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Part I: Data

Plot of number of new HF patients form 1995 to 2015

Plot of number of new HF patients form 2000 to 2014

Part II: Rates

Causes for Readmission

Length of Stay

Part III: Logistic Regression Models

Association of 1-Year Readmission with 2-Year All-Cause Mortality

Appendix

Cardiovascular Outcomes in Heart Failure Patients

[Code ▼](#)

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Co-Investigator: Michail Giakoumis, Georgia Barbayannis

Statistician: Davit Sargsyan

Date: Sat Jun 22 18:34:24 2019

Header

Part I: Data

[Code](#)

Number of case = 89,893

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Search:

Table 1: Number of first HF discharges by year

Year	Counts	Age at 1st HF
1995	14197	74.1
1996	10475	74.3
1997	9329	74
1998	8635	73.7
1999	7811	73.9
2000	7760	73.4
2001	7345	73.2
2002	7271	73
2003	7205	73.3
2004	6462	73
2005	6202	73.4
2006	5770	73.2
2007	5444	73
2008	5836	72.8
2009	5659	73.4
2010	5941	73.2

Year	Counts	Age at 1st HF
2011	5875	73.1
2012	5375	73.3
2013	5513	73
2014	5588	72.6
2015	5734	73.2

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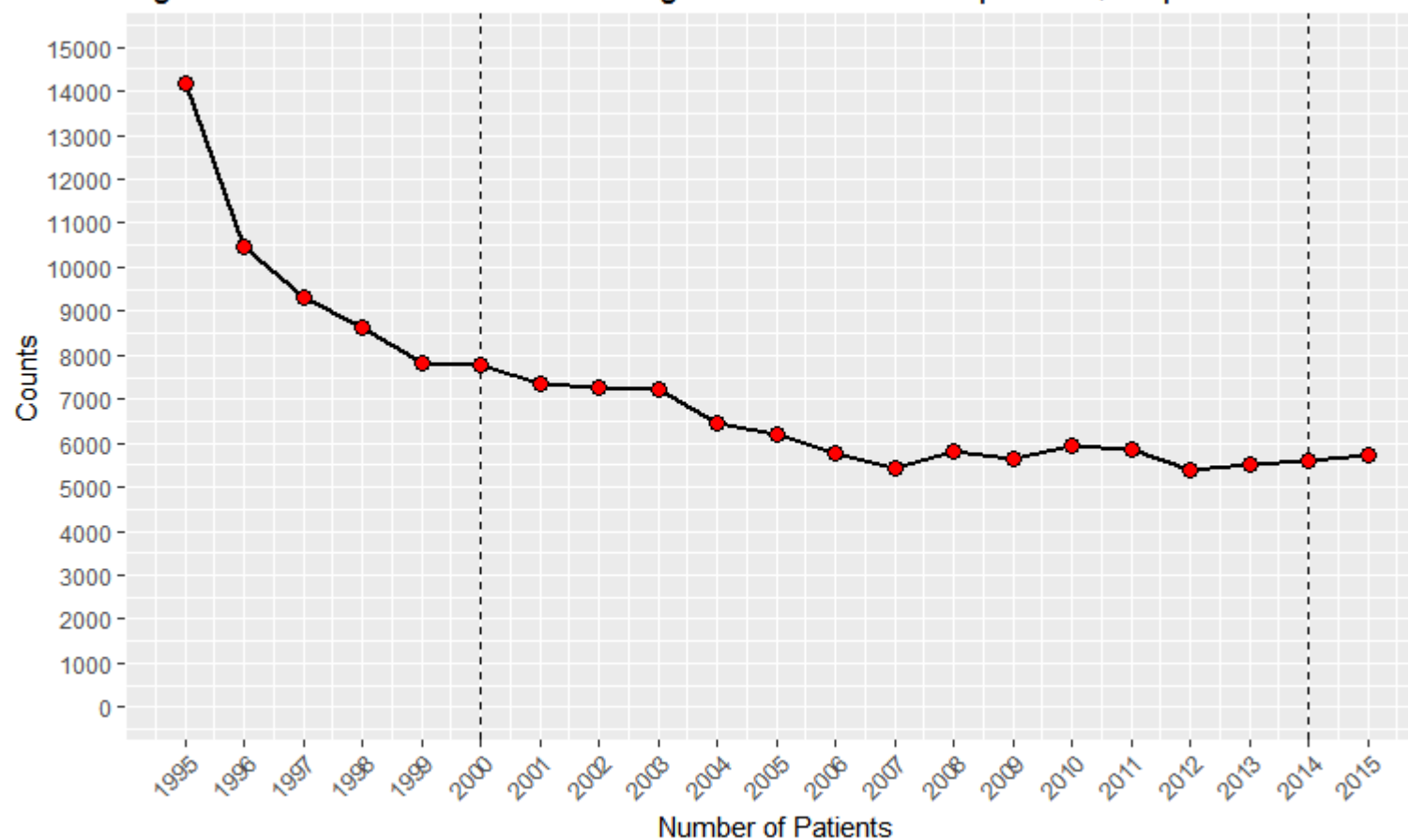
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Plot of number of new HF patients form 1995 to 2015

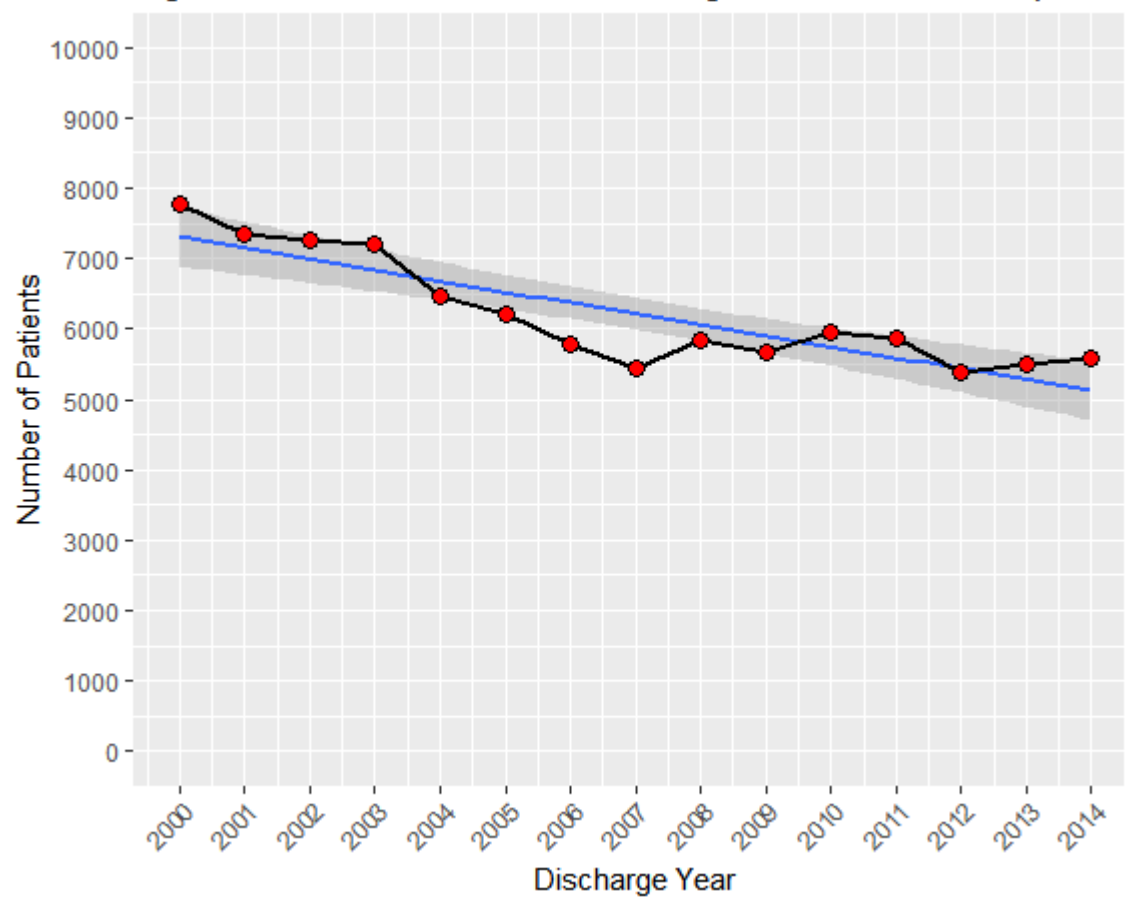
[Code](#)

Figure 1: Number of first HF discharges. Total of 149427 patients, no prior HF.

NOTE: the higher number of patients in the early years could be due to censored records containing prior HF; hence, more patients remained. Also, we needed at least one year follow-up for all patients; hence, we restricted records to 2000-2014 interval.

Plot of number of new HF patients form 2000 to 2014

[Code](#)

Figure 1: Number of first HF discharges. Total of 93,246 patients[Code](#)

Call:

lm(formula = Counts ~ years, data = t2)

Residuals:

Min	1Q	Median	3Q	Max
-772.4	-235.4	191.5	278.8	461.1

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	7305.87	195.94	37.287	1.33e-14 ***
years	-155.64	23.82	-6.534	1.90e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 398.6 on 13 degrees of freedom

Multiple R-squared: 0.7666, Adjusted R-squared: 0.7486

F-statistic: 42.7 on 1 and 13 DF, p-value: 1.9e-05

Code

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Table 2: HF patients' characteristics

Description	Number of Patients	Percent Patients
Mean Age at First AMI Admission +/- S.D	73.1+/-15	
Female (%)	49,246	52.8
Race (%)		
* White	68,729	73.7
* Black	14,731	15.8
* Other	9,786	10.5

Description	Number of Patients	Percent Patients
Ethnicity (%)		
* Hispanic	7,776	8.3
* Non-hispanic	76,850	82.4
* Unknown	8,620	9.2
Insurance(%)		
* Commercial	26,475	28.4
* Medicare	59,918	64.3
* Medicaid/Self-Pay/Other	6,853	7.3
Admission Hospital Type (%)		
* Teaching	44,876	48.1
* Non-Teaching	45,017	48.3
* Unknown	3,353	3.6
Admission to Hospital Area (%)		
* Urban	22,607	24.2
* Inner city	16,516	17.7
* Rural	11,650	12.5
* Suburb	39,120	42
* Unknown	3,353	3.6

Description	Number of Patients	Percent Patients
Admission Hospital Cath Lab		
* Cath Lab	41,138	44.1
* No Cath Lab	48,755	52.3
* Unknown	3,353	3.6
Number of HF Patients	93,246	

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Part II: Rates

All-Cause Readmissions

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Table 3a: all-cause readmissions (%)

