

Supplementary Online Content

KC M, Fan J, Hyslop T, et al. Relative burden of cancer and noncancer mortality among long-term survivors of breast, prostate, and colorectal cancer in the US. *JAMA Netw Open*. 2023;6(7):e2323115. doi:10.1001/jamanetworkopen.2023.23115

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eMethods.

This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Frequency Distribution of Noncancer Causes of Death in the Cancer Cohorts

Breast Cancer Cohort			
SN	Non-cancer specific causes of death	N	%
1	Diseases of Heart	9210	24.02
2	Other Cause of Death	7073	18.44
3	Alzheimers (ICD-9 and 10 only)	2727	7.11
4	Cerebrovascular Diseases	2522	6.58
5	Chronic Obstructive Pulmonary Disease and Allied Cond	2474	6.45
6	Lung and Bronchus	1894	4.94
7	Accidents and Adverse Effects	1025	2.67
8	Diabetes Mellitus	978	2.55
9	Pneumonia and Influenza	976	2.55
10	Pancreas	738	1.92
Prostate Cancer Cohort			
SN	Non-cancer specific causes of death	N	%
1	Diseases of Heart	1758	24.49
2	Other Cause of Death	1156	16.1
3	Lung and Bronchus	455	6.34
4	Chronic Obstructive Pulmonary Disease and Allied Cond	441	6.14
5	Cerebrovascular Diseases	343	4.78
6	Alzheimers (ICD-9 and 10 only)	249	3.47
7	Accidents and Adverse Effects	243	3.38
8	Diabetes Mellitus	210	2.93
9	Pancreas	195	2.72
10	Nephritis, Nephrotic Syndrome and Nephrosis	144	2.01
Colon Cancer Cohort			
SN	Non-cancer specific causes of death	N	%
1	Diseases of Heart	6690	28.96
2	Other Cause of Death	3751	16.24
3	Alzheimers (ICD-9 and 10 only)	1561	6.76
4	Cerebrovascular Diseases	1460	6.32
5	Chronic Obstructive Pulmonary Disease and Allied Cond	1406	6.09
6	Lung and Bronchus	956	4.14
7	Diabetes Mellitus	835	3.61
8	Pneumonia and Influenza	666	2.88
9	Accidents and Adverse Effects	596	2.58
10	Nephritis, Nephrotic Syndrome and Nephrosis	576	2.49
Rectal Cancer Cohort			
SN	Non-cancer specific causes of death	N	%
1	Diseases of Heart	1710	27.51
2	Other Cause of Death	979	15.75
3	Chronic Obstructive Pulmonary Disease and Allied Cond	391	6.29

4	Cerebrovascular Diseases	351	5.65
5	Lung and Bronchus	348	5.6
6	Alzheimers (ICD-9 and 10 only)	296	4.76
7	Diabetes Mellitus	219	3.52
8	Accidents and Adverse Effects	169	2.72
9	Pneumonia and Influenza	154	2.48
10	Nephritis, Nephrotic Syndrome and Nephrosis	150	2.41

eTable 2. Crosstabulations of Race vs Income and Race vs Residence (Metropolitan)

Race/ethnicity	Income				
	Overall	< \$40,000	\$40,000 - \$54,999	\$55,000 - \$69,999	\$70,000+
NH- white	446058 (71.06)	16555 (3.71)	83625 (18.75)	163063 (36.56)	182815 (40.98)
NH-Black	64117 (10.21)	5006(7.81)	16376 (25.54)	26102 (40.71)	16633 (25.94)
NH-Asian	50719 (8.08)	88 (0.17)	1472 (2.90)	17862 (35.22)	31297 (61.71)
Hispanic	64200 (10.23)	630 (0.98)	8840 (13.77)	33173 (51.67)	21557 (33.58)
NH-American Indian	2608 (0.42)	214 (8.21)	750 (28.76)	901 (34.55)	743 (28.49)

Note: There was an association between race/ethnicity and income (p-value<0.01).

