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**Table 1.** Types of first HCC treatment by presence and absence of treatment delay (within 12 months post HCC diagnosis)

	Transplant		Resection		Ablation		Embolization		Systemic Chemotherapy		Radiation	
	n	%	n	%	n	%	n	%	n	%	n	%
<b>Timely treatment</b>	120	78.4%	1127	93.2%	1051	84.8%	2907	83.2%	1641	86.7%	399	85.8%
<b>Delayed treatment</b>	33	21.6%	82	6.8%	188	15.2%	585	16.8%	251	13.3%	66	14.2%
<b>Total</b>	153		1209		1239		3492		1892		465	

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**Table 2.** Correlates of overall survival – 5-month landmark in early-stage HCC (with and without type of first HCC treatment)

	<b>Overall survival (Without first HCC treatment) n=1720 HR (95% CI)</b>	<b>Overall survival (with first HCC treatment) n=1720 HR (95% CI)</b>
<b>Delayed treatment</b>	1.21 (1.02,1.44)	1.11 (0.92,1.33)
<b>Age at diagnosis</b>		
65 - 69 years	Ref	Ref
70 - 74 years	1.17 (1.00,1.37)	1.18 (1.00,1.38)
75 - 79 years	1.37 (1.16,1.63)	1.33 (1.12,1.58)
80 years and older	1.71 (1.43,2.05)	1.56 (1.29,1.87)
<b>Male</b>	1.18 (1.04,1.33)	1.19 (1.05,1.36)
<b>Race and ethnicity</b>		
White	Ref	Ref
Black	1.43 (0.82,2.49)	1.54 (0.85,2.76)
Asian	0.83 (0.63,1.08)	0.85 (0.65,1.11)
Hispanic	0.84 (0.51,1.40)	0.83 (0.52,1.35)
Other/Unknown	0.61 (0.44,0.86)	0.69 (0.48,0.98)
<b>Neighborhood-level SES</b>		
Low poverty neighborhoods	Ref	Ref
Moderate poverty neighborhoods	0.95 (0.79,1.12)	0.92 (0.78,1.10)
High poverty neighborhoods	1.10 (0.89,1.36)	1.06 (0.86,1.32)
<b>Interaction of race, ethnicity, and poverty</b>		
Black#Moderate poverty neighborhoods	0.82 (0.41,1.63)	0.76 (0.38,1.54)
Black#Poor neighborhoods	0.85 (0.44,1.63)	0.73 (0.37,1.43)
Asian#Moderate poverty neighborhoods	0.75 (0.49,1.14)	0.79 (0.52,1.20)
Asian#Poor neighborhoods	0.86 (0.56,1.33)	0.84 (0.54,1.32)
Hispanic#Moderate poverty neighborhoods	1.64 (0.79,3.40)	1.61 (0.78,3.32)
Hispanic#Poor neighborhoods	0.78 (0.39,1.56)	0.80 (0.40,1.58)
<b>Geographic region</b>		
West	Ref	Ref
Northeast	0.90 (0.74,1.08)	0.95(0.78,1.15)
Midwest	1.16 (0.93,1.44)	1.16(0.93,1.44)
South	1.04 (0.86,1.24)	1.13(0.94,1.37)
<b>Metropolitan status</b>		
Metro > 1 million	Ref	Ref
Metro 250,000 - 1 million	1.06 (0.91,1.24)	1.06 (0.90,1.24)
Metro <250,000	1.17 (0.92,1.50)	1.18 (0.91,1.53)
Non-Metro	0.97 (0.77,1.22)	0.97 (0.77,1.22)

