Appendix S2: summary of included model development studies

Study	Data Source and Study Population Size (n=20510)	Model Outcome	Candidate Variables	Method of Predictor Selection	Included Predictor Variables	Missing Data	Modeling Method	Model Performance and Validation	Presentation
Brennan *et al.* 2004[22]	Single institution database (n=555)	1,2,3 year survival	n=14	Cox multivaraite analysis; p-value but non significant variables included	age, sex, portal vein inclusion, splenectomy, margin, location, differentiation, posterior margin, nodes positive, nodes negative, back pain, T stage, weight loss, maximum pathological axis (n=14)	Predicted using regression models	Multivaraite Cox proportional hazards regression	Calibration plot: good fit Discrimination: *c*-statistic 0.64 External Evaluation: absent; internal validation by bootstrap method	Nomogram
Kanda *et al.* 2014[23]	Single institution database (n=324)	Death within 12 months of surgery	n=19	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value < 0.1	CEA, CA19-9 (n=2)	Complete case analysis	Multivaraite Cox proportional hazards regression	Calibration: absent Discrimination: AUC 0.702 External Evaluation: absent	Index
Miura *et al.* 2014[24]	Single institution database (n=50)	1,3,5 year survival	n=50	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	Platelet count, CRP, CA19-9 (n=3)	Complete case analysis	Multivaraite Cox proportional hazards regression	Calibration: none Discrimination: none External Evaluation: absent	Score
Shen *et al.* 2018[18]	Multi-centre databases (n=239)	6,12,18 month survival	n=17	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	age, length of tumour contact, peripancreatic venous abnormality, lymph node staging (n=4)		Multivaraite Cox proportional hazards regression	Calibration plot: good fit Discrimination: *c*-statistic 0.824 External Evaluation: performed	Nomogram
Xu *et al.* 2017[25]	Single institution database (n=265)	1,3,5 year survival	n=14	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	Tumour grade, pathological stage, neural invasion, vascular invasion, Neutrophil Lymphocyte Ratio, Platelet to Lymphocyte Ratio, Albumin Globulin Ratio (n=7)		Multivaraite Cox proportional hazards regression	Calibration: calibration curve Discrimination: 1yr: c-index 0.86, AUC: 0.938. 3yr: c-index 0.837, AUC 0.844, 5yr: c-index: 0.809, AUC 0.884 External Evaluation: absent	Nomogram
Walczak & Velanovich 2017[26]	Single institution database (n=219)	7 month survival post surgery	n=7	Single hidden layer back propogation trained ANN.	age, sex, stage, survival time, quality of life, adjuvant therapy, resection details (n=7)	Complete case analysis	Artificial Neural Network	Calibration: absent Discrimination: AUC: 0.6576, sensitivity 91.30%, specificity 38.27% External Validation: absent; internal validation by random split method	Calculator
Hsu *et al.* 2012[27]	Single institution database (n=740)	Death at 9 and 12 months	n=15	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	age, tumour size, comorbidities, tumour grade (n=4)	Complete case analysis	Multivaraite Cox proportional hazards regression	Calibration: none Discrimination: none External Validation: absent; internal validation with p-value <0.05	Score
Botsis *et al.* 2009[28]	Single institution database (n=218)	Survival time	n=26	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	Age, differentiation, tumour size, Alk Phos, Albumin, Ca19-9 (n=6)	MICE presuming data missing at random	Multivaraite Cox proportional hazards regression	Calibration: absent Discrimination: *c*-statistic 0.73 External Validation: absent; internal validation by bootstrap method	Score
Liu *et al.* 2018[29]	Multi-centre	Survival time	n=10	Pre-selection by	American Joint Commission on		Multivaraite Cox	Calibration: absent	Score

	databases (n=1223)			Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	Cancer stage, tumour grade, post-operative Ca19-9 (n=3)		proportional hazards regression	Discrimination: *c*-statistic 0.70, AIC: 2406.37 External Validation: absent; internal validation by random split method	
Balzano *et al.* 2017[18]	Single institution database (n=296)	1 year mortality	n=56	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.2 for univariate analysis and <0.1 for multivariate analysis	American Society of Anaesthesiologists' score, Geriatric Nutritional Risk Index, abdominal/back pain, non metastatic liver disease or insulin resistance (n=4)		Multivaraite Cox proportional hazards regression	Calibration: Hosmer-Lemeshow 0.403. Discrimination: R^2 53.5%, AUC: 88.7%. External Validation performed	Score
Smith & Mezhir 2014[30]	National Registry Database (n=6400)	6 months, 1,3,5 year survival	n=12	Backward stepdown selection process	Survival: age, gender, marital status, race, grade, histology, T&M, size, radiation, Lymph Node Ratio (n=11). Lymph node ratio: grade T&M stage, size (n=4)	Complete case analysis	Bayesian Model	Calibration curve: goodness-of-fit statistic 0.4847 Discrimination: *c*-statistic: 0.65 External Validation: absent; internal validation by random split method	Calculator
Pu *et al.* 2017[31]	Single institution database (n=220)	1,2,3 year survival	n=20	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	Differentiation, American Joint Commission on Cancer stage, Alkaline Phosphate to Albumin Ratio (n=3)	Complete case analysis	Multivaraite Cox proportional hazards regression	Calibration curve: optimal consistency Discrimination: training: 0.673 validation: 0.693 External validation: absent; internal validation by random split method	Nomogram
Dasari *et al.* 2015[20]	Single institution database (n=567)	1,3 year survival	n=13	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	Tumour site, T stage, Lymph Node Ratio (n=3)	Complete case analysis	Multivaraite Cox proportional hazards regression	Calibration: none Discrimination: AUC 1yr &3yr: 0.66 & 0.74 External Validation performed	Index
Pu *et al.* 2018[21]	National Registry Database (n=3458)	1,3,5 year survival	n=12	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	Age, grade, T stage (n=3)	Complete case analysis	Multivaraite Cox proportional hazards regression	Calibration curve: optimal fit Discrimination: *c*-statistic 0.63 External and internal validation performed using bootstrap method	Nomogram
Katz *et al.* 2012[32]	National Registry Database (n=5736)	3 year survival	n=7	Pre-selection by Univaraiate analysis then Cox multivaraite analysis. P-value <0.05	Age, gender, race, site, grade, stage, radiotherapy (n=7)	Complete case analysis	Multivaraite Cox proportional hazards regression	Calibration curve: results not reported Discrimination: absent External Validation: absent	Calculator