

Supplement:

Supplement 1: ICD-9 Diagnosis Codes for Identification of Autoimmune Disease

Autoimmune Disease	ICD-9 Diagnosis Code
Crohn's Disease	555, 555.1, 555.2, 555.3, 555.8, 555.9
Dermatomyositis	710.3
Polymyositis	710.4
Psoriasis	696, 696.1, 696.2
Rheumatoid Arthritis	714, 714.1, 714.2
Sarcoidosis	135
Systemic Scleroderma	710.1
Sjogren's Syndrome	710.2
Systemic Lupus Erythematosus	710
Ulcerative Colitis	556.5, 556.6, 556.8, 556.9

Supplement 2: ICD-10 Codes to Identify Patients who died of their Cancer

ICD-10 Codes
General Codes: C798, C80, C97, D489 Site Specific Codes: C32-C34, C39, C780, D022, D143, D144, D15, D38

Supplement 3: Commonly Used Chemotherapy Agents for the Treatment of Breast Cancer

Agent	Healthcare Common Procedure Coding System Codes
Docetaxel	J9171, J9170
Paclitaxel	C9127, C9431, J9264, J9265, J9267
Doxorubicin	J9000, C9415, J9002, Q2048, Q2049, Q2050, J9001
Gemcitabine	J9201

Supplement 4A: Univariate and Multivariable Cox Regression Analysis on OS (Stage I Patients)

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Autoimmune disease (No vs. Yes)	0.73 (0.7, 0.77)	< 0.0001	1.05 (1.01, 1.1)	0.025
Age (per year increase)	1.12 (1.11, 1.12)	< 0.0001	1.09 (1.09, 1.1)	< 0.0001
Race				
Black vs. White	1.16 (1.08, 1.25)	< 0.0001	1.33 (1.23, 1.43)	< 0.0001
Others vs. White	0.47 (0.41, 0.52)	< 0.0001	0.58 (0.51, 0.65)	< 0.0001
CKD (No vs. Yes)	0.17 (0.16, 0.18)	< 0.0001	0.35 (0.33, 0.36)	< 0.0001
Charlson comorbidity index (per index increase)	1.68 (1.67, 1.7)	< 0.0001		
NCI comorbidity index (per index increase)	1.61 (1.59, 1.62)	< 0.0001		
Chemotherapy (No vs. Yes)	0.52 (0.47, 0.56)	< 0.0001	0.49 (0.45, 0.55)	< 0.0001
Radiation (No vs. Yes)	2.26 (2.16, 2.36)	< 0.0001	1.66 (1.58, 1.73)	< 0.0001

CI, confidence interval; HR, hazard ratio; OS, overall survival.

Supplement 4B: Proportional Hazards Regression with Death as the Competing Risk on CSM (Stage I Patients)

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Autoimmune disease (No vs. Yes)	0.97 (0.86, 1.08)	0.541	1.35 (1.2, 1.51)	< 0.0001
Age (per year increase)	1.04 (1.04, 1.05)	< 0.0001	1.04 (1.03, 1.05)	< 0.0001
Race				
Black vs. White	1.78 (1.53, 2.06)	< 0.0001	1.73 (1.49, 2.01)	< 0.0001
Others vs. White	0.68 (0.53, 0.88)	0.003	0.79 (0.61, 1.01)	0.059
CKD (No vs. Yes)	0.39 (0.35, 0.44)	< 0.0001	0.58 (0.51, 0.66)	< 0.0001
Charlson comorbidity index (per index increase)	1.31 (1.26, 1.35)	< 0.0001		
NCI comorbidity index (per index increase)	1.26 (1.22, 1.3)	< 0.0001		
Chemotherapy (No vs. Yes)	0.11 (0.09, 0.12)	< 0.0001	0.11 (0.09, 0.12)	< 0.0001
Radiation (No vs. Yes)	1.74 (1.56, 1.93)	< 0.0001	1.53 (1.37, 1.71)	< 0.0001

CI, confidence interval; CSM, cancer specific mortality; HR, hazard ratio.