<b>NCI comorbidity index</b>		
0	Ref	Ref
1	0.93 (0.74,1.17)	0.94 (0.75,1.18)
2	1.03 (0.83,1.28)	1.02 (0.82,1.26)
3	1.08 (0.87,1.34)	1.04 (0.83,1.30)
4	1.16 (0.86,1.55)	1.10 (0.82,1.47)
>=5	1.31 (1.02,1.67)	1.29 (1.01,1.65)
<b>Liver disease etiology</b>		
HCV	Ref	Ref
HBV	0.67 (0.51,0.87)	0.70 (0.54,0.92)
Alcohol related liver disease	1.24 (1.01,1.51)	1.28 (1.05,1.57)
Other liver diseases	0.62 (0.41,0.93)	0.65 (0.43,1.00)
MAFLD	0.96 (0.82,1.13)	1.06 (0.90,1.25)
No identifiable liver disease	0.98 (0.77,1.25)	1.10 (0.86,1.41)
<b>Liver dysfunction</b>		
Presence of hepatic encephalopathy	1.32 (1.06,1.66)	1.34 (1.07,1.67)
Presence of ascites	1.19 (0.99,1.44)	1.10 (0.91,1.33)
<b>First HCC treatment type</b>		
Liver transplantation		0.36 (0.24,0.55)
Surgical resection		0.49 (0.40,0.60)
Local ablation		0.91 (0.79,1.05)
Embolization		Ref
Systemic chemotherapy		1.20 (0.93,1.53)
Radiation		1.65 (1.16,2.36)

**Table 3.** Correlates of overall survival – 5-month landmark in advanced stage HCC (with and without type of first HCC treatment)

	<b>Overall survival (Without first HCC treatment) n=3568 HR (95% CI)</b>	<b>Overall survival (with first HCC treatment) n=3568 HR (95% CI)</b>
<b>Delayed treatment</b>	1.20 (1.08,1.34)	1.14 (1.02,1.27)
<b>Age at diagnosis</b>		
65 - 69 years	Ref	Ref
70 - 74 years	1.23 [1.11,1.37]	1.24 (1.11,1.38)
75 - 79 years	1.41 (1.26,1.57)	1.36 (1.22,1.52)
80 years and older	1.49 (1.33,1.66)	1.41 (1.26,1.58)
<b>Male</b>	1.12 (1.03,1.21)	1.07 (0.98,1.16)
<b>Race and ethnicity</b>		
White	Ref	Ref
Black	1.03 (0.73,1.45)	0.91 (0.63,1.32)
Asian	0.84 (0.71,0.99)	0.77 (0.65,0.92)
Hispanic	1.58 (1.09,2.28)	1.50 (1.06,2.14)
Other/Unknown	0.84 (0.67,1.05)	0.86 (0.69,1.07)
<b>Neighborhood-level SES</b>		
Low poverty neighborhoods	Ref	Ref
Moderate poverty neighborhoods	1.06 (0.95,1.18)	1.04 (0.93,1.15)
High poverty neighborhoods	1.15 (1.01,1.31)	1.07 (0.94,1.23)
<b>Interaction of race, ethnicity, and poverty</b>		
Black#Moderate poverty neighborhoods	0.92 (0.60,1.42)	0.96 (0.61,1.50)
Black#Poor neighborhoods	0.98 (0.65,1.47)	1.07 (0.69,1.65)
Asian#Moderate poverty neighborhoods	1.16 (0.91,1.48)	1.27 (0.99,1.63)
Asian#Poor neighborhoods	0.95 (0.70,1.27)	0.99 (0.71,1.36)
Hispanic#Moderate poverty neighborhoods	0.94 (0.60,1.48)	0.96 (0.62,1.47)
Hispanic#Poor neighborhoods	0.71 (0.45,1.13)	0.73 (0.46,1.16)
<b>Geographic region</b>		
West	Ref	Ref
Northeast	0.98 (0.88,1.09)	1.02 (0.91,1.13)
Midwest	1.15 (1.00,1.31)	1.13 (0.97,1.30)
South	1.10 (0.98,1.24)	1.20 (1.06,1.36)
<b>Metropolitan status</b>		
Metro > 1 million	Ref	Ref
Metro 250,000 - 1 million	1.09 (0.99,1.20)	1.09 (0.99,1.20)
Metro <250,000	0.96 (0.83,1.11)	0.92 (0.79,1.07)
Non-Metro	0.88 (0.77,1.01)	0.89 (0.77,1.02)

