)	0.68 (0.5–0.86)	0.7 (0.53–0.87)	0.72 (0.55–0.89)	0.72 (0.56–0.89)	0.73 (0.56–0.9)	
AFP≥200	NA (NA–NA)	0.91 (0.72–1)	0.78 (0.36–1)	0.79 (0.4–1)	0.7 (0.23–1)	0.62 (0.11–1)	0.59 (0.07–1)	0.62 (0.12–1)	0.67 (0.21–1)	0.71 (0.27–1)	
PIVKA-II	0.76 (0.34–1)	0.59 (0.3–0.89)	0.56 (0.31–0.8)	0.61 (0.4–0.82)	0.57 (0.36–0.79)	0.68 (0.5–0.86)	0.68 (0.51–0.85)	0.73 (0.58–0.87)	0.72 (0.58–0.86)	0.71 (0.57–0.85)	
PIVKA-II≥400	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
PIVKA-II+AFP	0.76 (0.42–1)	0.59 (0.28–0.91)	0.53 (0.26–0.79)	0.58 (0.36–0.81)	0.56 (0.34–0.78)	0.72 (0.58–0.86)	0.71 (0.59–0.83)	0.75 (0.65–0.86)	0.75 (0.64–0.86)	0.76 (0.65–0.86)	
PIVKA-II≥400+AFP≥200	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	0.89 (0.66–1)	0.72 (0.33–1)	0.69 (0.33–1)	0.7 (0.34–1)	0.74 (0.4–1)	0.77 (0.46–1)	
SNAPP	0.84 (0.53–1)	0.67 (0.31–1)	0.69 (0.4–0.99)	0.75 (0.51–0.99)	0.74 (0.51–0.98)	0.8 (0.63–0.98)	0.78 (0.6–0.96)	0.8 (0.62–0.97)	0.8 (0.64–0.97)	0.81 (0.64–0.98)	
SNAPP≥5	NA (NA–NA)	0.92 (0.73–1)	0.93 (0.77–1)	0.94 (0.79–1)	0.94 (0.81–1)	0.97 (0.89–1)	0.92 (0.75–1)	0.94 (0.8–1)	0.95 (0.83–1)	0.96 (0.85–1)	
RETREAT	0.81 (0.43–1)	0.72 (0.37–1)	0.67 (0.35–1)	0.66 (0.35–0.98)	0.66 (0.36–0.96)	0.75 (0.53–0.97)	0.75 (0.54–0.95)	0.76 (0.56–0.96)	0.76 (0.56–0.96)	0.76 (0.57–0.95)	
RETREAT≥5	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	0.94 (0.8–1)	0.95 (0.84–1)	0.96 (0.87–1)	0.93 (0.79–1)	
R3-AFP	0.88 (0.72–1)	0.84 (0.68–0.99)	0.81 (0.65–0.98)	0.81 (0.64–0.97)	0.8 (0.63–0.96)	0.85 (0.71–0.99)	0.85 (0.71–0.99)	0.85 (0.71–0.99)	0.86 (0.73–1)	0.86 (0.72–0.99)	
R3-AFP≥3	NA (NA–NA)	NA (NA–NA)	0.88 (0.66–1)	0.89 (0.69–1)	0.83 (0.56–1)	0.91 (0.77–1)	0.86 (0.66–1)	0.87 (0.68–1)	0.88 (0.7–1)	0.87 (0.68–1)	

AUC, area under curve; C-index, concordance index; 95% CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SNAPP, Size and Number, AFP, PIVKA-II, PET; RETREAT, Risk Estimation of Tumor Recurrence After Transplant; R3-AFP, Recurrence-Risk Reassessment AFP

Supplementary Table 9. Time-dependent AUC, iAUC and C-index of Intra-Hepatic Recurrence Prediction Models of Beyond Milan cohort (also shown in Figure 4B, 4D)