Race/ethnicity	Residence		
	Overall	Non-metropolitan	Metropolitan
NH-White	446058 (71.06)	61383 (13.76)	384675 (86.24)
NH-Black	64117 (10.21)	5779 (9.01)	58338 (90.99)
NH-Asian	50719 (8.08)	1700 (3.35)	49019 (96.65)
Hispanic	64200 (10.23)	2349 (3.66)	61851 (96.34)
NH-American Indian	2608 (0.42)	584 (22.39)	2024 (77.61)

Note: There was an association between race/ethnicity and residence (p-value<0.01).

eTable 3a. Estimates From LASSO for Breast Cancer Cohort

Breast specific mortality		Non-breast specific mortality	
Predictors	Coefficients	Predictors	Coefficients
Stage III	1.537251072	Age: 65+	2.699201705
Stage II	0.720426478	Age: 60-64	1.439952426
Grade III	0.684887731	Age: 55-59	0.988162494
Grade II	0.534389507	Stage III	0.636884153
Age: 65+	0.465242924	Age: 50 to 54	0.567543968
ER Positive	0.460846144	Stage II	0.275906812
Node positive	0.32159283	Income: <\$40,000	0.268716028
Race: NH Black	0.272865599	Race: NH American Indian	0.231050449
Income: <\$40,000	0.210125129	Income: \$40,000-\$54,999	0.169862759
Income: \$40,000-\$54,999	0.151766213	Race: NH Black	0.162013621
Race: NH American Indian	0.109816262	Grade III	0.063483896
Income: \$55,000-\$69,999	0.106816932	Income: \$55,000-\$69,999	0.029468223
Age: 60-64	0.090598634	Grade II	0.021965937
Race: Hispanic	0.081964288	Laterality: left	-0.003487806
Age: 55-59	0.04018637	PR Positive	-0.016875338
Laterality: left	0.029488998	Diagnosis year2005	-0.022470294
Received chemotherapy	0	Metropolitan	-0.022943673
Metropolitan	0	ER Positive	-0.02684002
Age: 50 to 54	-0.047973637	Diagnosis year2004	-0.027342957
Received radiation	-0.113938681	Node positive	-0.032457425
PR Positive	-0.12279612	Diagnosis year2006	-0.05338106
Diagnosis year2004	-0.132400159	Diagnosis year2007	-0.053936603
Race: NH Asian	-0.13352793	Diagnosis year2009	-0.098477185
Diagnosis year2006	-0.165020348	Diagnosis year2008	-0.102628064
Diagnosis year2005	-0.182476773	Diagnosis year2010	-0.1055015
Diagnosis year2011	-0.216875428	Race: Hispanic	-0.128755726
Diagnosis year2008	-0.220891581	Diagnosis year2011	-0.147772815
Diagnosis year2007	-0.230069019	Diagnosis year2012	-0.189877755
Diagnosis year2010	-0.260495116	Diagnosis year2013	-0.195374001
Diagnosis year2009	-0.288913878	Diagnosis year2014	-0.229486158
Diagnosis year2012	-0.314935441	Received radiation	-0.288273589
Diagnosis year2014	-0.336115864	Race: NH Asian	-0.308808776
Diagnosis year2013	-0.354917735	Received chemotherapy	-0.522345065