HF Discharge Year	30-Day	90-Day	180-Day	1-Year
2000	15.89	29.03	38.48	50.08
2001	15.75	28.3	38.27	49.67
2002	16.39	30.06	39.94	51.15
2003	16.52	30.03	39.51	50.41
2004	16.2	30.05	40.1	51.5

HF Discharge Year	30-Day	90-Day	180-Day	1-Year
2005	17.03	30.59	40.79	51.68
2006	16.88	30.36	40.05	50.9
2007	18.26	32.57	42.19	54.59
2008	21.18	36.19	46.25	57.59
2009	21.31	35.93	46.09	57.71
2010	19.56	33.5	43.75	53.04
2011	21.84	36.58	47.22	58.54
2012	20.11	35.89	46.31	57.69
2013	20.13	35.04	46.78	57.85
2014	20.29	35.33	46.28	57.02
Sum	18.29	32.35	42.48	53.64

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HF Readmissions

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Table 3b: HF readmissions (%)

HF Discharge Year	30-Day	90-Day	180-Day	1-Year
2000	5.62	10.27	13.89	18.88

HF Discharge Year	30-Day	90-Day	180-Day	1-Year
2001	5.75	9.83	13.21	18.33
2002	5.46	10.19	14.07	19.32
2003	5.84	10.28	13.75	18.45
2004	5.83	10.85	15.29	20.15
2005	6.24	10.92	15.03	19.91
2006	6.62	11.63	15.56	19.84
2007	6.48	11.59	15.52	20.24
2008	7.09	11.91	15.88	20.63
2009	7.02	11.68	15.36	20.36
2010	6.21	10.96	14.29	18.3
2011	7.4	12.34	16.24	20.89
2012	6.83	11.59	15.26	20.06
2013	6.44	11.25	15.62	19.93
2014	6.5	11.44	15.07	19.58
Sum	6.3	11.04	14.85	19.59

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All-Cause Death

Code

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Table 3c: all-cause death (%)

HF Discharge Year	30-Day	90-Day	180-Day	1-Year
2000	3.8	7.99	12.23	18.94
2001	3.89	7.8	12.09	18.34
2002	3.6	7.91	12.34	18.77
2003	4.36	9.48	13.89	20.22
2004	3.54	8.03	12.06	18.42
2005	4.18	8.98	13.17	19.51
2006	4.49	9.38	12.81	18.61
2007	3.97	8.91	13.1	18.83
2008	4.46	8.77	12.66	18.59
2009	4.52	9.68	14.1	20.22
2010	3.84	8.32	12	17.08
2011	4.89	9.28	13.75	19.63
2012	4	8.67	12.89	19.03
2013	4.24	8.56	12.37	17.41
2014	3.94	8.05	11.95	17.32
Sum	4.1	8.62	12.74	18.75

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CV Death

Code

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Table 3d: CV death (%)

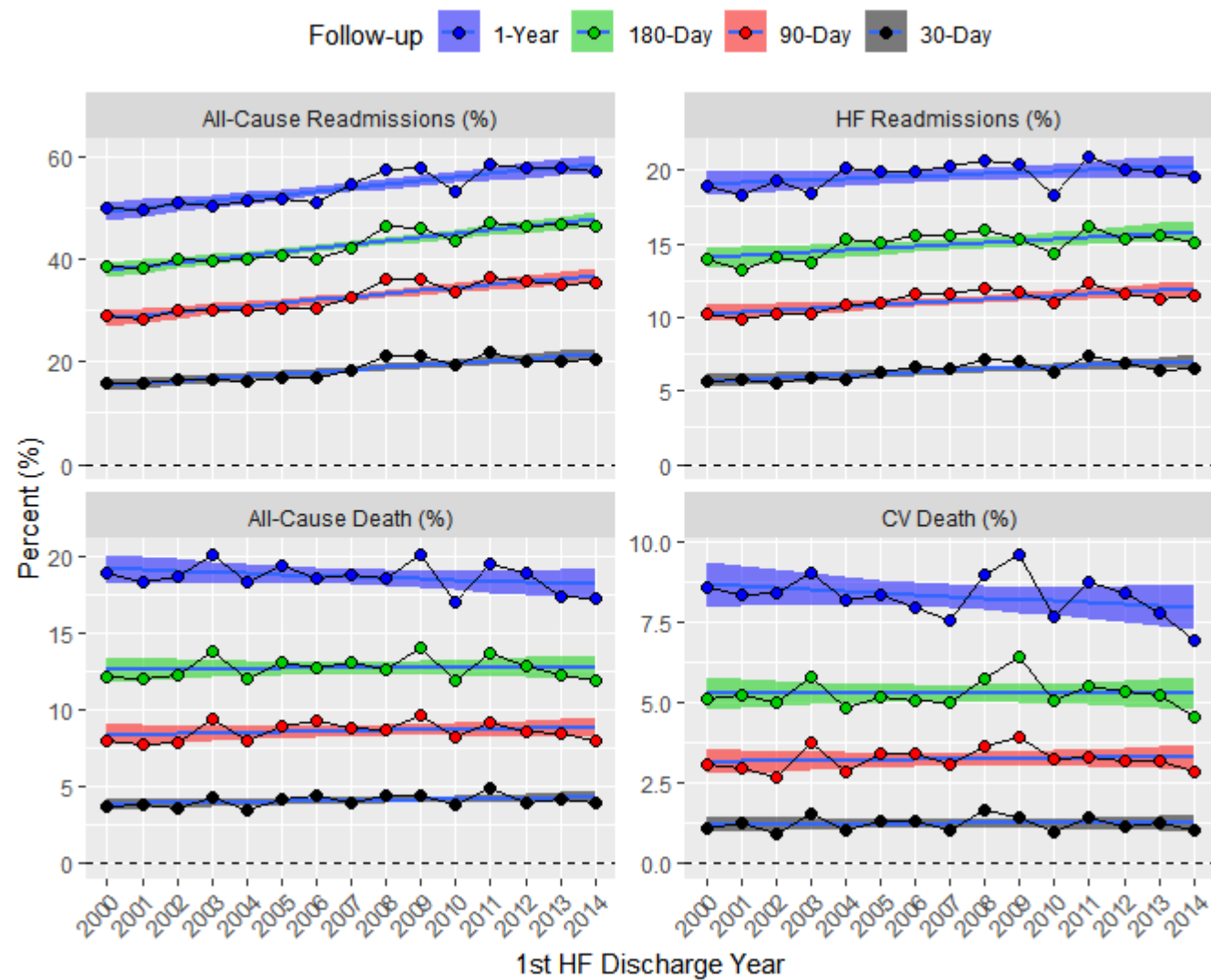
HF Discharge Year	30-Day	90-Day	180-Day	1-Year
2000	1.11	3.07	5.13	8.58
2001	1.29	2.98	5.24	8.36
2002	0.92	2.68	5.03	8.39
2003	1.57	3.75	5.82	9.02
2004	1.07	2.83	4.86	8.19
2005	1.32	3.4	5.19	8.35
2006	1.32	3.41	5.08	7.97
2007	1.07	3.07	5	7.55
2008	1.68	3.65	5.74	8.96
2009	1.43	3.94	6.41	9.61
2010	0.96	3.27	5.08	7.68
2011	1.46	3.29	5.5	8.73
2012	1.13	3.22	5.34	8.39
2013	1.29	3.19	5.21	7.75

HF Discharge Year	30-Day	90-Day	180-Day	1-Year
2014	1.02	2.83	4.55	6.93
Sum	1.24	3.23	5.28	8.32

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Code

\$`All-Cause Readmissions (%)`

Call:

```
lm(formula = `1-Year` ~ year, data = tmp)
```

Residuals:

Min	1Q	Median	3Q	Max
-2.9169	-0.9208	-0.1024	0.7018	2.9635

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	49.3051	0.8465	58.244	< 2e-16 ***
year	0.6652	0.1029	6.464	2.12e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.722 on 13 degrees of freedom

Multiple R-squared: 0.7627, Adjusted R-squared: 0.7444

F-statistic: 41.78 on 1 and 13 DF, p-value: 2.12e-05

\$`HF Readmissions (%)`

Call:

```
lm(formula = `1-Year` ~ year, data = tmp)
```

Residuals:

Min	1Q	Median	3Q	Max
-1.61621	-0.46246	0.09236	0.55593	0.88771

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	19.05550	0.37555	50.741	2.48e-16 ***
year	0.08607	0.04565	1.885	0.0819 .

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.7639 on 13 degrees of freedom

Multiple R-squared: 0.2147, Adjusted R-squared: 0.1543

F-statistic: 3.554 on 1 and 13 DF, p-value: 0.08193

\$`All-Cause Death (%)`

Call:

```
lm(formula = `1-Year` ~ year, data = tmp)
```

Residuals:

Min	1Q	Median	3Q	Max
-1.4273	-0.6791	-0.1916	0.6524	1.6391

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	19.24300	0.45678	42.127	2.75e-15 ***
year	-0.07357	0.05553	-1.325	0.208

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.9292 on 13 degrees of freedom

Multiple R-squared: 0.119, Adjusted R-squared: 0.0512

F-statistic: 1.755 on 1 and 13 DF, p-value: 0.208

\$`CV Death (%)`

Call:

```
lm(formula = `1-Year` ~ year, data = tmp)
```

Residuals:

Min	1Q	Median	3Q	Max
-1.0076	-0.3201	-0.1643	0.4334	1.4155

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	8.65708	0.31869	27.165	7.75e-13 ***
year	-0.05139	0.03874	-1.327	0.207

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.6483 on 13 degrees of freedom

Multiple R-squared: 0.1192, Adjusted R-squared: 0.05147
F-statistic: 1.76 on 1 and 13 DF, p-value: 0.2075

Causes for Readmission

Code

Show 20 entries

Search:

30-Day Readmissions by Cause (DX1)

V1	N	Percent
Heart failure	4,262	25.5
Other forms of chronic ischemic heart disease	1,076	6.4
Cardiac dysrhythmias	845	5.1
Symptoms involving respiratory system and other chest symptoms	506	3
Acute kidney failure	483	2.9
Pneumonia, organism unspecified	439	2.6
Acute myocardial infarction	433	2.6
Other diseases of endocardium	386	2.3
General symptoms	369	2.2
Diabetes mellitus	355	2.1
Septicemia	326	1.9
Disorders of fluid, electrolyte, and acid-base balance	290	1.7

V1	N	Percent
Complications peculiar to certain specified procedures	275	1.6
Other disorders of urethra and urinary tract	272	1.6
Chronic bronchitis	264	1.6
Other diseases of lung	248	1.5
Occlusion of cerebral arteries	240	1.4
Hypotension	179	1.1
Hypertensive chronic kidney disease	172	1
Hypertensive heart and chronic kidney disease	171	1