Prediction Models	Time-dependent AUC (95% CI)										Integrated AUC (95%CI)
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.35 (0.15–0.56)	0.40 (0.24–0.60)	0.48 (0.31–0.68)	0.47 (0.31–0.66)	0.47 (0.32–0.66)	0.48 (0.31–0.66)	0.47 (0.32–0.66)	0.46 (0.29–0.65)	0.47 (0.31–0.66)	0.47 (0.30–0.67)	0.39 (0.22–0.59)
AFP≥200	0.69 (0.54–0.84)	0.68 (0.56–0.79)	0.64 (0.53–0.73)	0.63 (0.52–0.72)	0.63 (0.52–0.72)	0.63 (0.51–0.72)	0.64 (0.54–0.72)	0.64 (0.53–0.73)	0.64 (0.54–0.74)	0.65 (0.55–0.74)	0.67 (0.55–0.78)
PIVKA-II	0.64 (0.43–0.83)	0.62 (0.46–0.75)	0.68 (0.54–0.81)	0.67 (0.54–0.79)	0.68 (0.56–0.80)	0.67 (0.54–0.80)	0.69 (0.55–0.81)	0.68 (0.54–0.80)	0.69 (0.55–0.82)	0.70 (0.55–0.82)	0.64 (0.47–0.78)
PIVKA-II≥400	0.62 (0.47–0.78)	0.53 (0.42–0.63)	0.59 (0.48–0.71)	0.58 (0.47–0.68)	0.58 (0.48–0.69)	0.57 (0.46–0.67)	0.57 (0.46–0.68)	0.57 (0.46–0.68)	0.58 (0.48–0.69)	0.59 (0.47–0.71)	0.58 (0.47–0.71)
PIVKA-II+AFP	0.59 (0.36–0.82)	0.55 (0.38–0.71)	0.61 (0.47–0.77)	0.62 (0.47–0.76)	0.62 (0.47–0.78)	0.62 (0.46–0.77)	0.63 (0.48–0.77)	0.62 (0.47–0.76)	0.64 (0.48–0.79)	0.63 (0.46–0.77)	0.58 (0.4–0.76)
PIVKA-II≥400+AFP≥200	0.73 (0.55–0.88)	0.68 (0.53–0.83)	0.69 (0.56–0.81)	0.67 (0.54–0.78)	0.68 (0.55–0.80)	0.67 (0.52–0.79)	0.68 (0.55–0.80)	0.68 (0.53–0.79)	0.69 (0.55–0.81)	0.71 (0.56–0.82)	0.7 (0.57–0.82)
SNAPP	0.60 (0.36–0.84)	0.55 (0.37–0.69)	0.61 (0.46–0.75)	0.58 (0.42–0.73)	0.59 (0.44–0.72)	0.56 (0.39–0.72)	0.58 (0.42–0.73)	0.57 (0.42–0.73)	0.57 (0.41–0.72)	0.58 (0.41–0.73)	0.58 (0.4–0.76)
SNAPP≥5	0.66 (0.50–0.81)	0.59 (0.48–0.69)	0.63 (0.52–0.74)	0.62 (0.51–0.73)	0.62 (0.52–0.73)	0.62 (0.51–0.73)	0.63 (0.52–0.73)	0.62 (0.51–0.73)	0.63 (0.52–0.73)	0.63 (0.52–0.73)	0.63 (0.5–0.76)
MoRAL	0.68 (0.48–0.87)	0.66 (0.50–0.78)	0.71 (0.57–0.84)	0.70 (0.57–0.82)	0.71 (0.58–0.83)	0.70 (0.58–0.82)	0.71 (0.57–0.83)	0.71 (0.56–0.83)	0.73 (0.58–0.84)	0.74 (0.59–0.86)	0.68 (0.52–0.82)
MoRAL≥314.8	0.67 (0.52–0.84)	0.58 (0.46–0.68)	0.62 (0.51–0.73)	0.61 (0.50–0.72)	0.62 (0.50–0.72)	0.61 (0.49–0.71)	0.60 (0.49–0.71)	0.60 (0.49–0.70)	0.62 (0.50–0.73)	0.61 (0.49–0.71)	0.63 (0.5–0.76)
R3-AFP	0.70 (0.49–0.86)	0.66 (0.49–0.79)	0.70 (0.57–0.82)	0.69 (0.56–0.82)	0.69 (0.56–0.81)	0.67 (0.53–0.80)	0.68 (0.53–0.81)	0.67 (0.52–0.81)	0.70 (0.55–0.82)	0.70 (0.55–0.84)	0.68 (0.52–0.82)