<b>NCI comorbidity index</b>		
0	Ref	Ref
1	1.07 (0.96,1.20)	1.09 (0.97,1.23)
2	0.98 (0.87,1.11)	1.00 (0.89,1.14)
3	1.11 (0.98,1.26)	1.14 (1.00,1.30)
4	1.23 (1.05,1.45)	1.24 (1.05,1.48)
>=5	1.30 (1.13,1.50)	1.30 (1.12,1.52)
<b>Liver disease etiology</b>		
HCV	Ref	Ref
HBV	0.73 (0.60,0.88)	0.81 (0.66,0.98)
Alcohol related liver disease	1.02 (0.88,1.17)	1.00 (0.87,1.15)
Other liver diseases	1.15 (0.88,1.48)	1.21 (0.94,1.55)
MAFLD	1.02 (0.93,1.13)	1.04 (0.94,1.15)
No identifiable liver disease	1.21 (1.07,1.37)	1.27 (1.11,1.45)
<b>Liver dysfunction</b>		
Presence of hepatic encephalopathy	1.02 (0.85,1.23)	1.06 (0.88,1.27)
Presence of ascites	1.16 (1.01,1.33)	1.08 (0.93,1.24)
<b>First HCC treatment type</b>		
Embolization		Ref
Liver transplantation		0.30 (0.20,0.43)
Surgical resection		0.48 (0.42,0.53)
Local ablation		0.77 (0.68,0.86)
Systemic chemotherapy		1.58 (1.43,1.75)
Radiation		1.88 (1.52,2.31)

**Table 4.** Correlates of overall survival – 5-month landmark in patients who received curative treatment (with and without type of first HCC treatment)

	<b>Overall survival (Without first HCC treatment) n=2290 HR (95% CI)</b>	<b>Overall survival (with first HCC treatment) n=2290 HR (95% CI)</b>
<b>Delayed treatment</b>	1.21 (1.02,1.44)	1.10 (0.92,1.31)
<b>Age at diagnosis</b>		
65 - 69 years	Ref	Ref
70 - 74 years	1.01 (0.88,1.16)	0.95 (0.82,1.09)
75 - 79 years	1.34 (1.16,1.55)	1.20 (1.04,1.39)
80 years and older	1.57 (1.35,1.83)	1.38 (1.18,1.61)
<b>Male</b>	1.09 (0.98,1.22)	1.11 (0.99,1.24)
<b>Race and ethnicity</b>		
White	Ref	Ref
Black	1.03 (0.65,1.64)	1.01 (0.61,1.67)
Asian	0.97 (0.78,1.21)	0.99 (0.79,1.23)
Hispanic	1.05 (0.57,1.92)	1.04 (0.58,1.85)
Other/Unknown	0.71 (0.53,0.94)	0.74 (0.56,0.99)
<b>Neighborhood-level SES</b>		
Low poverty neighborhoods	Ref	Ref
Moderate poverty neighborhoods	0.90 (0.77,1.06)	0.93 (0.80,1.09)
High poverty neighborhoods	1.08 (0.90,1.30)	1.13 (0.94,1.35)
<b>Interaction of race, ethnicity, and poverty</b>		
Black#Moderate poverty neighborhoods	1.09 (0.61,1.95)	1.07 (0.58,1.96)
Black#Poor neighborhoods	1.32 (0.77,2.26)	1.16 (0.65,2.06)
Asian#Moderate poverty neighborhoods	0.76 (0.54,1.08)	0.71 (0.49,1.01)
Asian#Poor neighborhoods	0.81 (0.54,1.21)	0.83 (0.55,1.25)
Hispanic#Moderate poverty neighborhoods	1.20 (0.55,2.62)	1.12 (0.53,2.38)
Hispanic#Poor neighborhoods	0.91 (0.44,1.90)	0.92 (0.46,1.84)
<b>Geographic region</b>		
West	Ref	Ref
Northeast	1.03 (0.89,1.19)	1.04 (0.90,1.19)
Midwest	1.18 (0.97,1.44)	1.21 (1.00,1.47)
South	1.15 (0.99,1.35)	1.26 (1.08,1.47)
<b>Metropolitan status</b>		
Metro > 1 million	Ref	Ref
Metro 250,000 - 1 million	1.12 (0.98,1.28)	1.12 (0.98,1.28)
Metro <250,000	1.24 (1.01,1.53)	1.20 (0.97,1.49)
Non-Metro	0.94 (0.78,1.14)	0.95 (0.79,1.15)