eTable 3b. Estimates From LASSO for Prostate Cancer Cohort

Prostate specific mortality		Non-prostate specific mortality	
Predictors	Coefficients	Predictors	Coefficients
Gleason score >=8	2.034374852	Age: 65+	1.974076105
PSA >20 ng/ml	0.992756164	Age: 60-64	1.085337557
Gleason score 7	0.959798764	Age: 55-59	0.785334807
Received chemotherapy	0.842982458	Gleason score >=8	0.593229466
Age: 65+	0.786030325	PSA >20 ng/ml	0.48315396
Diagnosis year2005	0.576025911	Income: <\$40,000	0.472943656
PSA 10-20 ng/ml	0.555856856	Age: 50 to 54	0.40508499
Diagnosis year2007	0.512294762	PSA 10-20 ng/ml	0.37328792
Diagnosis year2006	0.46865235	Income: \$40,000-\$54,999	0.308611712
Race: NH American Indian	0.301474953	Gleason score 7	0.307532718
Age: 60-64	0.299958217	Diagnosis year2008	0.160165023
Age: 55-59	0.229695509	Race: NH Black	0.158281607
Stage III	0.194229898	Diagnosis year2009	0.139001752
Income: <\$40,000	0.178404795	Income: \$55,000-\$69,999	0.085547563
Income: \$55,000-\$69,999	0.109471677	Diagnosis year2006	0.056766055
Diagnosis year2008	0.09756749	Diagnosis year2007	0.023847414
Race: NH Black	0.078537701	Received chemotherapy	0
Age: 50 to 54	0.017222436	Metropolitan	0
Income: \$40,000-\$54,999	0.000509206	Diagnosis year2010	-0.067855622
Metropolitan	0	Diagnosis year2011	-0.083717596
Race: Hispanic	-0.017384104	Diagnosis year2012	-0.096460298
Stage II	-0.22066363	Race: Hispanic	-0.134747387
Diagnosis year2009	-0.284852766	Diagnosis year2013	-0.203359358
Race: NH Asian	-0.45112247	Diagnosis year2005	-0.234171545
Diagnosis year2012	-0.675802517	Stage II	-0.241639917
Diagnosis year2010	-0.696123364	Race: NH Asian	-0.245438383
Diagnosis year2014	-0.715420816	Diagnosis year2014	-0.271951938
Diagnosis year2011	-0.723133848	Race: NH American Indian	-0.448841961
Diagnosis year2013	-0.794248077	Stage III	-0.58350858

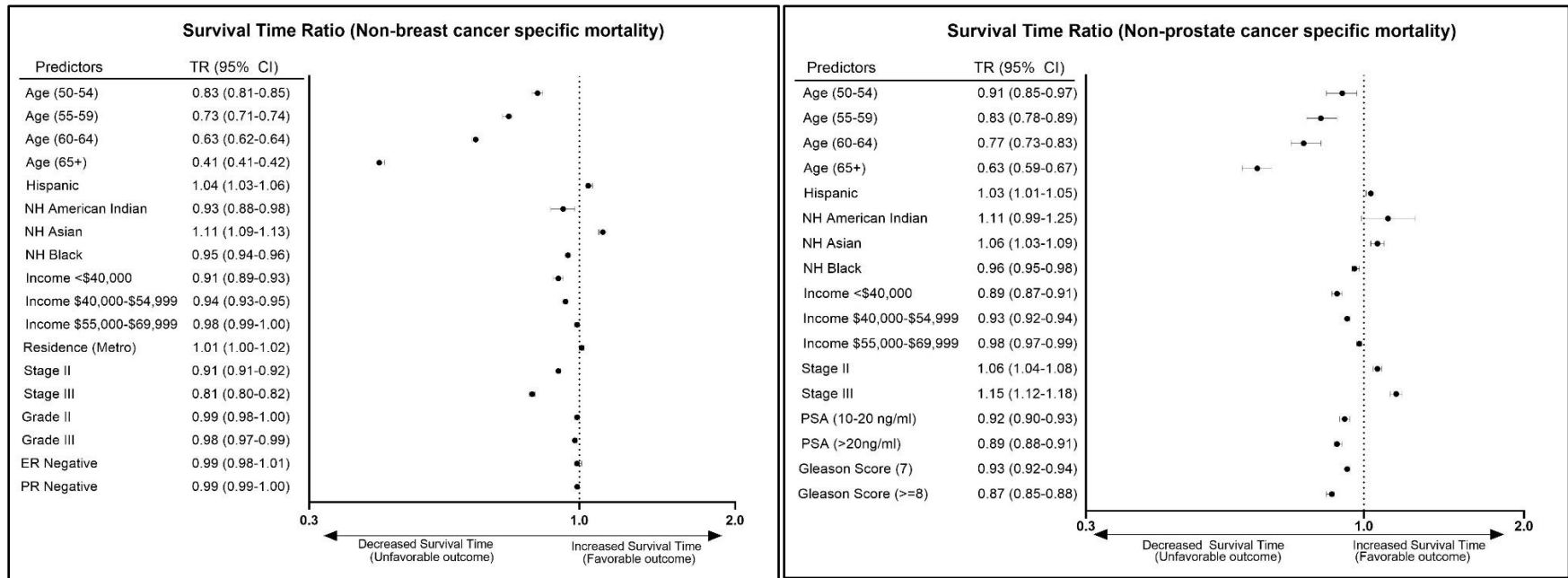
eTable 3c. Estimates From LASSO for Colon Cancer Cohort