R3-AFP≥3	0.59 (0.44–0.74)	0.59 (0.45–0.72)	0.61 (0.48–0.73)	0.59 (0.47–0.71)	0.59 (0.46–0.71)	0.58 (0.44–0.70)	0.58 (0.44–0.70)	0.58 (0.45–0.70)	0.59 (0.45–0.72)	0.61 (0.46–0.73)	0.59 (0.46–0.7)
Dynamic C-index (95%CI)											
Prediction Models	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.43 (0.26–0.6)	0.41 (0.25–0.57)	0.39 (0.25–0.54)	0.38 (0.25–0.51)	0.39 (0.26–0.53)	0.39 (0.26–0.52)	0.4 (0.27–0.54)	0.42 (0.28–0.55)	0.41 (0.28–0.55)	0.41 (0.28–0.55)	
AFP≥200	0.72 (0.47–0.97)	0.7 (0.48–0.93)	0.76 (0.57–0.95)	0.79 (0.62–0.96)	0.77 (0.59–0.95)	0.81 (0.66–0.96)	0.78 (0.62–0.95)	0.8 (0.64–0.95)	0.79 (0.64–0.95)	0.79 (0.63–0.95)	
PIVKA-II	0.64 (0.45–0.83)	0.6 (0.41–0.79)	0.57 (0.39–0.75)	0.59 (0.42–0.75)	0.57 (0.41–0.74)	0.61 (0.45–0.76)	0.6 (0.45–0.76)	0.62 (0.47–0.76)	0.61 (0.47–0.76)	0.62 (0.47–0.76)	
PIVKA-II≥400	0.79 (0.57–1)	0.79 (0.59–1)	0.66 (0.41–0.92)	0.67 (0.43–0.91)	0.65 (0.4–0.89)	0.71 (0.5–0.92)	0.71 (0.5–0.92)	0.73 (0.53–0.92)	0.68 (0.47–0.9)	0.68 (0.47–0.89)	
PIVKA-II+AFP	0.62 (0.41–0.82)	0.61 (0.42–0.8)	0.57 (0.39–0.75)	0.57 (0.4–0.74)	0.56 (0.38–0.73)	0.58 (0.41–0.74)	0.57 (0.41–0.74)	0.58 (0.42–0.74)	0.58 (0.42–0.73)	0.58 (0.43–0.74)	
PIVKA-II≥400+AFP≥200	0.75 (0.55–0.95)	0.73 (0.56–0.9)	0.72 (0.56–0.88)	0.74 (0.59–0.89)	0.72 (0.57–0.88)	0.77 (0.64–0.9)	0.75 (0.62–0.89)	0.77 (0.64–0.9)	0.75 (0.62–0.89)	0.75 (0.61–0.88)	
SNAPP	0.5 (0.32–0.68)	0.53 (0.34–0.71)	0.51 (0.33–0.7)	0.53 (0.35–0.72)	0.53 (0.35–0.71)	0.58 (0.42–0.75)	0.57 (0.4–0.74)	0.58 (0.41–0.75)	0.58 (0.41–0.74)	0.57 (0.41–0.74)	
SNAPP≥5	0.63 (0.35–0.91)	0.64 (0.39–0.89)	0.6 (0.34–0.85)	0.65 (0.42–0.88)	0.63 (0.4–0.86)	0.7 (0.5–0.9)	0.69 (0.48–0.89)	0.7 (0.51–0.9)	0.71 (0.52–0.9)	0.71 (0.52–0.9)	
MoRAL	0.66 (0.51–0.82)	0.63 (0.46–0.8)	0.6 (0.43–0.76)	0.62 (0.46–0.77)	0.6 (0.45–0.76)	0.64 (0.5–0.78)	0.64 (0.5–0.78)	0.65 (0.51–0.79)	0.64 (0.51–0.78)	0.64 (0.51–0.78)	
MoRAL≥314.8	0.8 (0.6–1)	0.82 (0.65–1)	0.74 (0.53–0.95)	0.74 (0.54–0.94)	0.72 (0.51–0.93)	0.77 (0.6–0.95)	0.8 (0.63–0.96)	0.81 (0.65–0.96)	0.76 (0.59–0.94)	0.78 (0.61–0.94)	
R3-AFP	0.47 (0.28–0.65)	0.56 (0.37–0.74)	0.54 (0.36–0.72)	0.54 (0.37–0.72)	0.56 (0.39–0.73)	0.63 (0.47–0.78)	0.63 (0.48–0.78)	0.64 (0.49–0.78)	0.63 (0.48–0.78)	0.63 (0.48–0.78)	
R3-AFP≥3	0.35 (0.14–0.56)	0.41 (0.16–0.65)	0.42 (0.19–0.66)	0.46 (0.23–0.69)	0.46 (0.24–0.69)	0.57 (0.35–0.79)	0.58 (0.37–0.8)	0.59 (0.37–0.8)	0.58 (0.37–0.79)	0.57 (0.36–0.78)	