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Search:

90-Day Readmissions by Cause (DX1)

V1	N	Percent
Heart failure	7,495	25.3
Other forms of chronic ischemic heart disease	1,843	6.2
Cardiac dysrhythmias	1,553	5.2
Symptoms involving respiratory system and other chest symptoms	846	2.9
Pneumonia, organism unspecified	791	2.7

V1	N	Percent
Acute myocardial infarction	790	2.7
Acute kidney failure	770	2.6
Diabetes mellitus	669	2.3
General symptoms	632	2.1
Other diseases of endocardium	576	1.9
Septicemia	541	1.8
Chronic bronchitis	493	1.7
Complications peculiar to certain specified procedures	493	1.7
Other disorders of urethra and urinary tract	430	1.5
Other diseases of lung	427	1.4
Disorders of fluid, electrolyte, and acid-base balance	426	1.4
Occlusion of cerebral arteries	393	1.3
Hypertensive heart disease	342	1.2
Hypertensive chronic kidney disease	334	1.1
Other cellulitis and abscess	305	1

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Search:

180-Day Readmissions by Cause (DX1)

V1	N	Percent
Heart failure	9,550	24.5
Other forms of chronic ischemic heart disease	2,295	5.9
Cardiac dysrhythmias	2,037	5.2
Symptoms involving respiratory system and other chest symptoms	1,210	3.1
Acute myocardial infarction	1,054	2.7
Pneumonia, organism unspecified	1,049	2.7
Acute kidney failure	943	2.4
Diabetes mellitus	931	2.4
General symptoms	856	2.2
Septicemia	683	1.8
Chronic bronchitis	664	1.7
Other diseases of endocardium	657	1.7
Complications peculiar to certain specified procedures	655	1.7
Other disorders of urethra and urinary tract	560	1.4
Other diseases of lung	551	1.4
Disorders of fluid, electrolyte, and acid-base balance	544	1.4
Occlusion of cerebral arteries	514	1.3
Hypertensive heart disease	468	1.2

V1	N	Percent
Other cellulitis and abscess	461	1.2
Hypertensive chronic kidney disease	439	1.1

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Search:

1-Year Readmissions by Cause (DX1)

V1	N	Percent
Heart failure	11,617	23.6
Other forms of chronic ischemic heart disease	2,659	5.4
Cardiac dysrhythmias	2,535	5.1
Symptoms involving respiratory system and other chest symptoms	1,565	3.2
Pneumonia, organism unspecified	1,413	2.9
Acute myocardial infarction	1,370	2.8
Diabetes mellitus	1,161	2.4
General symptoms	1,154	2.3
Acute kidney failure	1,133	2.3
Chronic bronchitis	913	1.9
Septicemia	821	1.7

V1	N	Percent
Complications peculiar to certain specified procedures	765	1.6
Other diseases of endocardium	721	1.5
Occlusion of cerebral arteries	690	1.4
Other disorders of urethra and urinary tract	687	1.4
Disorders of fluid, electrolyte, and acid-base balance	681	1.4
Other diseases of lung	674	1.4
Other cellulitis and abscess	649	1.3
Hypertensive heart disease	587	1.2
Hypertensive chronic kidney disease	521	1.1

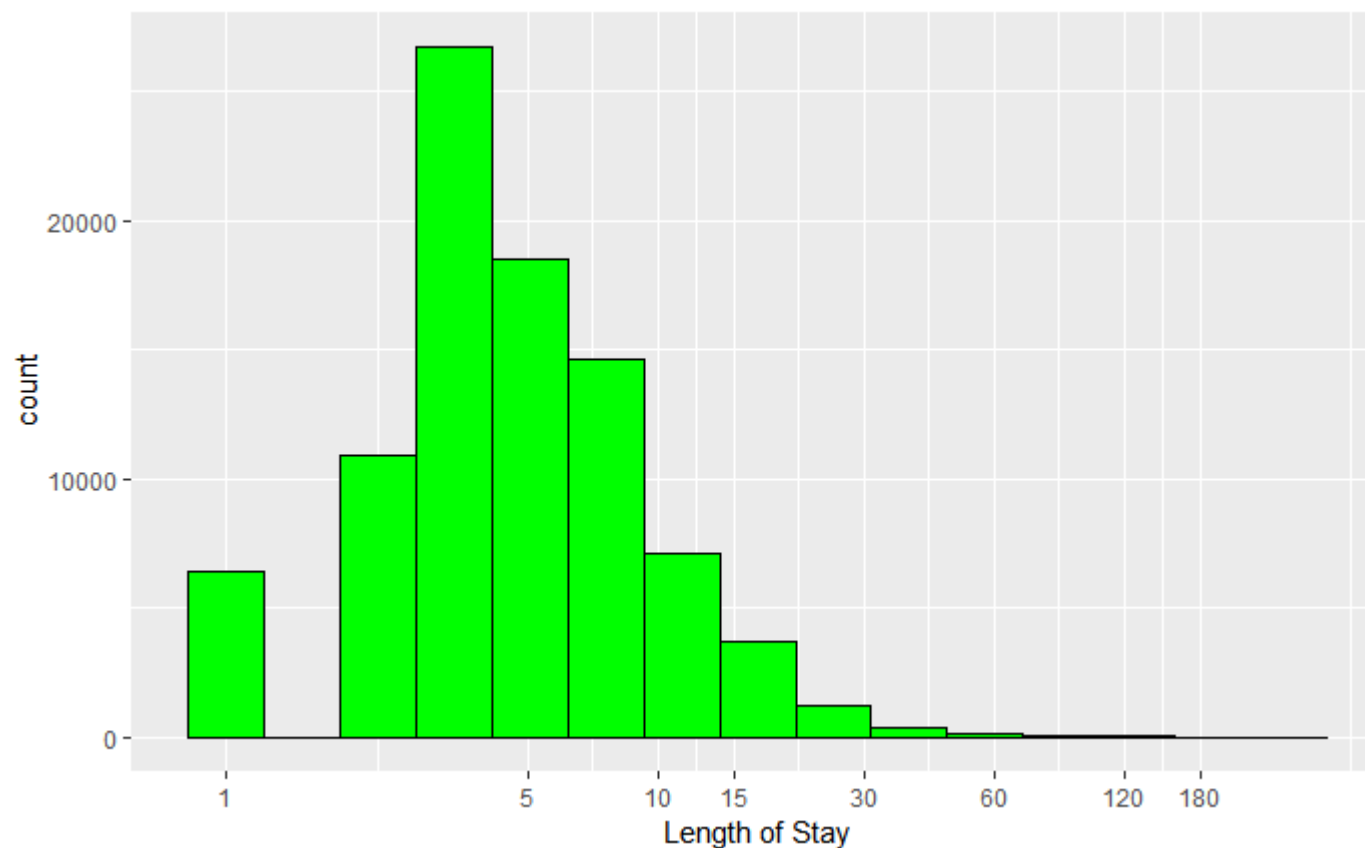
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Length of Stay

Code

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.000	3.000	4.000	5.709	7.000	289.000

Code



NOTE*: 3,433 patients were discharged at the day of admission. This might include transfers to other hospitals but we did not look at transfers.

Part III: Logistic Regression Models

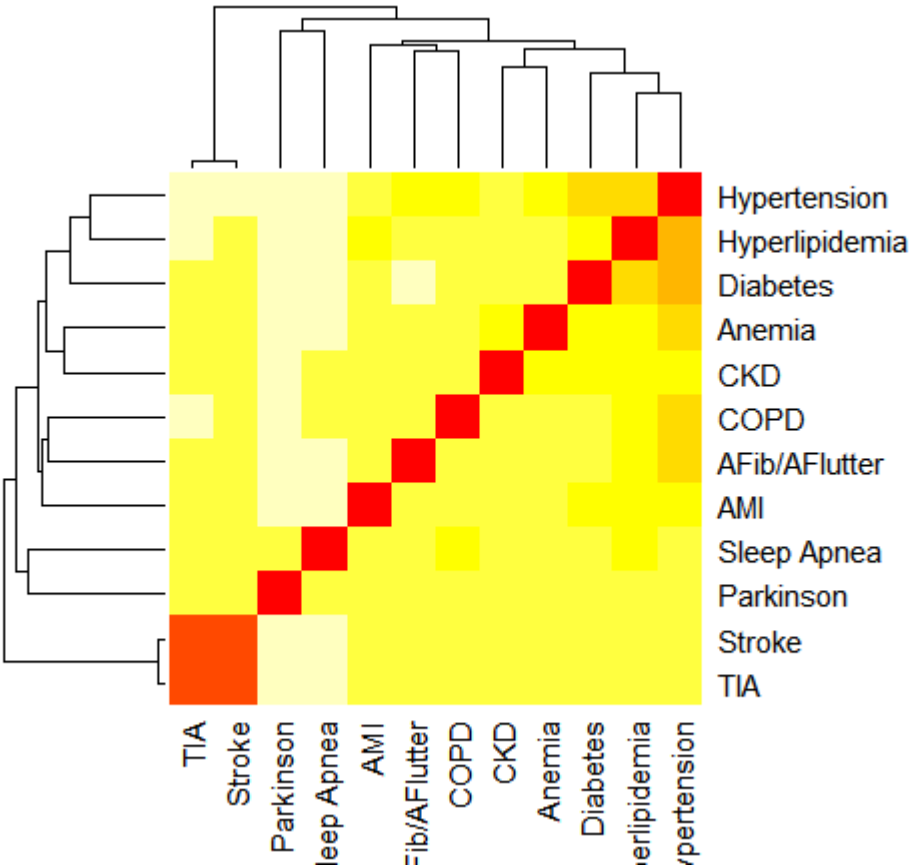
[Code](#)

```
[1] "3,353 patients are from hospitals with no info; REMOVE THEM"
```

[Code](#)

Correlations of binary variables

Code



Stroke and TIA are highly correlated while hypertension is mildly correlated with hyperlipidemia, diabetes, COPD and AFib/AFlutter.