Colon specific mortality		Non-colon specific mortality	
Predictors	Coefficients	Predictors	Coefficients
Stage III	1.099262148	Age: 65+	2.475938507
Received radiation	0.678781844	Age: 60-64	1.286602288
Stage II	0.655246821	Age: 55-59	0.921193796
Age: 65+	0.50581014	Age: 50 to 54	0.44765914
Sex: Male	0.237220064	Stage III	0.230463958
Race: NH Black	0.230035243	Received radiation	0.220824173
Age: 60-64	0.162084578	Stage II	0.176699139
Race: NH American Indian	0.138694827	Grade III	0.158286473
Received chemotherapy	0.112573668	Income: \$40,000-\$54,999	0.104610755
Grade II	0.102515375	Sex: Male	0.103691861
Age: 55-59	0.086135265	Grade II	0.049579938
Race: Hispanic	0.07740056	Income: <\$40,000	0.040602506
Age: 50 to 54	0.001206978	Income: \$55,000-\$69,999	0.015514833
Income: <\$40,000	0	Metropolitan	0
Income: \$40,000-\$54,999	0	Diagnosis year2004	0
Income: \$55,000-\$69,999	0	Diagnosis year2005	0
Diagnosis year2004	0	Diagnosis year2006	0
Diagnosis year2005	0	Diagnosis year2007	0
Diagnosis year2006	0	Diagnosis year2008	0
Diagnosis year2007	0	Diagnosis year2009	0
Diagnosis year2008	0	Diagnosis year2010	0
Diagnosis year2009	0	Diagnosis year2011	0
Diagnosis year2010	0	Diagnosis year2012	0
Diagnosis year2011	0	Diagnosis year2013	0
Diagnosis year2012	0	Diagnosis year2014	0
Diagnosis year2013	0	Node positive	0
Diagnosis year2014	0	Race: NH Black	-0.077714536
Node positive	0	Race: NH American Indian	-0.201364532
Grade III	-0.002445428	Race: Hispanic	-0.220277134
Race: NH Asian	-0.067874607	Race: NH Asian	-0.379184944
Metropolitan	-0.095197818	Received chemotherapy	-0.607521451

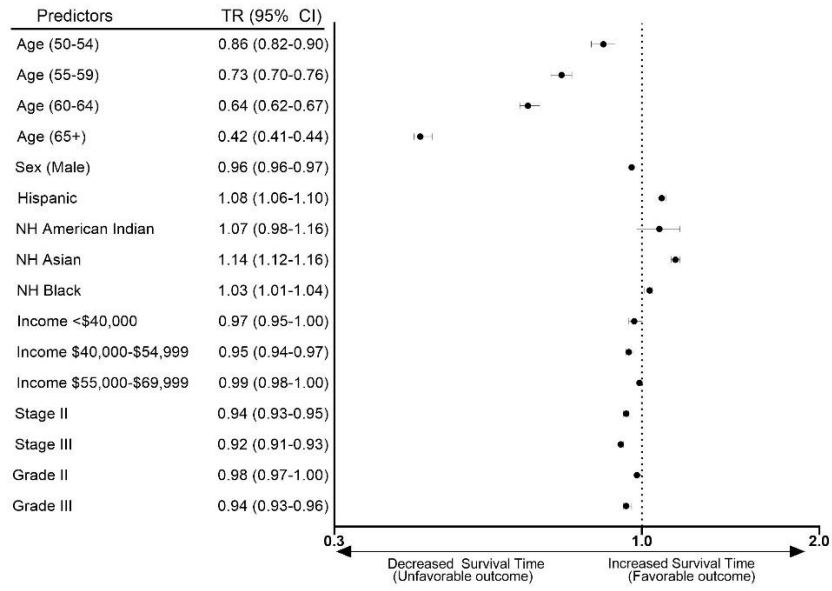
eTable 3d. Estimates From LASSO for Colon Cancer Cohort