AUC, area under curve; C-index, concordance index; 95% CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SNAPP, Size and Number, AFP, PIVKA-II, PET; MoRAL, Model for Recurrence After Liver Transplantation; R3-AFP, Recurrence-Risk Reassessment AFP

Supplementary Table 10. Time-dependent AUC, iAUC and C-index of Extra-Hepatic Recurrence Prediction Models of Milan cohort (also shown in Figure 5A, 5C)

Predictions Models	Time-dependent AUC (95% CI)										Integrated AUC (95%CI)
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.56 (0.43–0.69)	0.56 (0.44–0.68)	0.58 (0.46–0.70)	0.57 (0.45–0.68)	0.59 (0.47–0.70)	0.58 (0.47–0.69)	0.57 (0.47–0.69)	0.56 (0.45–0.68)	0.55 (0.43–0.68)	0.53 (0.40–0.63)	0.56 (0.45-0.67)
AFP≥200	0.50 (0.46–0.56)	0.52 (0.47–0.58)	0.53 (0.48–0.60)	0.52 (0.48–0.58)	0.54 (0.49–0.62)	0.54 (0.49–0.61)	0.54 (0.49–0.60)	0.54 (0.48–0.60)	0.54 (0.48–0.60)	0.53 (0.47–0.58)	0.51 (0.47-0.56)
PIVKA-II	0.66 (0.57–0.75)	0.66 (0.56–0.76)	0.68 (0.58–0.77)	0.64 (0.53–0.74)	0.65 (0.55–0.75)	0.65 (0.55–0.75)	0.67 (0.57–0.77)	0.65 (0.56–0.75)	0.66 (0.56–0.75)	0.67 (0.58–0.76)	0.66 (0.57-0.75)
PIVKA-II≥400	0.48 (0.47–0.49)	0.53 (0.48–0.60)	0.54 (0.48–0.62)	0.53 (0.49–0.60)	0.53 (0.48–0.60)	0.53 (0.48–0.60)	0.53 (0.48–0.59)	0.53 (0.48–0.58)	0.52 (0.48–0.58)	0.52 (0.48–0.57)	0.5 (0.48-0.55)
PIVKA-II+AFP	0.60 (0.50–0.70)	0.63 (0.52–0.72)	0.65 (0.56–0.75)	0.61 (0.51–0.72)	0.63 (0.52–0.73)	0.62 (0.52–0.73)	0.62 (0.52–0.72)	0.61 (0.50–0.72)	0.61 (0.49–0.72)	0.59 (0.47–0.69)	0.61 (0.51-0.7)
PIVKA-II≥400+AFP≥200	0.48 (0.45–0.54)	0.53 (0.46–0.61)	0.54 (0.47–0.62)	0.53 (0.47–0.60)	0.54 (0.48–0.62)	0.54 (0.48–0.61)	0.54 (0.49–0.61)	0.54 (0.48–0.61)	0.53 (0.48–0.60)	0.52 (0.46–0.59)	0.5 (0.46-0.57)
SNAPP	0.46 (0.35–0.59)	0.50 (0.38–0.63)	0.53 (0.42–0.64)	0.49 (0.38–0.60)	0.51 (0.40–0.63)	0.51 (0.40–0.62)	0.52 (0.43–0.63)	0.52 (0.42–0.63)	0.52 (0.43–0.62)	0.53 (0.44–0.63)	0.48 (0.37-0.6)
SNAPP≥5	0.50 (0.49–0.50)	0.52 (0.50–0.57)	0.52 (0.50–0.56)	0.52 (0.50–0.56)	0.51 (0.50–0.55)	0.51 (0.50–0.55)	0.51 (0.50–0.54)	0.51 (0.50–0.55)	0.51 (0.50–0.55)	0.51 (0.50–0.54)	0.51 (0.5-0.53)
RETREAT	0.56 (0.40–0.70)	0.58 (0.45–0.70)	0.61 (0.49–0.72)	0.62 (0.51–0.73)	0.63 (0.52–0.73)	0.62 (0.51–0.73)	0.62 (0.52–0.72)	0.62 (0.53–0.73)	0.62 (0.52–0.74)	0.61 (0.50–0.71)	0.58 (0.46-0.71)
RETREAT≥5	0.51 (0.50–0.51)	0.51 (0.50–0.51)	0.51 (0.50–0.51)	0.51 (0.50–0.51)	0.51 (0.50–0.51)	0.51 (0.50–0.51)	0.51 (0.50–0.51)	0.51 (0.50–0.52)	0.51 (0.50–0.52)	0.51 (0.50–0.52)	0.51 (0.5-0.51)
R3-AFP	0.57 (0.45–0.70)	0.60 (0.48–0.72)	0.62 (0.52–0.73)	0.64 (0.53–0.73)	0.65 (0.55–0.75)	0.64 (0.55–0.74)	0.66 (0.56–0.76)	0.66 (0.57–0.75)	0.65 (0.56–0.75)	0.63 (0.49–0.72)	0.6 (0.49-0.72)
R3-AFP≥3	0.51 (0.47–0.57)	0.50 (0.47–0.55)	0.52 (0.48–0.58)	0.52 (0.48–0.57)	0.53 (0.49–0.59)	0.53 (0.48–0.59)	0.53 (0.48–0.59)	0.53 (0.48–0.58)	0.53 (0.48–0.58)	0.53 (0.48–0.57)	0.51 (0.48-0.56)

Prediction Models	Dynamic C-index (95%CI)									
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year
AFP	0.44 (0.3–0.58)	0.43 (0.31–0.55)	0.42 (0.31–0.54)	0.46 (0.35–0.58)	0.44 (0.34–0.55)	0.56 (0.47–0.66)	0.59 (0.5–0.69)	0.61 (0.51–0.7)	0.61 (0.52–0.7)	0.61 (0.52–0.71)
AFP≥200	0.52 (NA–NA)	0.51 (0.28–0.73)	0.49 (0.25–0.73)	0.54 (0.34–0.75)	0.48 (0.24–0.72)	0.55 (0.32–0.78)	0.56 (0.31–0.8)	0.61 (0.38–0.84)	0.67 (0.46–0.89)	0.71 (0.51–0.91)
PIVKA-II	0.46 (0.34–0.58)	0.44 (0.32–0.56)	0.44 (0.34–0.54)	0.49 (0.39–0.59)	0.45 (0.36–0.55)	0.57 (0.47–0.66)	0.58 (0.48–0.67)	0.63 (0.54–0.72)	0.63 (0.54–0.72)	0.62 (0.53–0.72)
PIVKA-II≥400	NA (NA–NA)	0.26 (0.24–0.29)	0.35 (0.23–0.47)	0.42 (0.31–0.54)	0.48 (0.38–0.59)	0.76 (0.7–0.81)	0.67 (0.45–0.89)	0.73 (0.54–0.93)	0.78 (0.61–0.95)	0.78 (0.6–0.96)
PIVKA-II+AFP	0.47 (0.34–0.6)	0.42 (0.31–0.53)	0.4 (0.29–0.51)	0.46 (0.35–0.57)	0.44 (0.33–0.54)	0.58 (0.49–0.68)	0.6 (0.51–0.69)	0.63 (0.55–0.72)	0.63 (0.54–0.72)	0.63 (0.54–0.72)
PIVKA-II≥400+AFP≥200	0.5 (NA–NA)	0.41 (0.21–0.61)	0.45 (0.27–0.64)	0.51 (0.35–0.67)	0.49 (0.31–0.66)	0.6 (0.41–0.78)	0.55 (0.34–0.76)	0.61 (0.4–0.81)	0.67 (0.48–0.86)	0.69 (0.51–0.88)
SNAPP	0.41 (0.21–0.61)	0.32 (0.16–0.48)	0.34 (0.19–0.49)	0.42 (0.26–0.58)	0.41 (0.26–0.56)	0.49 (0.35–0.63)	0.46 (0.32–0.6)	0.48 (0.34–0.62)	0.49 (0.34–0.63)	0.49 (0.35–0.64)
SNAPP≥5	NA (NA–NA)	0.31 (NA–NA)	0.44 (NA–NA)	0.5 (NA–NA)	0.55 (NA–NA)	0.77 (NA–NA)	0.68 (0.31–1)	0.74 (0.42–1)	0.78 (0.5–1)	0.81 (0.56–1)
RETREAT	0.48 (0.33–0.62)	0.47 (0.35–0.6)	0.47 (0.34–0.6)	0.48 (0.34–0.61)	0.49 (0.36–0.62)	0.64 (0.51–0.77)	0.65 (0.53–0.78)	0.66 (0.53–0.79)	0.67 (0.54–0.79)	0.67 (0.54–0.79)
RETREAT≥5	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)
R3-AFP	0.44 (0.23–0.65)	0.43 (0.25–0.61)	0.46 (0.3–0.63)	0.47 (0.31–0.63)	0.49 (0.33–0.65)	0.65 (0.52–0.78)	0.66 (0.54–0.79)	0.68 (0.55–0.8)	0.7 (0.57–0.82)	0.7 (0.58–0.81)
R3-AFP≥3	0.6 (0–1)	0.68 (0.09–1)	0.55 (0.04–1)	0.59 (0.12–1)	0.49 (0.06–0.92)	0.74 (0.53–0.96)	0.67 (0.41–0.92)	0.69 (0.45–0.94)	0.71 (0.47–0.95)	0.7 (0.45–0.94)