All-Cause Readmissions

Code

Show 27 entries

Search:

Table2A: All-Cause Readmissions

Risk Factor	30-Day	90-Day	180-Day	1-Year
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Risk Factor	30-Day	90-Day	180-Day	1-Year
Discharge year	1.023 (1.019, 1.028) <0.001	1.02 (1.017, 1.024) <0.001	1.019 (1.016, 1.022) <0.001	1.013 (1.01, 1.017) <0.001
Age (per 10 Years)	0.997 (0.983, 1.012) 0.709	0.99 (0.978, 1.002) 0.098	0.975 (0.964, 0.987) <0.001	0.97 (0.959, 0.982) <0.001
Sex (Male)	0.991 (0.956, 1.027) 0.614	0.995 (0.966, 1.025) 0.748	0.994 (0.967, 1.023) 0.688	0.979 (0.952, 1.007) 0.137
Race (Black)	0.972 (0.921, 1.024) 0.285	1.052 (1.007, 1.099) 0.023	1.118 (1.072, 1.165) <0.001	1.152 (1.105, 1.201) <0.001
Race (Other)	0.969 (0.914, 1.028) 0.297	0.919 (0.874, 0.965) <0.001	0.932 (0.889, 0.976) 0.003	0.927 (0.885, 0.971) 0.001
Non-Hispanic vs. Hispanic	0.934 (0.875, 0.997) 0.042	0.834 (0.79, 0.881) <0.001	0.842 (0.799, 0.887) <0.001	0.844 (0.801, 0.89) <0.001
Unknown vs. Hispanic	0.868 (0.797, 0.945) 0.001	0.794 (0.741, 0.852) <0.001	0.8 (0.749, 0.855) <0.001	0.806 (0.754, 0.861) <0.001
Commercial Insurance vs. Medicare	0.883 (0.844, 0.924) <0.001	0.873 (0.84, 0.906) <0.001	0.857 (0.827, 0.888) <0.001	0.853 (0.824, 0.884) <0.001
Medicaid/Self-Pay/Other vs. Medicare	1.001 (0.928, 1.079) 0.986	0.96 (0.901, 1.022) 0.197	0.931 (0.877, 0.988) 0.018	0.933 (0.879, 0.989) 0.02
Length of Stay	1.019 (1.016, 1.021) <0.001	1.019 (1.016, 1.021) <0.001	1.014 (1.012, 1.017) <0.001	1.007 (1.005, 1.01) <0.001
AFib/AFflutter	1.014 (0.968, 1.061) 0.562	1.042 (1.003, 1.083) 0.034	1.058 (1.02, 1.098) 0.003	1.089 (1.049, 1.131) <0.001
AMI	1.094 (1.031, 1.162) 0.003	1.075 (1.021, 1.131) 0.006	1.049 (0.998, 1.102) 0.061	1.034 (0.982, 1.088) 0.202

Risk Factor	30-Day	90-Day	180-Day	1-Year
Anemia	1.176 (1.121, 1.234) <0.001	1.203 (1.155, 1.253) <0.001	1.209 (1.162, 1.258) <0.001	1.204 (1.156, 1.255) <0.001
CKD	1.293 (1.205, 1.386) <0.001	1.306 (1.227, 1.389) <0.001	1.32 (1.241, 1.405) <0.001	1.336 (1.25, 1.427) <0.001
COPD	1.157 (1.104, 1.212) <0.001	1.184 (1.138, 1.231) <0.001	1.229 (1.183, 1.277) <0.001	1.291 (1.241, 1.344) <0.001
Diabetes	1.169 (1.12, 1.221) <0.001	1.206 (1.163, 1.251) <0.001	1.251 (1.208, 1.295) <0.001	1.299 (1.253, 1.347) <0.001
Hypertension	1.154 (1.104, 1.207) <0.001	1.213 (1.169, 1.259) <0.001	1.321 (1.276, 1.368) <0.001	1.444 (1.395, 1.495) <0.001
Hyperlipidemia	1.011 (0.967, 1.057) 0.622	1.065 (1.026, 1.106) <0.001	1.082 (1.043, 1.122) <0.001	1.128 (1.088, 1.171) <0.001
Sleep Apnea	0.904 (0.777, 1.053) 0.194	0.907 (0.797, 1.032) 0.138	0.969 (0.855, 1.099) 0.626	1.04 (0.911, 1.187) 0.565
Parkinson	1.187 (1.024, 1.376) 0.023	1.17 (1.029, 1.329) 0.016	1.09 (0.962, 1.236) 0.176	1.173 (1.03, 1.335) 0.016
Stroke	1.261 (0.983, 1.617) 0.068	1.204 (0.966, 1.5) 0.098	1.162 (0.935, 1.444) 0.177	1.237 (0.983, 1.558) 0.07
TIA	0.851 (0.657, 1.104) 0.225	0.907 (0.722, 1.141) 0.405	0.952 (0.759, 1.193) 0.667	0.895 (0.705, 1.138) 0.366
Hosp No Cath Lab vs. Cath Lab	0.992 (0.947, 1.038) 0.719	1.005 (0.967, 1.044) 0.809	1.001 (0.966, 1.039) 0.94	1.02 (0.984, 1.058) 0.279
Hosp Inner City Area vs. Urban	1.08 (1.024, 1.139) 0.005	1.059 (1.012, 1.107) 0.012	1.061 (1.017, 1.108) 0.006	1.053 (1.009, 1.099) 0.019

Risk Factor	30-Day	90-Day	180-Day	1-Year
Hosp Rural Area vs. Urban	0.854 (0.801, 0.91) <0.001	0.863 (0.819, 0.909) <0.001	0.849 (0.808, 0.891) <0.001	0.835 (0.796, 0.877) <0.001
Hosp Suburb Area vs. Urban	1.024 (0.98, 1.07) 0.29	1.031 (0.995, 1.069) 0.096	1.017 (0.983, 1.053) 0.331	0.999 (0.965, 1.034) 0.949
Hosp Non-Teaching vs. Teaching	1.069 (1.02, 1.119) 0.005	1.068 (1.028, 1.11) <0.001	1.087 (1.048, 1.127) <0.001	1.095 (1.056, 1.136) <0.001

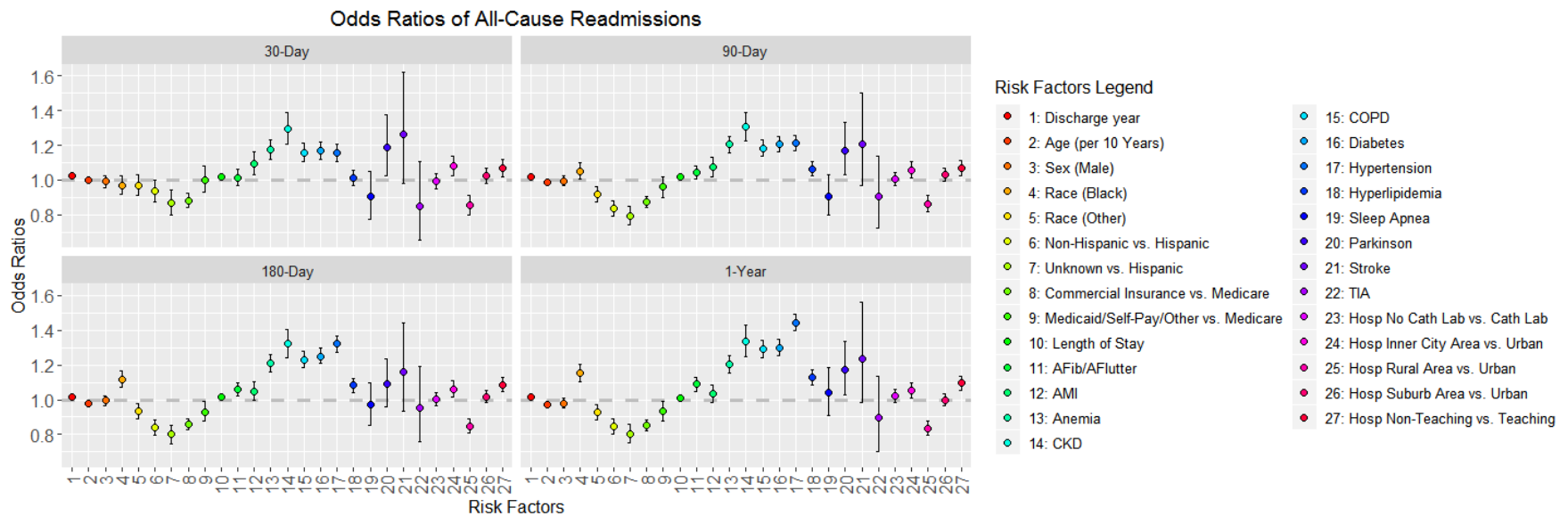
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HF Cause Readmissions

Show

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entries

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Search:

Table2B: All-Cause Readmissions

Risk Factor	30-Day	90-Day	180-Day	1-Year
Discharge year	1.016 (1.009, 1.022) <0.001	1.01 (1.005, 1.015) <0.001	1.008 (1.003, 1.012) 0.001	1.001 (0.997, 1.005) 0.776
Age (per 10 Years)	0.937 (0.916, 0.958) <0.001	0.979 (0.962, 0.997) 0.019	0.989 (0.974, 1.005) 0.171	0.993 (0.979, 1.008) 0.361
Sex (Male)	1.116 (1.055, 1.18) <0.001	1.085 (1.039, 1.134) <0.001	1.079 (1.038, 1.121) <0.001	1.08 (1.043, 1.118) <0.001
Race (Black)	1.079 (0.995, 1.171) 0.067	1.178 (1.106, 1.254) <0.001	1.258 (1.191, 1.329) <0.001	1.316 (1.253, 1.383) <0.001
Race (Other)	0.94 (0.856, 1.033) 0.201	0.925 (0.86, 0.996) 0.039	0.925 (0.866, 0.987) 0.018	0.974 (0.919, 1.032) 0.371
Non-Hispanic vs. Hispanic	0.822 (0.745, 0.907) <0.001	0.78 (0.723, 0.842) <0.001	0.781 (0.73, 0.836) <0.001	0.791 (0.744, 0.841) <0.001
Unknown vs. Hispanic	0.726 (0.636, 0.829) <0.001	0.718 (0.649, 0.795) <0.001	0.732 (0.669, 0.8) <0.001	0.73 (0.673, 0.792) <0.001
Commercial Insurance vs. Medicare	0.923 (0.859, 0.991) 0.028	0.907 (0.858, 0.96) <0.001	0.893 (0.85, 0.938) <0.001	0.883 (0.845, 0.923) <0.001
Medicaid/Self-Pay/Other vs. Medicare	1.162 (1.041, 1.297) 0.007	1.234 (1.132, 1.345) <0.001	1.177 (1.09, 1.272) <0.001	1.159 (1.081, 1.244) <0.001
Length of Stay	1.007 (1.003, 1.011) 0.001	1.006 (1.002, 1.009) <0.001	1.005 (1.002, 1.008) 0.002	1.002 (0.999, 1.005) 0.11
AFib/AFlutter	0.969 (0.897, 1.046) 0.418	1.043 (0.985, 1.105) 0.148	1.067 (1.014, 1.122) 0.012	1.057 (1.011, 1.106) 0.015