Rectal Specific Mortality		Non-rectal specific mortality	
Predictors	Coefficients	Predictors	Coefficients
Stage III	0.767787428	Age: 65+	2.489941
Age: 65+	0.489828926	Age: 60-64	1.440028
Race: NH American Indian	0.440062967	Age: 55-59	1.027247
Stage II	0.405510409	Age: 50 to 54	0.58245
Race: NH Black	0.276920301	Stage II	0.22218
Received radiation	0.248965583	Income: \$40,000-\$54,999	0.185543
Income: <\$40,000	0.233499737	Stage III	0.173978
Age: 60-64	0.201605727	Race: NH American Indian	0.159218
Sex: Male	0.157909355	Sex: Male	0.153263
Income: \$55,000-\$69,999	0.145678625	Income: <\$40,000	0.145227
Income: \$40,000-\$54,999	0.145542349	Income: \$55,000-\$69,999	0.067393
Grade III	0.136721223	Received radiation	0
Race: Hispanic	0.132288965	Metropolitan	0
Grade II	0.113521841	Diagnosis year2004	0
Received chemotherapy	0.08699774	Diagnosis year2005	0
Age: 55-59	0.050525555	Diagnosis year2006	0
Age: 50 to 54	0.026208036	Diagnosis year2007	0
Diagnosis year2010	0.024210606	Diagnosis year2008	0
Node positive	0	Diagnosis year2009	0
Diagnosis year2004	-0.003333617	Diagnosis year2010	0
Race: NH Asian	-0.017040191	Diagnosis year2011	0
Metropolitan	-0.018932207	Diagnosis year2012	0
Diagnosis year2006	-0.053334985	Diagnosis year2013	0
Diagnosis year2009	-0.061803173	Diagnosis year2014	0
Diagnosis year2007	-0.080438055	Node positive	0
Diagnosis year2005	-0.089145029	Grade II	0
Diagnosis year2013	-0.098261766	Grade III	0
Diagnosis year2011	-0.10421356	Race: NH Black	-0.03386
Diagnosis year2014	-0.131655872	Race: Hispanic	-0.18415
Diagnosis year2012	-0.1339987	Received chemotherapy	-0.30955
Diagnosis year2008	-0.18215978	Race: NH Asian	-0.36205

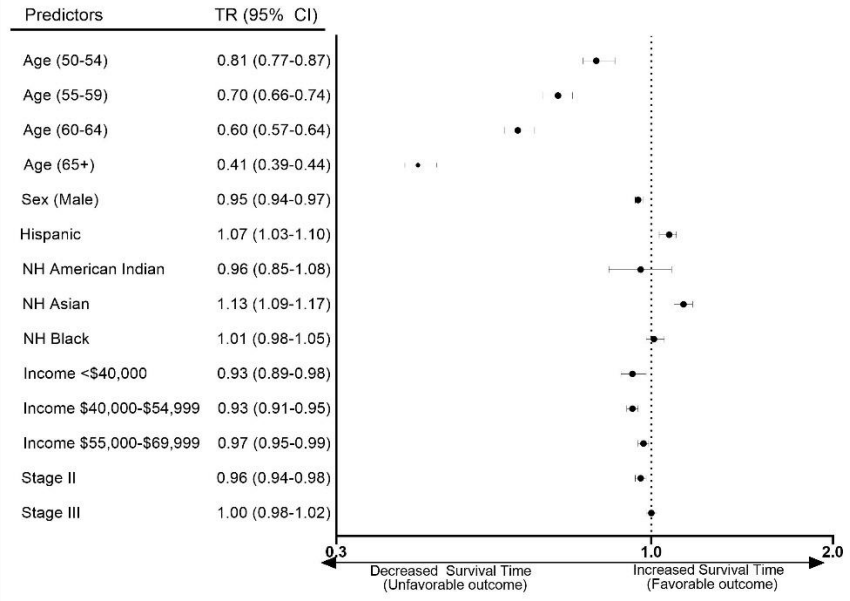
eFigure 1. Survival Time Ratio of Noncancer Specific Mortality Among Patients With Breast, Prostate, Colon and Rectal Cancer