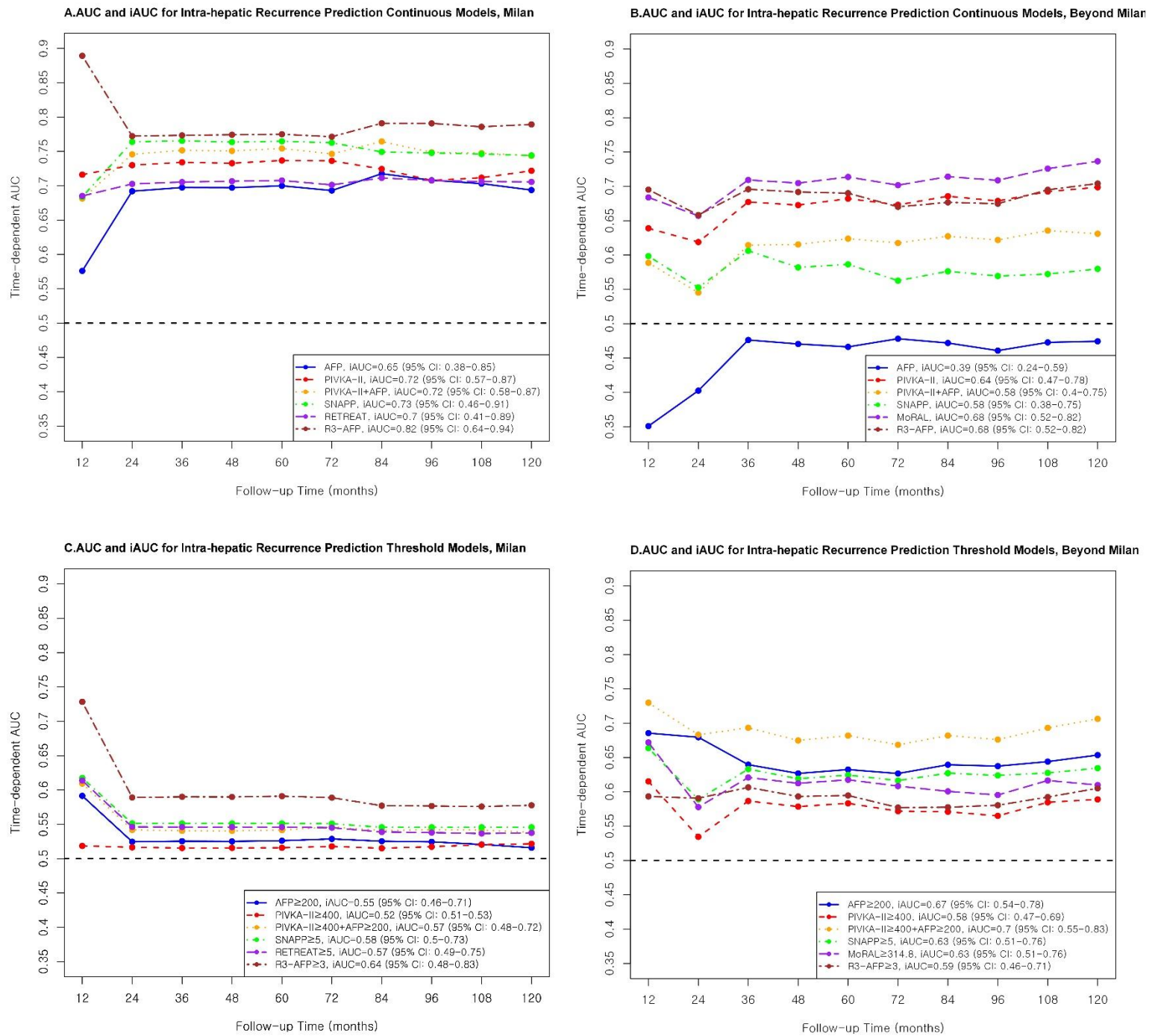
AUC, area under curve; C-index, concordance index; 95% CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SNAPP, Size and Number, AFP, PIVKA-II, PET; RETREAT, Risk Estimation of Tumor Recurrence After Transplant; R3-AFP, Recurrence-Risk Reassessment AFP