Risk Factor	30-Day	90-Day	180-Day	1-Year
AMI	1.182 (1.074, 1.302) <0.001	1.172 (1.089, 1.262) <0.001	1.129 (1.058, 1.206) <0.001	1.124 (1.06, 1.192) <0.001
Anemia	1.054 (0.973, 1.143) 0.196	1.04 (0.978, 1.106) 0.207	1.029 (0.975, 1.085) 0.305	1.031 (0.983, 1.082) 0.211
CKD	1.078 (0.957, 1.214) 0.215	1.071 (0.977, 1.173) 0.142	1.054 (0.973, 1.143) 0.199	1.054 (0.981, 1.134) 0.153
COPD	1.038 (0.961, 1.121) 0.346	1.054 (0.993, 1.117) 0.082	1.068 (1.014, 1.125) 0.012	1.095 (1.045, 1.146) <0.001
Diabetes	1.111 (1.035, 1.192) 0.003	1.148 (1.088, 1.211) <0.001	1.173 (1.119, 1.23) <0.001	1.22 (1.169, 1.272) <0.001
Hypertension	0.981 (0.914, 1.053) 0.599	1.031 (0.976, 1.089) 0.277	1.069 (1.018, 1.122) 0.007	1.118 (1.07, 1.167) <0.001
Hyperlipidemia	0.938 (0.871, 1.01) 0.091	1.015 (0.96, 1.074) 0.596	1.031 (0.982, 1.083) 0.22	1.054 (1.009, 1.102) 0.018
Sleep Apnea	0.753 (0.576, 0.985) 0.039	0.793 (0.648, 0.971) 0.025	0.814 (0.683, 0.971) 0.022	0.831 (0.711, 0.971) 0.02
Parkinson	0.713 (0.528, 0.964) 0.028	0.833 (0.675, 1.028) 0.088	0.86 (0.718, 1.031) 0.103	0.892 (0.761, 1.046) 0.159
Stroke	1.839 (1.302, 2.595) <0.001	1.366 (1.014, 1.84) 0.04	1.312 (1.004, 1.716) 0.047	1.437 (1.131, 1.824) 0.003
TIA	0.49 (0.339, 0.709) <0.001	0.681 (0.498, 0.932) 0.016	0.721 (0.544, 0.955) 0.022	0.7 (0.545, 0.899) 0.005
Hosp No Cath Lab vs. Cath Lab	1.236 (1.148, 1.33) <0.001	1.139 (1.075, 1.205) <0.001	1.103 (1.049, 1.16) <0.001	1.064 (1.017, 1.113) 0.007

Risk Factor	30-Day	90-Day	180-Day	1-Year
Hosp Inner City Area vs. Urban	1.04 (0.953, 1.133) 0.38	1.046 (0.979, 1.117) 0.185	1.111 (1.048, 1.177) <0.001	1.09 (1.035, 1.148) 0.001
Hosp Rural Area vs. Urban	0.971 (0.88, 1.071) 0.559	0.943 (0.874, 1.018) 0.133	0.915 (0.855, 0.979) 0.01	0.904 (0.851, 0.961) 0.001
Hosp Suburb Area vs. Urban	1.115 (1.04, 1.196) 0.002	1.047 (0.992, 1.105) 0.099	1.055 (1.006, 1.107) 0.027	1.038 (0.994, 1.083) 0.09
Hosp Non-Teaching vs. Teaching	1.053 (0.978, 1.133) 0.169	1.065 (1.006, 1.128) 0.03	1.088 (1.034, 1.144) 0.001	1.101 (1.052, 1.152) <0.001

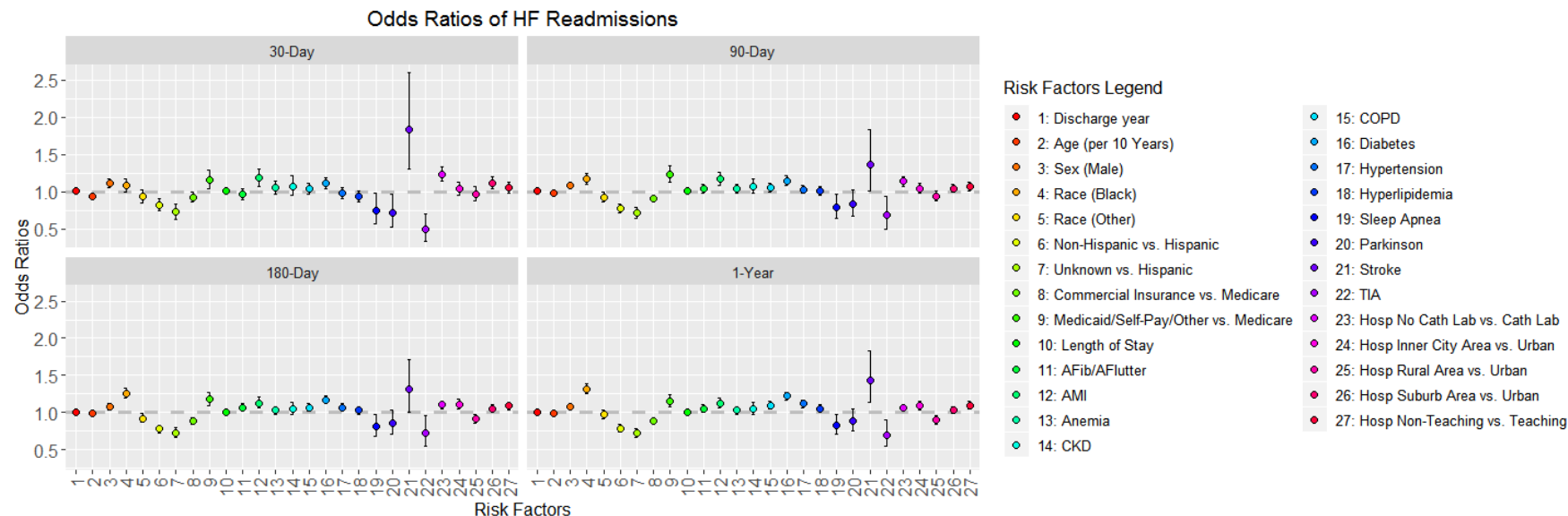
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All-Cause Death

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Table2C: All-Cause Death

Risk Factor	30-Day	90-Day	180-Day	1-Year
Discharge year	1.014 (1.005, 1.022) 0.001	1.011 (1.005, 1.017) <0.001	1.005 (1, 1.01) 0.047	0.997 (0.993, 1.001) 0.183
Age (per 10 Years)	1.68 (1.622, 1.741) <0.001	1.644 (1.604, 1.686) <0.001	1.624 (1.591, 1.658) <0.001	1.605 (1.577, 1.634) <0.001
Sex (Male)	1.162 (1.083, 1.247) <0.001	1.151 (1.094, 1.21) <0.001	1.162 (1.114, 1.213) <0.001	1.163 (1.121, 1.206) <0.001
Race (Black)	0.711 (0.621, 0.813) <0.001	0.771 (0.704, 0.844) <0.001	0.801 (0.744, 0.863) <0.001	0.854 (0.803, 0.908) <0.001
Race (Other)	0.769 (0.671, 0.882) <0.001	0.797 (0.725, 0.876) <0.001	0.786 (0.726, 0.851) <0.001	0.805 (0.753, 0.861) <0.001
Non-Hispanic vs. Hispanic	1.396 (1.18, 1.652) <0.001	1.362 (1.214, 1.528) <0.001	1.412 (1.283, 1.554) <0.001	1.445 (1.333, 1.566) <0.001
Unknown vs. Hispanic	1.387 (1.137, 1.691) 0.001	1.37 (1.195, 1.571) <0.001	1.387 (1.236, 1.556) <0.001	1.391 (1.262, 1.533) <0.001
Commercial Insurance vs. Medicare	0.843 (0.762, 0.932) <0.001	0.84 (0.783, 0.902) <0.001	0.839 (0.791, 0.89) <0.001	0.812 (0.773, 0.854) <0.001
Medicaid/Self-Pay/Other vs. Medicare	0.858 (0.682, 1.079) 0.19	0.801 (0.684, 0.938) 0.006	0.865 (0.763, 0.98) 0.023	0.894 (0.808, 0.989) 0.03
Length of Stay	1.048 (1.043, 1.052) <0.001	1.058 (1.054, 1.062) <0.001	1.057 (1.054, 1.061) <0.001	1.054 (1.051, 1.057) <0.001

Risk Factor	30-Day	90-Day	180-Day	1-Year
AFib/AFlutter	1.106 (1.018, 1.201) 0.017	1.072 (1.01, 1.138) 0.023	1.075 (1.022, 1.131) 0.005	1.053 (1.007, 1.101) 0.024
AMI	1.184 (1.052, 1.332) 0.005	1.227 (1.129, 1.335) <0.001	1.206 (1.123, 1.295) <0.001	1.223 (1.149, 1.301) <0.001
Anemia	1.197 (1.093, 1.31) <0.001	1.178 (1.103, 1.257) <0.001	1.29 (1.221, 1.364) <0.001	1.322 (1.259, 1.387) <0.001
CKD	1.325 (1.157, 1.519) <0.001	1.366 (1.238, 1.507) <0.001	1.363 (1.253, 1.483) <0.001	1.404 (1.304, 1.512) <0.001
COPD	1.196 (1.093, 1.309) <0.001	1.215 (1.14, 1.296) <0.001	1.236 (1.17, 1.305) <0.001	1.297 (1.237, 1.36) <0.001
Diabetes	0.984 (0.9, 1.075) 0.716	1.006 (0.945, 1.071) 0.852	1.031 (0.978, 1.087) 0.254	1.054 (1.007, 1.103) 0.023
Hypertension	1.024 (0.94, 1.115) 0.587	1.094 (1.029, 1.163) 0.004	1.108 (1.051, 1.167) <0.001	1.161 (1.109, 1.215) <0.001
Hyperlipidemia	0.742 (0.678, 0.813) <0.001	0.743 (0.697, 0.792) <0.001	0.769 (0.728, 0.811) <0.001	0.77 (0.735, 0.807) <0.001
Sleep Apnea	1.032 (0.712, 1.496) 0.866	0.953 (0.73, 1.244) 0.723	0.944 (0.757, 1.178) 0.61	0.908 (0.753, 1.097) 0.318
Parkinson	1.334 (1.051, 1.693) 0.018	1.499 (1.266, 1.776) <0.001	1.384 (1.19, 1.61) <0.001	1.373 (1.198, 1.573) <0.001
Stroke	1.255 (0.793, 1.988) 0.332	1.56 (1.146, 2.122) 0.005	1.647 (1.266, 2.144) <0.001	1.522 (1.197, 1.935) <0.001
TIA	1.057 (0.656, 1.703) 0.819	0.835 (0.606, 1.152) 0.273	0.779 (0.591, 1.026) 0.076	0.857 (0.667, 1.101) 0.227