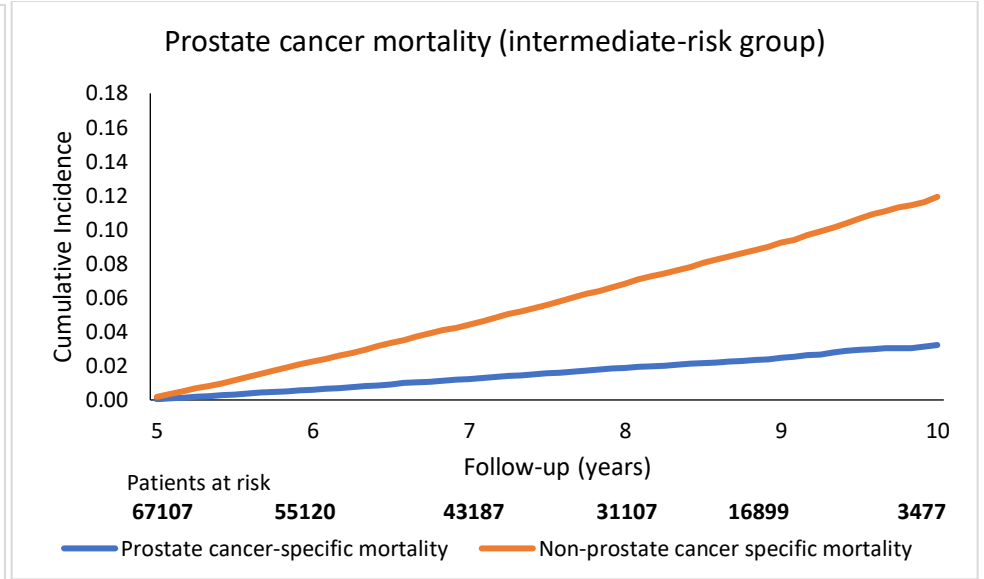
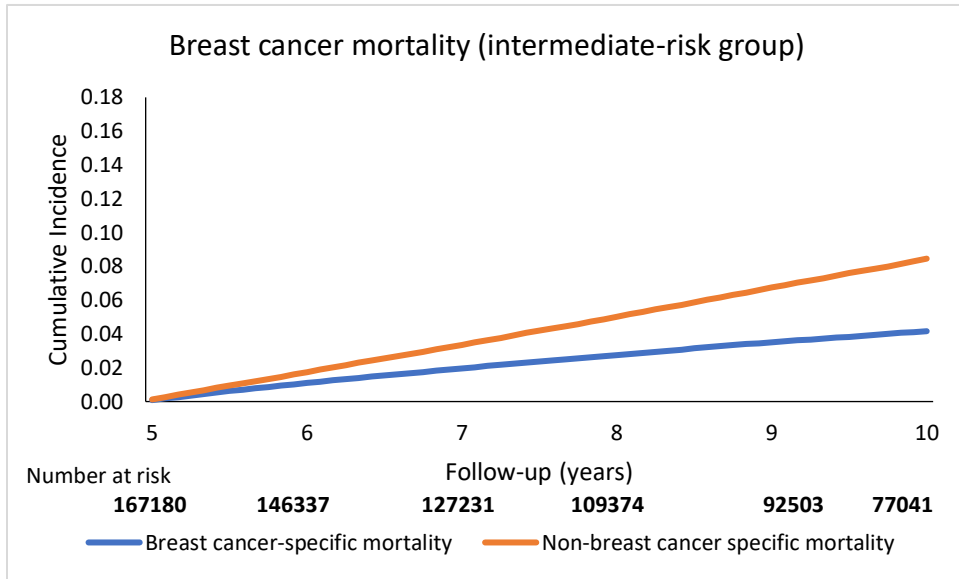
Survival Time Ratio (Non-colon cancer-specific mortality)