Supplementary Table 11. Time-dependent AUC, iAUC and C-index of Extra-Hepatic Recurrence Prediction Models of Beyond Milan cohort (also shown in Figure 5B, 5D)

Prediction Models	Time-dependent AUC (95% CI)										Integrated AUC (95%CI)
	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.76 (0.65–0.86)	0.70 (0.58–0.79)	0.69 (0.56–0.79)	0.62 (0.50–0.72)	0.63 (0.51–0.74)	0.61 (0.48–0.73)	0.61 (0.46–0.71)	0.62 (0.49–0.73)	0.59 (0.42–0.70)	0.59 (0.43–0.69)	0.71 (0.61–0.8)
AFP≥200	0.69 (0.59–0.80)	0.67 (0.60–0.75)	0.66 (0.59–0.73)	0.64 (0.57–0.71)	0.65 (0.58–0.72)	0.64 (0.56–0.72)	0.65 (0.57–0.72)	0.65 (0.58–0.72)	0.65 (0.56–0.71)	0.66 (0.58–0.72)	0.68 (0.6–0.76)
PIVKA-II	0.72 (0.59–0.84)	0.67 (0.56–0.76)	0.67 (0.56–0.76)	0.67 (0.56–0.76)	0.68 (0.58–0.78)	0.68 (0.58–0.76)	0.68 (0.56–0.77)	0.67 (0.55–0.76)	0.68 (0.55–0.78)	0.69 (0.56–0.78)	0.7 (0.59–0.79)
PIVKA-II≥400	0.68 (0.58–0.79)	0.61 (0.52–0.69)	0.62 (0.54–0.70)	0.62 (0.54–0.69)	0.63 (0.55–0.71)	0.61 (0.54–0.69)	0.61 (0.51–0.68)	0.60 (0.52–0.68)	0.62 (0.53–0.69)	0.62 (0.52–0.70)	0.65 (0.56–0.74)
PIVKA-II+AFP	0.75 (0.63–0.85)	0.71 (0.62–0.79)	0.71 (0.61–0.80)	0.70 (0.60–0.78)	0.71 (0.62–0.80)	0.70 (0.60–0.79)	0.70 (0.58–0.79)	0.69 (0.57–0.78)	0.70 (0.58–0.79)	0.71 (0.60–0.80)	0.73 (0.62–0.92)
PIVKA-II≥400+AFP≥200	0.77 (0.66–0.87)	0.72 (0.62–0.80)	0.72 (0.62–0.80)	0.70 (0.60–0.77)	0.71 (0.62–0.79)	0.69 (0.59–0.76)	0.69 (0.59–0.77)	0.69 (0.58–0.76)	0.70 (0.59–0.77)	0.71 (0.60–0.78)	0.74 (0.64–0.92)
SNAPP	0.81 (0.68–0.91)	0.75 (0.64–0.84)	0.75 (0.65–0.85)	0.73 (0.62–0.82)	0.74 (0.63–0.83)	0.72 (0.62–0.82)	0.73 (0.63–0.81)	0.72 (0.61–0.81)	0.71 (0.58–0.79)	0.72 (0.58–0.81)	0.77 (0.67–0.96)
SNAPP≥5	0.75 (0.65–0.84)	0.72 (0.63–0.80)	0.73 (0.65–0.81)	0.70 (0.61–0.77)	0.71 (0.63–0.78)	0.69 (0.61–0.76)	0.70 (0.61–0.77)	0.69 (0.61–0.77)	0.69 (0.59–0.76)	0.70 (0.61–0.76)	0.73 (0.65–0.9)
MoRAL	0.76 (0.64–0.86)	0.72 (0.63–0.81)	0.73 (0.62–0.81)	0.71 (0.60–0.79)	0.72 (0.62–0.80)	0.71 (0.61–0.80)	0.71 (0.59–0.80)	0.70 (0.59–0.79)	0.71 (0.58–0.79)	0.72 (0.59–0.80)	0.74 (0.64–0.92)
MoRAL≥314.8	0.68 (0.57–0.77)	0.61 (0.53–0.70)	0.61 (0.53–0.69)	0.61 (0.53–0.69)	0.62 (0.55–0.69)	0.61 (0.53–0.68)	0.60 (0.51–0.67)	0.59 (0.51–0.67)	0.61 (0.53–0.67)	0.60 (0.51–0.67)	0.64 (0.55–0.73)
R3-AFP	0.87 (0.80–0.94)	0.79 (0.71–0.86)	0.81 (0.73–0.88)	0.82 (0.74–0.88)	0.81 (0.74–0.88)	0.78 (0.69–0.86)	0.78 (0.67–0.85)	0.77 (0.66–0.85)	0.78 (0.66–0.85)	0.79 (0.67–0.87)	0.83 (0.75–0.89)
R3-AFP≥3	0.74 (0.68–0.80)	0.73 (0.66–0.80)	0.74 (0.67–0.81)	0.74 (0.67–0.81)	0.75 (0.66–0.82)	0.72 (0.62–0.79)	0.70 (0.60–0.78)	0.71 (0.60–0.78)	0.71 (0.59–0.79)	0.72 (0.60–0.80)	0.74 (0.68–0.79)
