

Appendix

TABLE E-1 Conditions of the Modified Charlson Comorbidity Index, Number of Patients per Condition, and ICD-9 Codes Used for the Algorithm

Weight Assignment	Condition	No. of Patients*	ICD-9 Codes Used for Algorithm
1			
	Mild liver disease†	115 (18)	070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 070.6, 070.9, 570, 570.1, 573.3, 573.4, 573.8, 753.9, V42.7
	Chronic pulmonary disease†	93 (14)	416.8, 416.9, 490-491.0, 491.2-495.2, 495.4-505, 506.4, 508.1, 508.8
	Congestive heart failure†‡	64 (9.9)	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4-425.9, 428-428.43
	Diabetes with chronic complications†	16 (2.5)	249.40-249.91, 250.40-250.90
	Rheumatologic disease†	10 (1.5)	466.5, 710.0-710.4, 714.0-714.2, 714.8, 725
	Dementia†	0 (0)	290, 290.0, 290.3, 290.8-290.43, 294.1, 294.11-294.21, 331.2
2			
	Any malignancy, including leukemia and lymphoma	626 (96)	150.0-159.0, 162-173.59, 173.70-175.9, 180.0-183.9, 185-186.9, 188.0-188.6, 188.8-189.4, 189.9, 191.0-192.3, 192.9-194.4, 200.2-202.38, 202.70-202.81, 203.0-204.22, 204.90-208.22, 208.90-209.36, 209.70, 209.72-209.79, 230.2-230.6, 230.8, 231.2, 231.9, 232.5-232.7, 233.0, 233.1, 233.31, 233.32, 233.4, 233.7, 235.2-235.4, 235.7, 235.8, 236.2, 236.4, 236.5, 236.7-236.91, 237.1-237.4, 237.6, 238.0-238.3, 238.79, 239.0-239.4, 239.6, 239.7, 239.89, 239.9
	Hemiplegia or paraplegia†	71 (11)	342.00-342.92, 344.00-344.5, 344.89-344.9
	Renal disease†	53 (8.2)	403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 582-583.7, 585-586, 588.0, V42.0, V45.1, V56-V56.8
3			
	Moderate or severe liver disease†	5 (0.8)	456.0-456.2, 572.2-572.8
6			
	Metastatic solid tumor	633 (98)	197.0-198.7, 198.81-190.9, 192.0-196.9, 199.0
	AIDS or HIV†§	2 (0.3)	042

*The values are given as the number of patients, with the percentage in parentheses. †These conditions are based on the ICD-9 codes that were assigned to these patients. If one or more of the conditions were present in a patient, this patient was considered to have additional comorbidities. The mean modified Charlson Comorbidity Index score (and standard deviation) was 6.9 ± 1.7 , and 300 patients had at least one additional comorbidity. ‡This includes myocardial infarction in the history, congestive heart failure, peripheral vascular disease, and cerebrovascular disease. The following comorbidities were mutually exclusive: mild liver disease and moderate or severe liver disease, and any malignancy and metastatic solid tumor. §AIDS = acquired immune deficiency syndrome, and HIV = human immunodeficiency virus.

TABLE E-2 Computational Parameters for Boosted Regression, Explanation, Recommended Settings, and Settings Chosen for Our Study*

Parameter	Explanation	Recommended ¹⁹	Our Setting
Interaction	Specifies the maximum number of interactions allowed.	Between 3 and 7	3
Maximal iterations	Specifies the maximum number of trees to be fitted.	Set higher if the “best” iteration is almost as large as the set value	10,000
Shrinkage factor	Specifies the shrinkage factor, ranging between 0 and 1. Shrinkage means reducing or shrinking the impact of each additional tree in an effort to avoid overfitting.	0.01 to 0.001	0.01
Bagging	Specifies the fraction of training observations that is used to fit an individual tree. A value of 0.6 means that 60% of the observations are used for building each tree.	0.4 to 0.8	0.5
Distribution	Specifies the distribution of the inefficiency term. Possible distributions are normal, logistic, and Poisson.	NA†	Logistic
Train fraction	Specifies the percentage of data to be used as training data.	0.8 is default	0.8

*For our model, various parameters were used within suggested ranges and were tested for their in-sample and out-of-sample predictability to assess overfitting. The parameters that we chose provided the best possible model. †NA = not applicable.

TABLE E-3 The Most Commonly Used Prognostication Models to Estimate Survival in Patients with Spine Metastases, Factors Included in Their Models, and Comparison with Our Prognostication Model*

Predictive Parameters	Bauer Score (N = 153)	Sioutos Score (N = 109)	Tokuhashi Score (N = 64)	Tomita Score (N = 67)	van der Linden Score (N = 342)	Current Study (N = 649)
Age	Not included	Not included	Not included	Not included	Not included	Included
Performance status	Not included	Not included	Included	Not included	Included	Included
Pathologic fracture	Included	Not included	Not included	Not included	Not included	Not significant
Neurological compromise	Not included	Included	Included	Not included	Not included	Not significant
Primary tumor type	Included	Included	Included	Included	Included	Included
Multiple spine disease	Included	Included	Included	Included	Not included	Included
Extraspinal bone metastases	Included	Not included	Included	Included	Not included	Not significant
Visceral metastases	Included	Not included	Included	Included	Included	Included
Prior systemic therapy	Not included	Not included	Not included	Not included	Not included	Included
White blood-cell count	Not included	Not included	Not included	Not included	Not included	Included
Hemoglobin level	Not included	Not included	Not included	Not included	Not included	Included

*Included indicates that the parameter was included in the prognostic assessment system to estimate survival; not included indicates that the parameter was not included. The exact parameters that were taken into account in every multivariate regression model of each prognostication model were not always reported. All factors tested in previous assessment systems were carried along for our multivariate regression model.