<b>Tumor Staging</b>		
Unifocal <=5 cm without vascular invasion and metastasis	Ref	Ref
Beyond unifocal without vascular invasion and metastasis	1.20 (1.07,1.35)	1.28 (1.14,1.44)
Vascular invasion or metastasis	1.86 (1.49,2.32)	2.19 (1.77,2.73)
Non-determinable	1.59 (1.37,1.86)	1.79 (1.53,2.09)
<b>NCI comorbidity index</b>		
0	Ref	Ref
1	0.97 (0.83,1.14)	0.96 (0.82,1.12)
2	1.11 (0.94,1.31)	1.06 (0.90,1.25)
3	1.16 (0.97,1.38)	1.15 (0.96,1.37)
4	1.54 (1.22,1.93)	1.48 (1.18,1.86)
>=5	1.25 (1.02,1.54)	1.22 (0.99,1.50)
<b>Liver disease etiology</b>		
HCV	Ref	Ref
HBV	0.63 (0.50,0.80)	0.65 (0.51,0.83)
Alcohol related liver disease	0.94 (0.76,1.17)	1.00 (0.82,1.23)
Other liver diseases	0.75 (0.52,1.10)	0.84 (0.57,1.23)
MAFLD	0.81 (0.71,0.92)	0.87 (0.76,1.00)
No identifiable liver disease	0.90 (0.76,1.07)	0.95 (0.79,1.13)
<b>Liver dysfunction</b>		
Presence of hepatic encephalopathy	0.90 (0.68,1.19)	1.01 (0.76,1.34)
Presence of ascites	1.37 (1.10,1.70)	1.34 (1.07,1.67)
<b>First HCC treatment type</b>		
Liver transplantation		Ref
Surgical resection		1.87 (1.38,2.53)
Local ablation		2.98 (2.23,4.00)



**Table 5.** Correlates of overall survival – 5-month landmark in patients who received non curative treatment (with and without type of first HCC treatment)

	<b>Delayed treatment (without first HCC treatment) n=4354 OR (95% CI)</b>	<b>Delayed treatment (with first HCC treatment) n=4354 OR (95% CI)</b>
<b>Delayed treatment</b>	1.04 (0.95,1.15)	1.06 (0.97,1.17)
<b>Age at diagnosis</b>		
65 - 69 years	Ref	Ref
70 - 74 years	1.24 (1.13,1.36)	1.24 (1.13,1.36)
75 - 79 years	1.29 (1.18,1.42)	1.27 (1.15,1.40)
80 years and older	1.33 (1.20,1.47)	1.33 (1.21,1.47)
<b>Male</b>	1.10 (1.03,1.19)	1.10 (1.02,1.19)
<b>Race and ethnicity</b>		
White	Ref	Ref
Black	0.71 (0.49,1.02)	0.69 (0.48,1.00)
Asian	0.72 (0.62,0.83)	0.71 (0.61,0.82)
Hispanic	1.44 (1.09,1.91)	1.38 (1.05,1.81)
Other/Unknown	0.76 (0.62,0.92)	0.78 (0.64,0.96)
<b>Neighborhood-level SES</b>		
Low poverty neighborhoods	Ref	Ref
Moderate poverty neighborhoods	1.04 (0.95,1.13)	1.02 (0.94,1.12)
High poverty neighborhoods	1.02 (0.91,1.15)	0.97 (0.87,1.10)
<b>Interaction of race, ethnicity, and poverty</b>		
Black#Moderate poverty neighborhoods	1.22 (0.80,1.86)	1.28 (0.84,1.96)
Black#Poor neighborhoods	1.38 (0.91,2.09)	1.41 (0.92,2.15)
Asian#Moderate poverty neighborhoods	1.21 (0.98,1.51)	1.25 (1.01,1.55)
Asian#Poor neighborhoods	1.07 (0.82,1.39)	1.10 (0.84,1.43)
Hispanic#Moderate poverty neighborhoods	0.82 (0.56,1.21)	0.89 (0.61,1.28)
Hispanic#Poor neighborhoods	0.71 (0.49,1.04)	0.72 (0.50,1.04)
<b>Geographic region</b>		
West	Ref	Ref
Northeast	0.93 (0.85,1.03)	0.94 (0.86,1.04)
Midwest	1.07 (0.94,1.21)	1.08 (0.95,1.23)
South	1.12 (1.01,1.24)	1.14 (1.03,1.26)
<b>Metropolitan status</b>		
Metro > 1 million	Ref	Ref
Metro 250,000 - 1 million	0.99 (0.91,1.07)	0.98 (0.90,1.07)
Metro <250,000	0.94 (0.81,1.08)	0.92 (0.79,1.06)
Non-Metro	0.93 (0.83,1.06)	0.93 (0.82,1.05)