Risk Factor	30-Day	90-Day	180-Day	1-Year
Hosp No Cath Lab vs. Cath Lab	1.138 (1.043, 1.24) 0.004	1.082 (1.017, 1.152) 0.013	1.071 (1.015, 1.129) 0.012	1.075 (1.026, 1.126) 0.002
Hosp Inner City Area vs. Urban	0.96 (0.85, 1.086) 0.519	0.98 (0.901, 1.066) 0.642	1.014 (0.946, 1.088) 0.691	1.001 (0.943, 1.062) 0.98
Hosp Rural Area vs. Urban	1.067 (0.945, 1.205) 0.292	0.986 (0.904, 1.075) 0.746	0.979 (0.909, 1.054) 0.575	0.955 (0.896, 1.018) 0.158
Hosp Suburb Area vs. Urban	1.147 (1.053, 1.25) 0.002	1.072 (1.009, 1.14) 0.024	1.063 (1.009, 1.119) 0.022	1.05 (1.004, 1.098) 0.031
Hosp Non-Teaching vs. Teaching	0.965 (0.885, 1.051) 0.414	1.02 (0.958, 1.085) 0.538	1.016 (0.963, 1.071) 0.566	1.024 (0.977, 1.072) 0.321

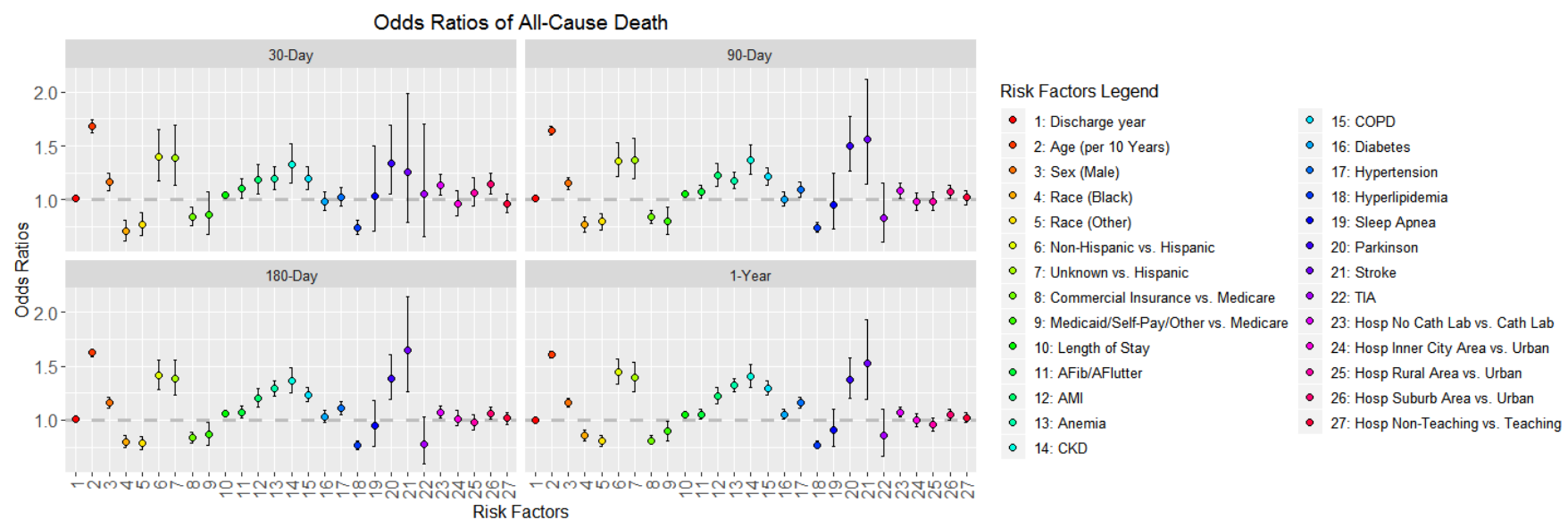
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CV Death

Code

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Search:

Table2D: CV Death

Risk Factor	30-Day	90-Day	180-Day	1-Year
Discharge year	1.008 (0.993, 1.023) 0.296	1.009 (0.999, 1.018) 0.067	1 (0.993, 1.008) 0.942	0.992 (0.986, 0.998) 0.01
Age (per 10 Years)	1.414 (1.332, 1.501) <0.001	1.518 (1.462, 1.577) <0.001	1.539 (1.493, 1.586) <0.001	1.529 (1.492, 1.566) <0.001
Sex (Male)	1.2 (1.061, 1.359) 0.004	1.13 (1.045, 1.222) 0.002	1.155 (1.086, 1.229) <0.001	1.17 (1.112, 1.23) <0.001
Race (Black)	0.642 (0.503, 0.819) <0.001	0.835 (0.726, 0.961) 0.012	0.813 (0.728, 0.907) <0.001	0.884 (0.81, 0.964) 0.005
Race (Other)	0.772 (0.608, 0.982) 0.035	0.872 (0.754, 1.008) 0.064	0.844 (0.752, 0.948) 0.004	0.896 (0.817, 0.982) 0.019
Non-Hispanic vs. Hispanic	1.6 (1.174, 2.181) 0.003	1.495 (1.239, 1.803) <0.001	1.528 (1.319, 1.771) <0.001	1.461 (1.301, 1.64) <0.001
Unknown vs. Hispanic	1.671 (1.168, 2.389) 0.005	1.569 (1.261, 1.951) <0.001	1.517 (1.276, 1.803) <0.001	1.408 (1.227, 1.616) <0.001
Commercial Insurance vs. Medicare	0.744 (0.622, 0.891) 0.001	0.8 (0.716, 0.895) <0.001	0.834 (0.764, 0.91) <0.001	0.814 (0.758, 0.873) <0.001
Medicaid/Self-Pay/Other vs. Medicare	0.742 (0.503, 1.095) 0.133	0.795 (0.625, 1.013) 0.063	0.885 (0.735, 1.064) 0.193	0.856 (0.739, 0.992) 0.038

Risk Factor	30-Day	90-Day	180-Day	1-Year
Length of Stay	1.03 (1.025, 1.035) <0.001	1.035 (1.031, 1.039) <0.001	1.032 (1.028, 1.036) <0.001	1.029 (1.026, 1.033) <0.001
AFib/AFlutter	1.018 (0.876, 1.183) 0.816	1.132 (1.032, 1.241) 0.008	1.103 (1.025, 1.187) 0.009	1.071 (1.009, 1.138) 0.024
AMI	1.283 (1.049, 1.57) 0.015	1.358 (1.199, 1.538) <0.001	1.311 (1.187, 1.448) <0.001	1.324 (1.221, 1.436) <0.001
Anemia	1.157 (0.982, 1.362) 0.08	1.053 (0.95, 1.167) 0.327	1.154 (1.065, 1.251) <0.001	1.163 (1.089, 1.242) <0.001
CKD	0.973 (0.745, 1.27) 0.838	1.052 (0.895, 1.238) 0.539	1.14 (1.006, 1.292) 0.041	1.109 (1, 1.23) 0.051
COPD	1.057 (0.896, 1.245) 0.512	1.118 (1.01, 1.237) 0.031	1.089 (1.005, 1.18) 0.038	1.14 (1.068, 1.217) <0.001
Diabetes	0.939 (0.801, 1.101) 0.438	0.97 (0.879, 1.07) 0.542	0.981 (0.908, 1.06) 0.629	0.971 (0.912, 1.034) 0.363
Hypertension	1.048 (0.9, 1.22) 0.544	1.087 (0.988, 1.196) 0.088	1.159 (1.074, 1.251) <0.001	1.167 (1.097, 1.242) <0.001
Hyperlipidemia	0.861 (0.734, 1.01) 0.065	0.857 (0.776, 0.947) 0.002	0.858 (0.794, 0.928) <0.001	0.904 (0.849, 0.963) 0.002
Sleep Apnea	0.975 (0.499, 1.904) 0.94	0.806 (0.513, 1.267) 0.351	0.697 (0.478, 1.016) 0.061	0.8 (0.602, 1.063) 0.124
Parkinson	0.568 (0.303, 1.064) 0.077	0.983 (0.726, 1.332) 0.914	0.952 (0.747, 1.213) 0.693	0.957 (0.786, 1.166) 0.663
Stroke	2.102 (1.112, 3.975) 0.022	1.929 (1.265, 2.942) 0.002	1.916 (1.363, 2.693) <0.001	1.751 (1.306, 2.349) <0.001

Risk Factor	30-Day	90-Day	180-Day	1-Year
TIA	0.596 (0.302, 1.174) 0.135	0.62 (0.396, 0.969) 0.036	0.643 (0.449, 0.921) 0.016	0.716 (0.526, 0.975) 0.034
Hosp No Cath Lab vs. Cath Lab	1.061 (0.91, 1.237) 0.453	0.988 (0.896, 1.088) 0.805	1.005 (0.931, 1.086) 0.891	1.014 (0.952, 1.08) 0.674
Hosp Inner City Area vs. Urban	0.885 (0.714, 1.098) 0.268	1.013 (0.89, 1.153) 0.85	1.069 (0.966, 1.183) 0.199	1.013 (0.933, 1.1) 0.759
Hosp Rural Area vs. Urban	0.759 (0.608, 0.948) 0.015	0.802 (0.697, 0.924) 0.002	0.84 (0.751, 0.938) 0.002	0.88 (0.806, 0.961) 0.005
Hosp Suburb Area vs. Urban	1.014 (0.875, 1.176) 0.851	1.029 (0.937, 1.131) 0.551	1.036 (0.961, 1.117) 0.354	1.015 (0.955, 1.079) 0.632
Hosp Non-Teaching vs. Teaching	1.169 (1.002, 1.363) 0.047	1.157 (1.049, 1.275) 0.003	1.11 (1.027, 1.199) 0.008	1.118 (1.05, 1.192) <0.001