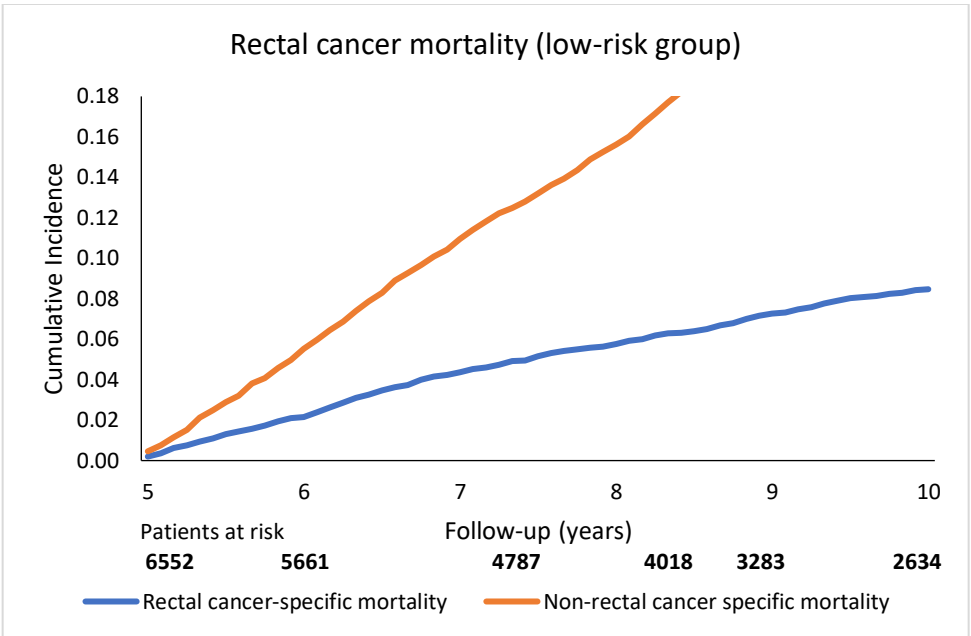
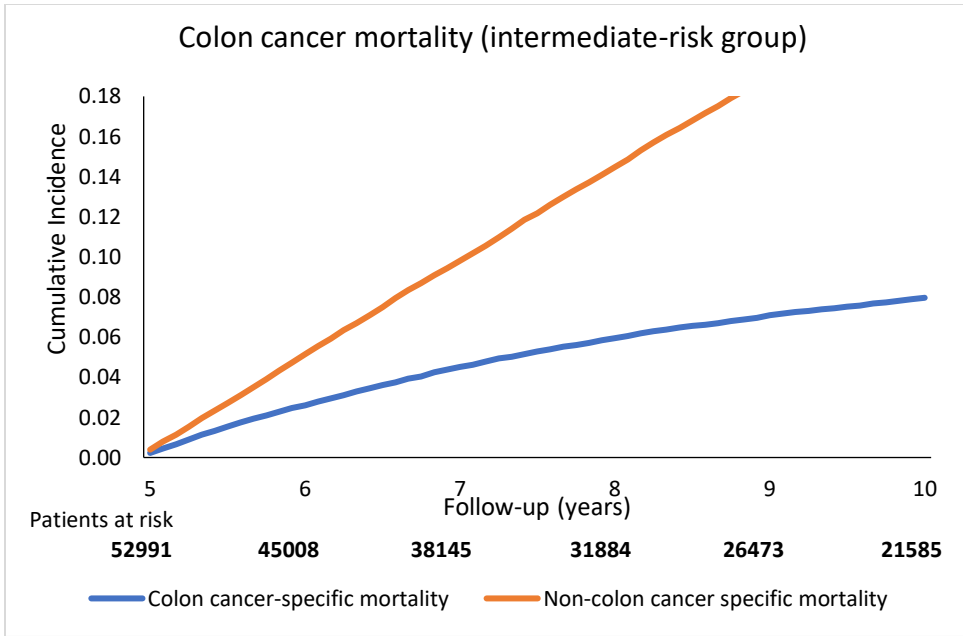


Survival Time Ratio (Non-rectal cancer specific mortality)