Supplement 5A: Univariate and Multivariable Cox Regression Analysis on OS (Stage II Patients)

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Autoimmune disease (No vs. Yes)	0.85 (0.81, 0.9)	< 0.0001	1.24 (1.18, 1.31)	< 0.0001
Age (per year increase)	1.08 (1.07, 1.08)	< 0.0001	1.06 (1.06, 1.06)	< 0.0001
Race				
Black vs. White	1.14 (1.1, 1.22)	0.0001	1.34 (1.25, 1.43)	< 0.0001
Others vs. White	0.62 (0.55, 0.69)	< 0.0001	0.73 (0.66, 0.82)	< 0.0001
CKD (No vs. Yes)	0.24 (0.23, 0.25)	< 0.0001	0.39 (0.38, 0.4)	< 0.0001
Charlson comorbidity index (per index increase)	1.57 (1.56, 1.59)	< 0.0001		
NCI comorbidity index (per index increase)	1.49 (1.48, 1.51)	< 0.0001		
Chemotherapy (No vs. Yes)	0.7 (0.66, 0.74)	< 0.0001	0.77 (0.73, 0.82)	< 0.0001
Radiation (No vs. Yes)	1.99 (1.9, 2.09)	< 0.0001	1.68 (1.6, 1.77)	< 0.0001

CI, confidence interval; HR, hazard ratio; OS, overall survival.

Supplement 5B: Proportional Hazards Regression with Death as the Competing Risk on CSM (Stage II Patients)

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Autoimmune disease (No vs. Yes)	1.01 (0.94, 1.09)	0.765	1.36 (1.26, 1.47)	< 0.0001
Age (per year increase)	1.02 (1.02, 1.02)	< 0.0001	1.01 (1.01, 1.02)	< 0.0001
Race				
Black vs. White	1.46 (1.33, 1.6)	< 0.0001	1.43 (1.3, 1.58)	< 0.0001
Others vs. White	0.71 (0.6, 0.83)	< 0.0001	0.75 (0.64, 0.88)	0.0003
CKD (No vs. Yes)	0.51 (0.48, 0.55)	< 0.0001	0.64 (0.59, 0.7)	< 0.0001
Charlson comorbidity index (per index increase)	1.21 (1.18, 1.24)	< 0.0001		
NCI comorbidity index (per index increase)	1.18 (1.16, 1.2)	< 0.0001		
Chemotherapy (No vs. Yes)	0.39 (0.36, 0.41)	< 0.0001	0.39 (0.36, 0.42)	< 0.0001
Radiation (No vs. Yes)	1.52 (1.41, 1.63)	< 0.0001	1.45 (1.35, 1.55)	< 0.0001

CI, confidence interval; CSM, cancer specific mortality; HR, hazard ratio.

Supplement 6A: Univariate and Multivariable Cox Regression Analysis on OS (Stage III Patients)

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Autoimmune disease (No vs. Yes)	0.93 (0.87, 0.99)	0.027	1.34 (1.25, 1.43)	< 0.0001
Age (per year increase)	1.05 (1.04, 1.05)	< 0.0001	1.03 (1.03, 1.04)	< 0.0001
Race				
Black vs. White	1.28 (1.18, 1.37)	< 0.0001	1.42 (1.32, 1.54)	< 0.0001
Others vs. White	0.78 (0.68, 0.88)	0.0001	0.86 (0.75, 0.97)	0.018
CKD (No vs. Yes)	0.33 (0.31, 0.35)	< 0.0001	0.47 (0.44, 0.5)	< 0.0001
Charlson comorbidity index (per index increase)	1.44 (1.42, 1.47)	< 0.0001		
NCI comorbidity index (per index increase)	1.4 (1.38, 1.42)	< 0.0001		
Chemotherapy (No vs. Yes)	0.61 (0.58, 0.65)	< 0.0001	0.79 (0.74, 0.84)	< 0.0001
Radiation (No vs. Yes)	1.86 (1.76, 1.97)	< 0.0001	1.6 (1.51, 1.69)	< 0.0001

CI, confidence interval; HR, hazard ratio; OS, overall survival.