<b>Tumor Staging</b>		
Unifocal <=5 cm without vascular invasion and metastasis	Ref	Ref
Beyond unifocal without vascular invasion and metastasis	1.57 (1.44,1.71)	1.54 (1.41,1.69)
Vascular invasion or metastasis	2.33 (1.91,2.83)	2.20 (1.80,2.70)
Non-determinable	1.94 (1.75,2.16)	1.86 (1.67,2.07)
<b>NCI comorbidity index</b>		
0	Ref	Ref
1	1.09 (0.98,1.22)	1.09 (0.98,1.21)
2	1.00 (0.89,1.12)	1.03 (0.92,1.15)
3	1.05 (0.93,1.17)	1.07 (0.96,1.20)
4	1.08 (0.92,1.27)	1.06 (0.90,1.25)
>=5	1.24 (1.09,1.41)	1.23 (1.09,1.40)
<b>Liver disease etiology</b>		
HCV	Ref	Ref
HBV	0.73 (0.61,0.86)	0.73 (0.61,0.87)
Alcohol related liver disease	1.08 (0.96,1.22)	1.07 (0.96,1.21)
Other liver diseases	0.94 (0.75,1.19)	1.00 (0.80,1.25)
MAFLD	1.14 (1.04,1.24)	1.10 (1.01,1.21)
No identifiable liver disease	1.26 (1.11,1.42)	1.21 (1.07,1.37)
<b>Liver dysfunction</b>		
Presence of hepatic encephalopathy	1.10 (0.96,1.27)	1.11 (0.96,1.27)
Presence of ascites	1.03 (0.92,1.15)	1.02 (0.91,1.14)
<b>First HCC treatment type</b>		
Embolization		Ref
Systemic chemotherapy		1.54 (1.43,1.66)
Radiation		1.52 (1.31,1.76)

**Table 6.** Sensitivity analysis using 5, 6, 7, 8, 9-month landmark

	Sample size	Delayed Treatment	
		Without first HCC treatment HR (95% CI)	With first HCC treatment) HR (95% CI)
<b>5- month landmark</b>	6644	1.15 (1.05 – 1.25)	1.07 (0.98 – 1.17)
<b>6- month landmark</b>	6487	1.14 (1.05 – 1.23)	1.06 (0.98 – 1.16)
<b>7- month landmark</b>	6328	1.17 (1.08 – 1.27)	1.10 (1.01 – 1.19)
<b>8- month landmark</b>	6133	1.20 (1.11 – 1.30)	1.11 (1.03 – 1.21)
<b>9- month landmark</b>	5947	1.19 (1.10 – 1.29)	1.10 (1.02 – 1.20)

**Table 7.** Sensitivity analysis using 5, 6, 7, 8, 9-month landmark (without transplant patients)

	Sample size	Delayed Treatment	
		Without first HCC treatment HR (95% CI)	With first HCC treatment) HR (95% CI)
<b>5- month landmark</b>	6523	1.14 (1.05 – 1.24)	1.07 (0.98 – 1.17)
<b>6- month landmark</b>	6360	1.13 (1.04 – 1.22)	1.06 (0.98 – 1.16)
<b>7- month landmark</b>	6198	1.19 (1.10 – 1.28)	1.11 (1.02 – 1.20)
<b>8- month landmark</b>	6000	1.22 (1.13 – 1.31)	1.12 (1.03 – 1.21)
<b>9- month landmark</b>	5814	1.20 (1.11 – 1.30)	1.11 (1.02 – 1.20)

**Table 8.** Differences in comorbidities and substance use by race and socioeconomic status

	CAD		COPD		Alcohol use		Tobacco use	
Non-Hispanic White	28.6	p=0.61	17.4	p=0.004	1.8	p=0.54	23.0	p<0.001
Black	27.6		23.1		1.4		30.4	
Low poverty	25.1	p<0.001	15.0	p=0.006	1.3	p=0.002	18.0	p<0.001
Moderate poverty	27.9		16.9		1.5		20.4	
High poverty	29.5		20.3		2.5		26.5	

CAD – coronary artery disease; COPD – chronic obstructive pulmonary disease; SES – socioeconomic status