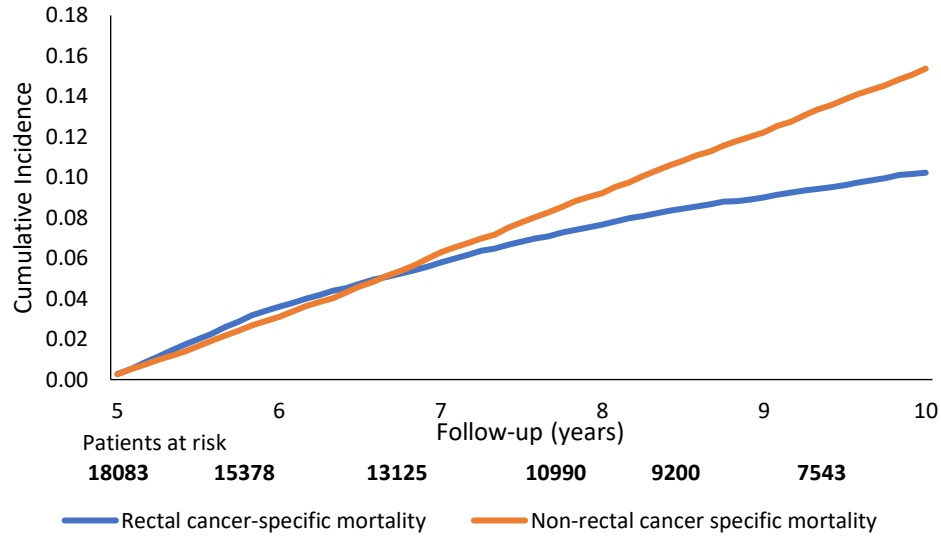


eFigure 2. Cumulative Mortality for Patients With Breast, Prostate, Colon, and Rectal Cancer Who Were Categorized as Intermediate Risk

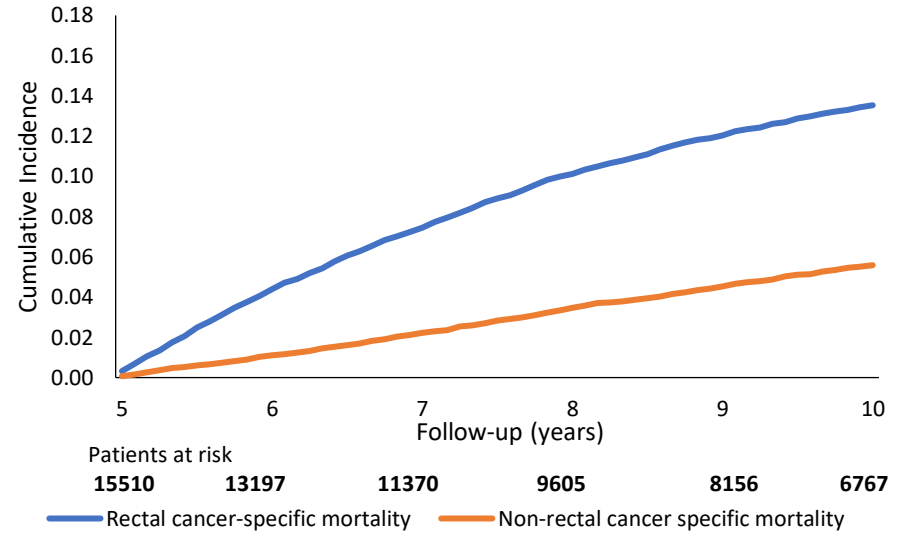




Rectal cancer mortality (intermediate-risk group)



Rectal cancer mortality (high-risk group)



eMethods.

Exclusion of patients with missing information on demographic or clinical factors

In our study, we excluded patients with missing information on demographic or clinical factors as well as those with missing follow-up time. This exclusion was necessary due to the nature of our study's goal, which is to accurately stratify patients into three risk categories: low, intermediate, and high-risk. To achieve this, it was crucial to have complete information on all variables included in the model.

Additionally, we employed LASSO regularization to select important variables and mitigate the risk of model overfitting. This regularization techniques requires non-missing values to perform the selection process effectively.

About 32% of patients were excluded due to missing demographic or clinical information or missing follow-up time. Notably, a significant portion of the excluded patients (77%) were prostate cancer patients. This high proportion is attributed to the limited availability of Gleason scores in the SEER database.