Supplement 6B: Proportional Hazards Regression with Death as the Competing Risk on CSM (Stage III Patients)

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Autoimmune disease (No vs. Yes)	1.07 (0.99, 1.15)	0.107	1.41 (1.29, 1.53)	< 0.0001
Age (per year increase)	1.02 (1.02, 1.02)	< 0.0001	1.01 (1.01, 1.01)	< 0.0001
Race				
Black vs. White	1.34 (1.23, 1.46)	< 0.0001	1.37 (1.25, 1.49)	< 0.0001
Others vs. White	0.87 (0.75, 1.01)	0.058	0.94 (0.81, 1.09)	0.423
CKD (No vs. Yes)	0.55 (0.51, 0.59)	< 0.0001	0.69 (0.63, 0.75)	< 0.0001
Charlson comorbidity index (per index increase)	1.18 (1.15, 1.21)	< 0.0001		
NCI comorbidity index (per index increase)	1.16 (1.13, 1.19)	< 0.0001		
Chemotherapy (No vs. Yes)	0.53 (0.49, 0.56)	< 0.0001	0.55 (0.51, 0.59)	< 0.0001
Radiation (No vs. Yes)	1.53 (1.43, 1.64)	< 0.0001	1.44 (1.35, 1.54)	< 0.0001

CI, confidence interval; CSM, cancer specific mortality; HR, hazard ratio.

Supplement 7A: Univariate and Multivariable Cox Regression Analysis on OS (Stage IV Patients)

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Autoimmune disease (No vs. Yes)	1.14 (1.07, 1.22)	0.0001	1.45 (1.35, 1.55)	< 0.0001
Age (per year increase)	1.04 (1.035, 1.04)	< 0.0001	1.036 (1.03, 1.04)	< 0.0001
Race				
Black vs. White	1.13 (1.05, 1.22)	0.001	1.32 (1.23, 1.43)	< 0.0001
Others vs. White	0.64 (0.56, 0.73)	< 0.0001	0.72 (0.63, 0.82)	< 0.0001
CKD (No vs. Yes)	0.6 (0.57, 0.64)	< 0.0001	0.76 (0.71, 0.8)	< 0.0001
Charlson comorbidity index (per index increase)	1.31 (1.28, 1.33)	< 0.0001		
NCI comorbidity index (per index increase)	1.25 (1.23, 1.27)	< 0.0001		
Chemotherapy (No vs. Yes)	1.01 (0.95, 1.07)	0.723	1.06 (1, 1.12)	0.063
Radiation (No vs. Yes)	1.43 (1.35, 1.52)	< 0.0001	1.26 (1.19, 1.34)	< 0.0001

CI, confidence interval; HR, hazard ratio; OS, overall survival.

Supplement 7B: Proportional Hazards Regression with Death as the Competing Risk on CSM (Stage IV Patients)

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Autoimmune disease (No vs. Yes)	1.2 (1.11, 1.28)	< 0.0001	1.4 (1.29, 1.5)	< 0.0001
Age (per year increase)	1.02 (1.022, 1.03)	< 0.0001	1.02 (1, 1.03)	< 0.0001
Race				
Black vs. White	1.09 (1.01, 1.18)	0.031	1.2 (1.11, 1.31)	< 0.0001
Others vs. White	0.65 (0.56, 0.74)	< 0.0001	0.91 (0.62, 0.81)	< 0.0001
CKD (No vs. Yes)	0.74 (0.69, 0.79)	< 0.0001	0.88 (0.82, 0.94)	0.0002
Charlson comorbidity index (per index increase)	1.11 (1.07, 1.14)	< 0.0001		
NCI comorbidity index (per index increase)	1.09 (1.06, 1.12)	< 0.0001		
Chemotherapy (No vs. Yes)	0.95 (0.9, 1)	0.058	0.94 (0.89, 1)	0.048
Radiation (No vs. Yes)	1.26 (1.19, 1.34)	< 0.0001	1.13 (1.1, 1.21)	< 0.0001

CI, confidence interval; CSM, cancer specific mortality; HR, hazard ratio.