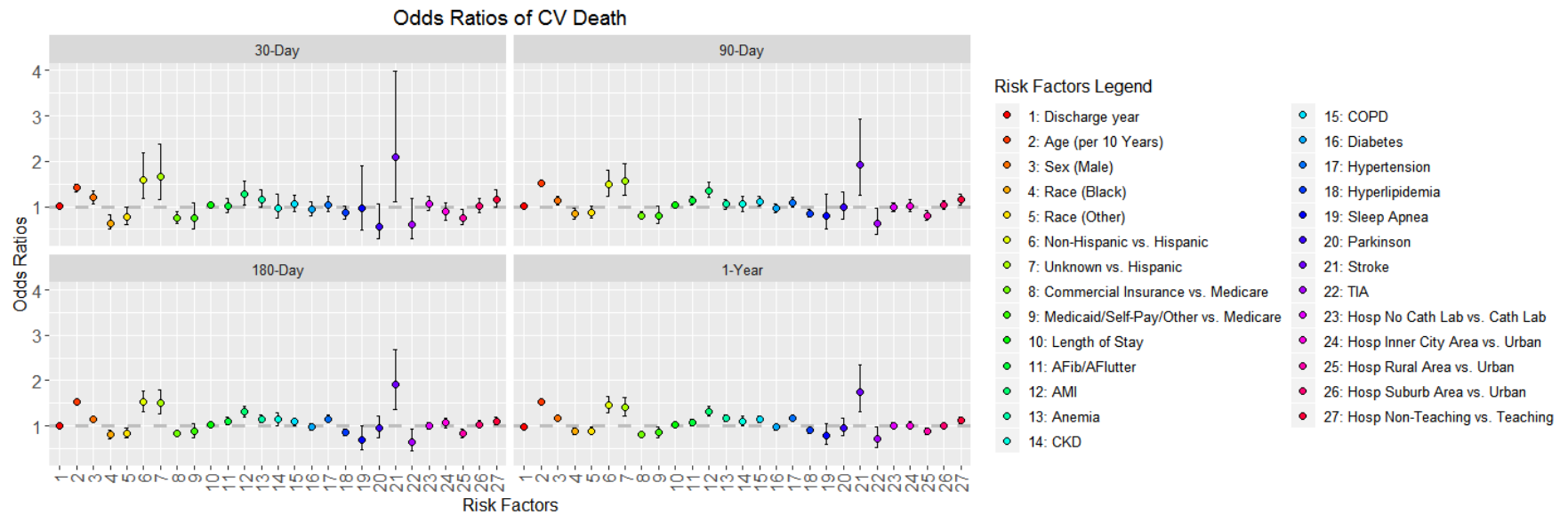
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Code



Association of 1-Year Readmission with 2-Year All-Cause Mortality

Reasons for readmission

The top 21 reasons for admission were grouped into the following categories:

Code

Show 21 entries

Search:

Table: grouping of reasons for redmission

major	group
Cardiac dysrhythmias	Arrhythmia
Occlusion of cerebral arteries	Cerebrovascular

major	group
Diabetes mellitus	Diabetes mellitus
General symptoms	General symptoms
Heart failure	Heart failure
Other forms of chronic ischemic heart disease	Heart Disease
Acute myocardial infarction	Heart Disease
Other diseases of endocardium	Heart Disease
Hypertensive heart disease	Hypertension
Hypertensive heart and chronic kidney disease	Hypertension
Septicemia	Infections
Other cellulitis and abscess	Infections
Acute kidney failure	Kidney Disease
Other disorders of urethra and urinary tract	Kidney Disease
Disorders of fluid, electrolyte, and acid-base balance	Kidney Disease
Hypertensive chronic kidney disease	Kidney Disease
Complications peculiar to certain specified procedures	Procedures
Symptoms involving respiratory system and other chest symptoms	Respiratory
Pneumonia, organism unspecified	Respiratory
Chronic bronchitis	Respiratory

major

group

Other diseases of lung

Respiratory

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2-year all-cause mortality vs. 1-year readmission, unadjusted logistic model

Code

Show 10 ▾ entries

Search:

	names	coef	lb	ub	pval	sign
1	Readmitted within 1 year	1.539	1.494	1.585	<0.001	**

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Risk of death within 2 years from initial HF discharge was significantly higher in patients who were readmitted for any cause within 1 year from the said discharge (OR = 1.54, 95% C.I. = 1.49 to 1.59, p-value < 0.001).

2-year all-cause death vs. 1-year readmission, adjusted for all covariates

Code

Show 28 ▾ entries

Search:

Table: 2-year mortality vs. 1-year readmissions, adjusted model

	names	coef	lb	ub	pval	sign
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names	coef	lb	ub	pval	sign
All-Cause Readmitted within 1 Year	1.505	1.456	1.554	<0.001	**
Discharge year	0.983	0.979	0.986	<0.001	**
Age (per 10 Years)	1.612	1.587	1.637	<0.001	**
Sex (Male)	1.18	1.141	1.219	<0.001	**
Race (Black)	0.825	0.782	0.871	<0.001	**
Race (Other)	0.764	0.72	0.811	<0.001	**
Non-Hispanic vs. Hispanic	1.449	1.352	1.553	<0.001	**
Unknown vs. Hispanic	1.424	1.309	1.55	<0.001	**
Commercial Insurance vs. Medicare	0.819	0.784	0.856	<0.001	**
Medicaid/Self-Pay/Other vs. Medicare	0.9	0.826	0.981	0.016	*
Length of Stay	1.048	1.045	1.052	<0.001	**
AFib/AFlutter	1.071	1.029	1.116	<0.001	**
AMI	1.192	1.127	1.262	<0.001	**
Anemia	1.318	1.261	1.377	<0.001	**
CKD	1.486	1.388	1.591	<0.001	**
COPD	1.302	1.247	1.359	<0.001	**
Diabetes	1.071	1.028	1.115	0.001	**
Hypertension	1.2	1.152	1.25	<0.001	**

names	coef	lb	ub	pval	sign
Hyperlipidemia	0.756	0.725	0.788	<0.001	**
Sleep Apnea	0.784	0.662	0.928	0.005	**
Parkinson	1.466	1.288	1.668	<0.001	**
Stroke	1.649	1.315	2.068	<0.001	**
TIA	0.836	0.661	1.059	0.137	
Hosp No Cath Lab vs. Cath Lab	1.114	1.068	1.161	<0.001	**
Hosp Inner City Area vs. Urban	1.032	0.979	1.089	0.236	
Hosp Rural Area vs. Urban	0.956	0.903	1.012	0.12	
Hosp Suburb Area vs. Urban	1.069	1.027	1.113	0.001	**
Hosp Non-Teaching vs. Teaching	1.002	0.961	1.045	0.931	

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The 2-year risk of death remained significantly higher in patients who were readmitted for any cause within 1 year from the said discharge after adjusting for all covariates (OR = 1.50, 95% C.I. = 1.46 to 1.55, p-value < 0.001).

2-year mortality

Code

Show 27 ▼ entries

Search:

Table: number and percent dead in 2 years

Reason	Alive	Alive_Pct	Dead	Dead_Pct	Total
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Reason	Alive	Alive_Pct	Dead	Dead_Pct	Total
Heart failure	7,547	65	4,070	35	11,617
Not Readmitted	33,504	77.5	9,722	22.5	43,226
Heart Disease	3,647	76.8	1,103	23.2	4,750
Respiratory	3,115	68.2	1,450	31.8	4,565
Kidney Disease	1,884	62.3	1,138	37.7	3,022
Arrhythmia	1,972	77.8	563	22.2	2,535
Infections	861	58.6	609	41.4	1,470
Diabetes mellitus	818	70.5	343	29.5	1,161
General symptoms	839	72.7	315	27.3	1,154
Hypertension	739	69.8	320	30.2	1,059
Procedures	571	74.6	194	25.4	765
Cerebrovascular	427	61.9	263	38.1	690
Other Reason	12,160	70.6	5,072	29.4	17,232
Sum	68,084	73	25,162	27	93,246

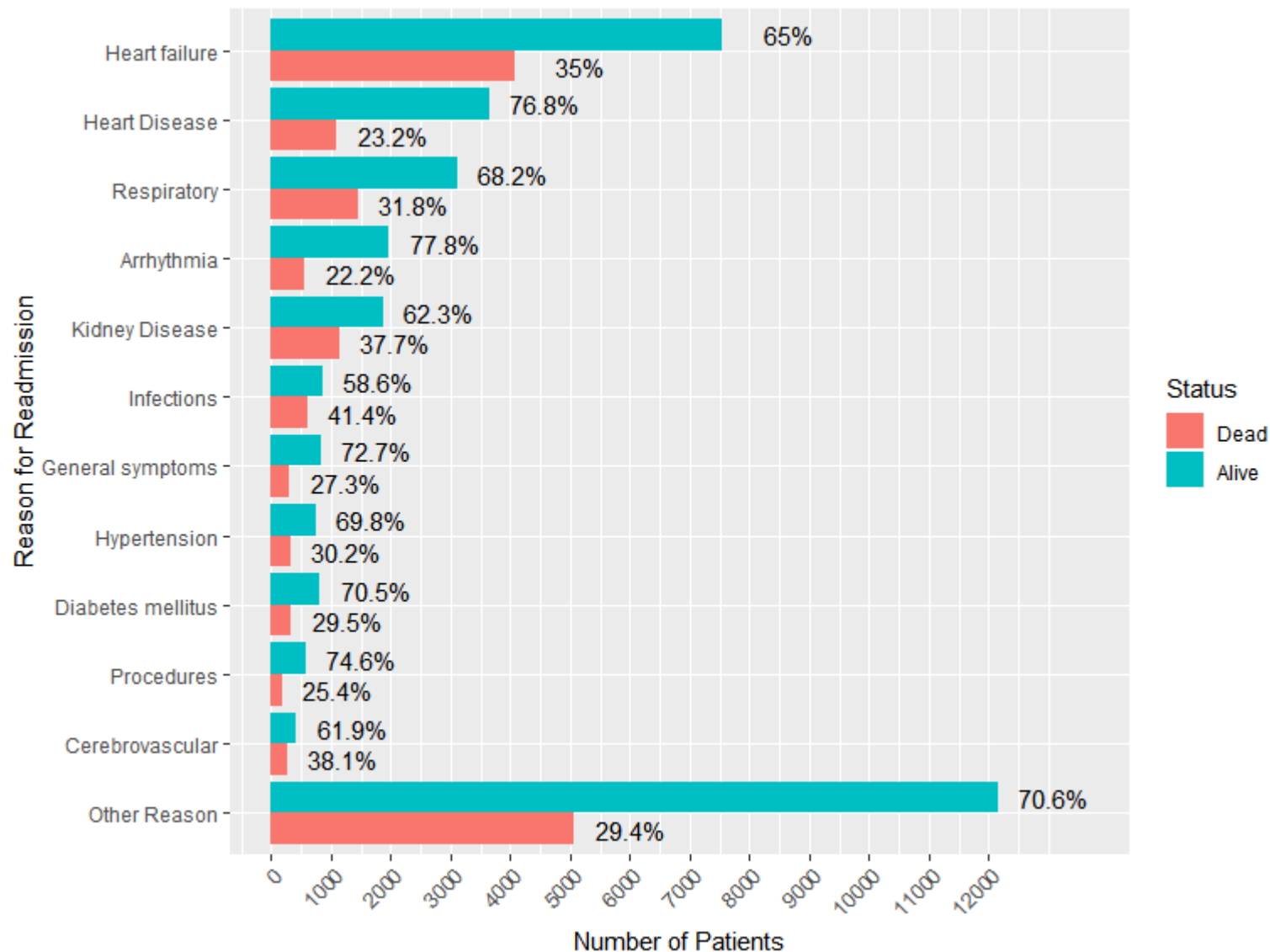
Showing 1 to 14 of 14 entries

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Code



Odds ratios of 2-year all-cause death by reason for readmission

[Code](#)