Dynamic C-index (95%CI)											
Predictions Models	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year	10 Year	
AFP	0.59 (0.48–0.71)	0.61 (0.52–0.71)	0.65 (0.57–0.73)	0.67 (0.59–0.74)	0.66 (0.58–0.73)	0.66 (0.6–0.73)	0.65 (0.58–0.72)	0.64 (0.57–0.71)	0.64 (0.57–0.71)	0.64 (0.57–0.71)	
AFP≥200	0.61 (0.4–0.81)	0.62 (0.46–0.78)	0.69 (0.54–0.83)	0.72 (0.59–0.85)	0.71 (0.57–0.84)	0.76 (0.64–0.87)	0.74 (0.62–0.86)	0.75 (0.64–0.87)	0.75 (0.64–0.87)	0.75 (0.64–0.87)	
PIVKA-II	0.59 (0.47–0.7)	0.62 (0.53–0.7)	0.6 (0.52–0.69)	0.6 (0.52–0.69)	0.59 (0.51–0.68)	0.63 (0.55–0.7)	0.62 (0.54–0.7)	0.63 (0.55–0.71)	0.62 (0.55–0.7)	0.62 (0.55–0.7)	
PIVKA-II≥400	0.68 (0.48–0.87)	0.77 (0.64–0.9)	0.69 (0.54–0.84)	0.7 (0.56–0.84)	0.68 (0.54–0.83)	0.74 (0.62–0.87)	0.75 (0.63–0.87)	0.76 (0.65–0.88)	0.73 (0.6–0.85)	0.73 (0.6–0.85)	
PIVKA-II+AFP	0.6 (0.47–0.72)	0.62 (0.53–0.7)	0.61 (0.52–0.7)	0.61 (0.53–0.7)	0.6 (0.52–0.69)	0.64 (0.57–0.72)	0.64 (0.57–0.72)	0.65 (0.58–0.73)	0.65 (0.57–0.72)	0.65 (0.57–0.72)	
PIVKA-II≥400+AFP≥200	0.63 (0.49–0.77)	0.67 (0.56–0.78)	0.68 (0.58–0.77)	0.7 (0.61–0.79)	0.69 (0.59–0.79)	0.75 (0.66–0.83)	0.73 (0.65–0.82)	0.75 (0.66–0.83)	0.74 (0.65–0.82)	0.73 (0.65–0.82)	
SNAPP	0.58 (0.44–0.73)	0.67 (0.59–0.76)	0.67 (0.59–0.75)	0.69 (0.61–0.77)	0.69 (0.61–0.77)	0.73 (0.66–0.81)	0.72 (0.65–0.8)	0.73 (0.66–0.81)	0.73 (0.65–0.81)	0.73 (0.65–0.8)	
SNAPP≥5	0.64 (0.43–0.85)	0.71 (0.57–0.86)	0.7 (0.57–0.84)	0.75 (0.62–0.87)	0.74 (0.61–0.86)	0.79 (0.69–0.89)	0.78 (0.68–0.89)	0.8 (0.7–0.9)	0.8 (0.71–0.9)	0.8 (0.71–0.9)	
MoRAL	0.6 (0.48–0.72)	0.63 (0.54–0.71)	0.62 (0.53–0.7)	0.63 (0.55–0.71)	0.62 (0.54–0.7)	0.66 (0.58–0.73)	0.65 (0.58–0.73)	0.66 (0.59–0.73)	0.66 (0.58–0.73)	0.66 (0.58–0.73)	
MoRAL≥314.8	0.64 (0.44–0.84)	0.74 (0.6–0.89)	0.69 (0.53–0.84)	0.69 (0.54–0.84)	0.67 (0.52–0.83)	0.73 (0.6–0.86)	0.76 (0.63–0.88)	0.77 (0.65–0.89)	0.73 (0.6–0.85)	0.74 (0.62–0.87)	
R3-AFP	0.51 (0.38–0.64)	0.68 (0.61–0.75)	0.66 (0.57–0.74)	0.66 (0.59–0.74)	0.68 (0.6–0.75)	0.74 (0.67–0.81)	0.74 (0.67–0.81)	0.75 (0.68–0.81)	0.74 (0.68–0.81)	0.74 (0.67–0.81)	
R3-AFP≥3	0.87 (0.66–1)	0.78 (0.63–0.93)	0.79 (0.65–0.94)	0.81 (0.67–0.95)	0.81 (0.68–0.95)	0.87 (0.77–0.97)	0.87 (0.78–0.97)	0.87 (0.78–0.96)	0.86 (0.77–0.96)	0.86 (0.76–0.95)	

AUC, area under curve; C-index, concordance index; 95% CI, 95% confidence interval; AFP, alpha-fetoprotein; PIVKA-II, protein induced by vitamin K absence-II; SNAPP, Size and Number, AFP, PIVKA-II, PET; MoRAL, Model for Recurrence After Liver Transplantation; R3-AFP, Recurrence-Risk Reassessment AFP

Supplementary Figure 1.



