

**Table S1. Univariate and multivariate survival analysis for evaluating the influence of tumor size on cause-specific survival in the validation set.**

Variable	5-year HCSS (%)	Univariate analysis		Multivariate analysis	
		Log rank $\chi^2$ test	P	HR(95%CI)	P
Sex		15.237	P<0.001		P<0.001
Male	31.1%			Ref	
Female	33.9%			0.892(0.847-0.939)	P<0.001
Age		63.266	P<0.001		P<0.001
≤45	52.0%			Ref	
>45	30.4%			2.241(2.007-2.503)	P<0.001
Race		75.271	P<0.001		P<0.001
Caucasian	31.4%			Ref	
African American	23.8%			1.067(1.004-1.134)	0.036
Others*	37.6%			0.819(0.774-0.866)	P<0.001
Pathological grading		474.034	P<0.001		P<0.001
High/Moderate	41.2%			Ref	
Poor/undifferentiation	22.8%			1.619(1.504-1.744)	P<0.001
Unknown	28.2%			1.577(1.500-1.658)	P<0.001
Stage		3222.311	P<0.001		P<0.001
Localized	43.0%			Ref	
Regional	19.3%			1.830(1.743-1.921)	P<0.001
Distant	7.4%			2.967(2.788-3.158)	P<0.001
Unstaged	19.9%			1.765(1.571-1.983)	P<0.001
Marital Status		101.364	P<0.001		P<0.001
Married	34.7%			Ref	
Never married	32.6%			1.063(1.005-1.125)	0.034
Divorced/Separated	27.6%			1.172(1.103-1.247)	P<0.001
Widowed	20.5%			1.329(1.235-1.431)	P<0.001
Unknown	26.6%			1.060(0.955-1.177)	0.272
Tumor size (mm)		2575.761	P<0.001		P<0.001
0-38 mm	48.1%			Ref	
39-54 mm	27.4%			1.695(1.591-1.807)	P<0.001
55-75 mm	20.4%			2.193(2.055-2.341)	P<0.001
≥76 mm	15.1%			2.827(2.672-2.991)	P<0.001

\*including other (American Indian/AK Native, Asian/Pacific Islander) and unknowns.

P values were adjusted for sex, age, race, pathological grading, stage, marital status and tumor size as covariates between the two groups.

**Table S2. Pairwise comparisons between different combinations of tumor size and gender relative to HCSM in the validation set.**

Variable	Gender			
	Male		Female	
	HR (95% CI)	P	HR(95%CI)	P
Tumor size (mm)		P<0.001		P<0.001
0-38	0.598(0.556-0.643)	P<0.001	0.556(0.487-0.634)	P<0.001
39-54	1	P<0.001	1	P<0.001
55-75	1.290(1.190-1.399)	P<0.001	1.287(1.113-1.488)	0.001
≥76 mm	1.781(1.661-1.911)	P<0.001	1.343(1.178-1.532)	P<0.001

All the results were adjusted using Cox proportional hazards models for age, race, pathological grading, stage, marital status and tumor size.

**Table S3. Univariate and multivariate analyses for evaluating tumor size influencing CSS in HCC based on different cancer stage in the validation set.**

Variable	5-year CCS(%)	Univariate analysis		Multivariate analysis	
		Log rank $\chi^2$ test	P	HR(95%CI)	P
Localized Tumor size (mm)		905.565	<0.001		<0.001
0-38	54.2%			0.544(0.498-0.594)	<0.001
39-54	36.7%			1	
55-75	30.7%			1.381(1.242-1.536)	<0.001
≥76 mm	23.1%			1.963(1.784-2.161)	<0.001
Regional Tumor size (mm)		516.254	<0.001		<0.001
0-38	37.1%			0.600(0.536-0.671)	<0.001
39-54	14.7%			1	
55-75	10.9%			1.254(1.117-1.409)	<0.001

≥76 mm	11.0%			1.753(1.586-1.937)	<0.001
Distant Tumor size (mm)		8.942	0.030		0.001
0-38	8.6%			0.910(0.755-1.096)	0.320
39-54	4.8%			1	
55-75	6.4%			1.095(0.912-1.313)	0.330
≥76 mm	7.9%			1.193(1.023-1.391)	0.024

NI: not included in multivariate survival analysis.

P values were adjusted for sex, age, race, pathological grading, marital status and tumor size as covariates between the two groups.