Supplementary Figure 1. AUC and iAUC for intra-hepatic recurrence prediction in Milan and Beyond Milan cohort.

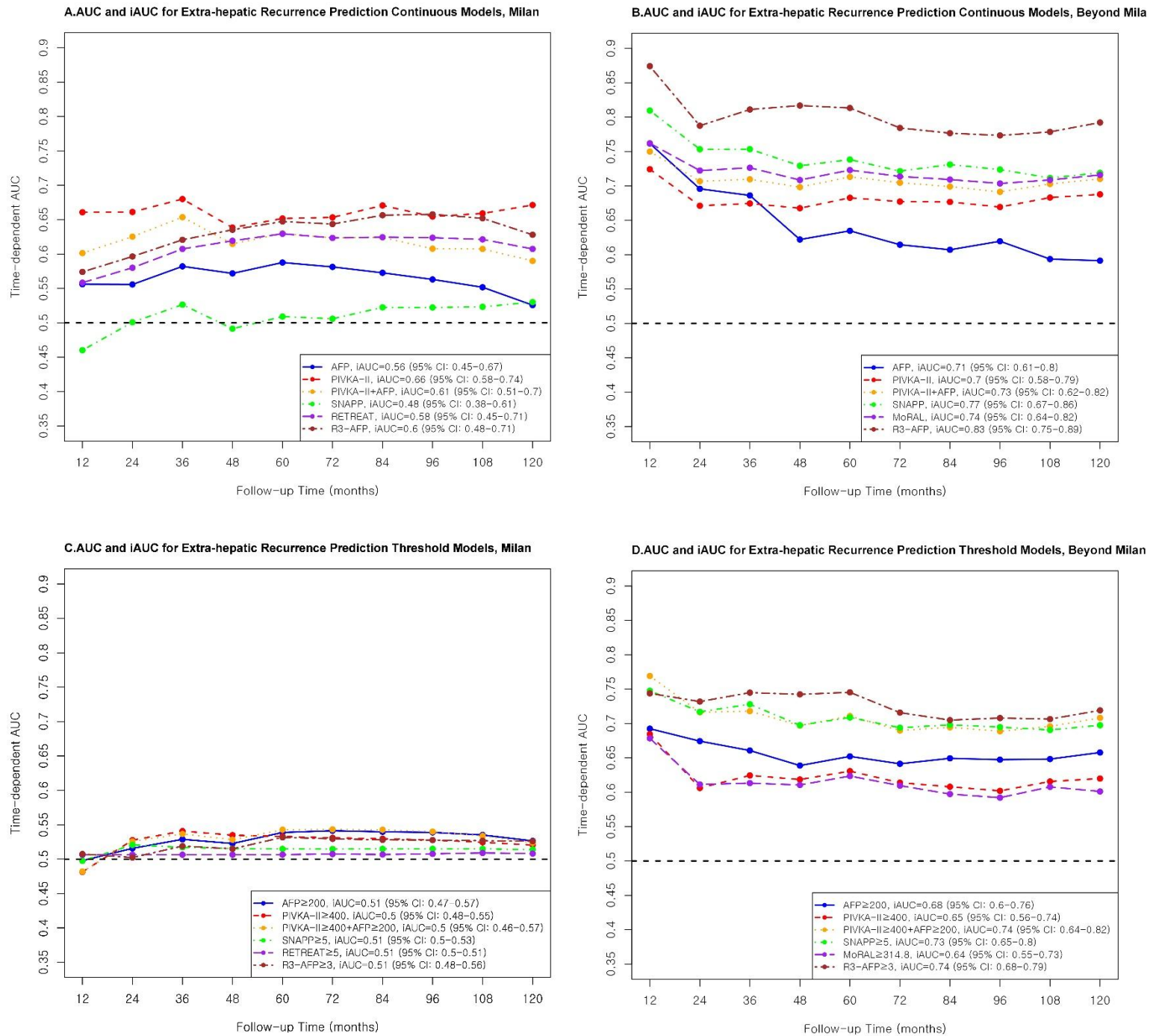
A: Continuous variable–based AUC and iAUC in the Milan cohort.

B: Continuous variable–based AUC and iAUC in the Beyond Milan cohort.

C: Threshold-based AUC and iAUC in the Milan cohort.

D: Threshold-based AUC and iAUC in the Beyond Milan cohort.

Supplementary Figure 2.



Supplementary Figure 2. AUC and iAUC for extra-hepatic recurrence prediction in Milan and Beyond Milan cohort.

A: Continuous variable–based AUC and iAUC in the Milan cohort.

B: Continuous variable–based AUC and iAUC in the Beyond Milan cohort.

C: Threshold-based AUC and iAUC in the Milan cohort.

D: Threshold-based AUC and iAUC in the Beyond Milan cohort.