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Table: 2-year mortality vs. reason for readmission

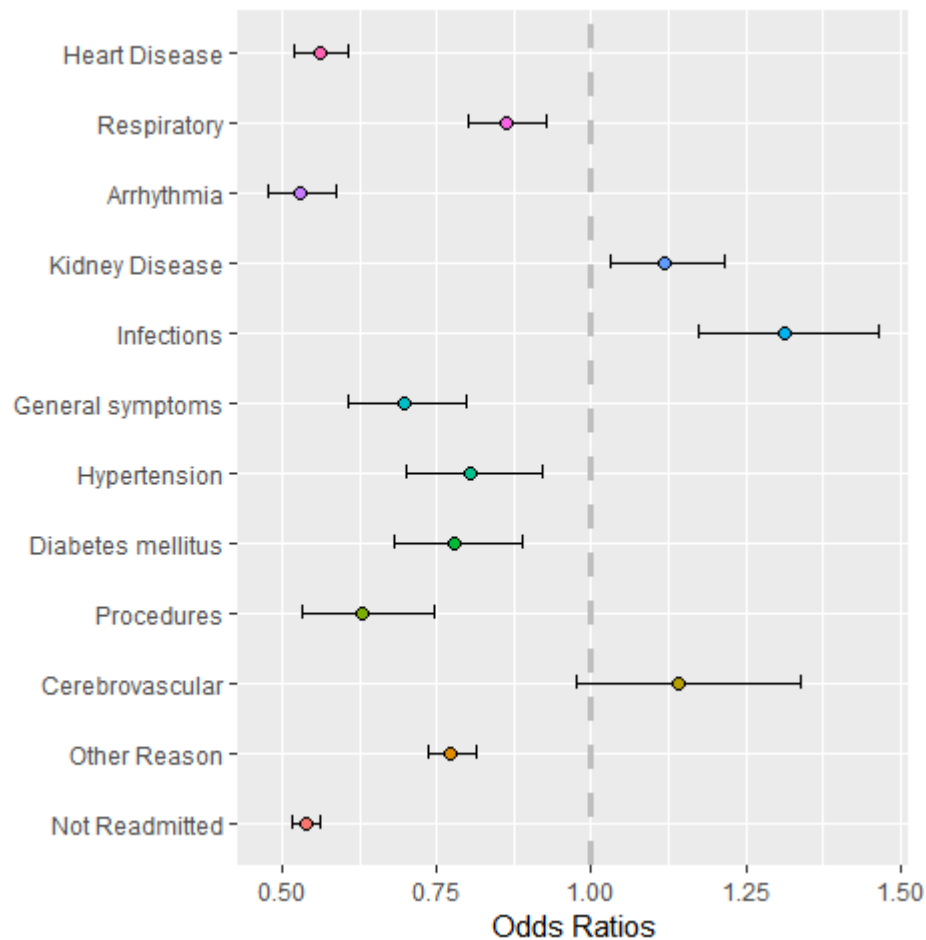
names	coef	lb	ub	pval	sign
Heart Disease	0.561	0.519	0.606	<0.001	**
Respiratory	0.863	0.802	0.929	<0.001	**
Arrhythmia	0.529	0.478	0.586	<0.001	**
Kidney Disease	1.12	1.031	1.217	0.007	**
Infections	1.312	1.174	1.465	<0.001	**
General symptoms	0.696	0.608	0.797	<0.001	**
Hypertension	0.803	0.7	0.92	0.002	**
Diabetes mellitus	0.778	0.682	0.887	<0.001	**
Procedures	0.63	0.533	0.745	<0.001	**
Cerebrovascular	1.142	0.975	1.338	0.1	
Other Reason	0.773	0.736	0.813	<0.001	**
Not Readmitted	0.538	0.515	0.562	<0.001	**

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Compare to risk of 2-year (from the index HF discharge) all-cause mortality after the first HF readmission, not being readmitted or being readmitted for the first time for heart disease, respiratory problems, arrhythmia, diabetes, general symptoms, hypertension, procedures or other reasons decreased the risk. On the other hand, readmission for kidney disease or infections increased the risk.

Appendix

ICD Codes

Diagnoses (ICD-9)

Show 15 entries

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Appendix Table 1: ICD-9 codes for comorbidities

Comorbidity	Variable	ICD9
AFib/AFlutter	af	427.31; 427.32
AMI	ami	410.00; 410.01; 410.02; 410.10; 410.11; 410.12; 410.20; 410.21; 410.22; 410.30; 410.31; 410.32; 410.40; 410.41; 410.42; 410.50; 410.51; 410.52; 410.60; 410.61; 410.62; 410.70; 410.71; 410.72; 410.80; 410.81; 410.82; 410.90; 410.91; 410.92
Anemia	anemia	280.0; 280.1; 280.8; 280.9; 281.0; 281.1; 281.2; 281.3; 281.4; 281.8; 281.9; 285.21; 285.29; 285.8; 285.9
CKD	ckd	585.1; 585.2; 585.3; 585.4; 585.5; 585.6; 585.9
COPD	copd	490; 491.0; 491.1; 491.20; 491.21; 491.22; 491.8; 491.9; 492.0; 492.8; 493.00; 493.01; 493.02; 493.10; 493.11; 493.12; 493.20; 493.21; 493.22; 493.81; 493.82; 493.90; 493.91; 493.92; 494.0; 494.1; 495.0; 495.1; 495.2; 495.3; 495.4; 495.5; 495.6; 495.7; 495.8; 495.9; 496
Cancer	cancer	140.3; 140.4; 140.0; 140.1; 140.9; 140.8; 140.5; 140.6; 141.9; 141.3; 141.0; 141.2; 141.8; 141.4; 141.5; 141.6; 141.1; 142.1; 142.2; 142.8; 142.9; 142.0; 143.0; 143.9; 143.8; 143.1; 144.9; 144.0; 144.8; 144.1; 145.5; 145.1; 145.2; 145.3; 145.0; 145.9; 145.6; 145.8; 145.4; 146.9; 146.5; 146.6; 146.7; 146.4; 146.0; 146.1; 146.2; 146.8; 146.3; 147.9; 147.1; 147.0; 147.8; 147.2; 147.3; 148.0; 148.9; 148.8; 148.1; 148.2; 148.3; 149.0; 149.9; 149.1; 149.8; 150.4; 150.5; 150.8; 150.9; 150.2; 150.3; 150.0; 150.1; 151.0; 151.2; 151.5; 151.3; 151.4; 151.1; 151.6; 151.8; 151.9; 152.1; 152.9; 152.2; 152.3; 152.8; 152.0; 153.5; 153.6; 153.1; 153.0; 153.9; 153.2; 153.7; 153.8; 153.3; 153.4; 154.1; 154.2; 154.8; 154.0; 154.3; 155.0; 155.2; 155.1; 156.2; 156.8; 156.0; 156.1; 156.9; 157.1; 157.0; 157.8; 157.3; 157.9; 157.4; 157.2; 158.9; 158.0; 158.8; 159.1; 159.0; 159.8; 159.9; 160.0; 160.8; 160.2; 160.9; 160.3; 160.1; 160.5; 160.4; 161.0; 161.8; 161.1; 161.9; 161.2; 161.3; 162.2; 162.3; 162.5; 162.0; 162.8; 162.4; 162.9; 163.9; 163.8; 163.0; 163.1; 164.1; 164.9; 164.2; 164.3; 164.8; 164.0; 165.8; 165.9; 165.0; 170.5; 170.9; 170.6; 170.7; 170.8; 170.0; 170.1; 170.2; 170.3; 170.4; 171.7; 171.8; 171.2; 171.0; 171.6; 171.3; 171.9; 171.5; 171.4; 172.3; 172.4; 172.0; 172.1; 172.2; 172.7; 172.5; 172.6; 172.8; 172.9; 173.02; 173.20; 173.12; 173.09; 173.10; 173.11; 173.22; 173.19; 173.51; 173.21; 173.32; 173.39; 173.40; 173.41; 173.42; 173.49; 173.50; 173.80; 173.81; 173.52; 173.29; 173.30; 173.31; 173.00; 173.01; 173.62; 173.69; 173.70; 173.71; 173.72; 173.79; 173.91; 173.82; 173.89; 173.90; 173.59; 173.92; 173.99; 173.60; 173.61; 174.1; 174.8; 174.5; 174.2; 174.3; 174.4; 174.6; 174.9; 174.0; 175.0; 175.9; 176.2; 176.4; 176.5; 176.8; 176.9; 176.3; 176.0; 176.1; 179; 180.9;

Comorbidity	Variable	ICD9
		180.8; 180.0; 180.1; 181; 182.0; 182.1; 182.8; 183.8; 183.9; 183.5; 183.2; 183.3; 183.0; 183.4; 184.1; 184.2; 184.0; 184.9; 184.8; 184.3; 184.4; 185; 186.9; 186.0; 187.1; 187.2; 187.3; 187.4; 187.5; 187.6; 187.7; 187.8; 187.9; 188.3; 188.5; 188.6; 188.7; 188.4; 188.0; 188.9; 188.2; 188.8; 188.1; 189.8; 189.0; 189.4; 189.9; 189.2; 189.3; 189.1; 190.4; 190.2; 190.0; 190.1; 190.7; 190.3; 190.5; 190.6; 190.8; 190.9; 191.2; 191.3; 191.6; 191.7; 191.4; 191.5; 191.0; 191.1; 191.8; 191.9; 192.0; 192.1; 192.9; 192.2; 192.3; 192.8; 193; 194.0; 194.1; 194.3; 194.4; 194.5; 194.6; 194.8; 194.9; 195.8; 195.4; 195.1; 195.3; 195.5; 195.2; 195.0; 196.9; 196.2; 196.3; 196.0; 196.1; 196.8; 196.5; 196.6; 197.0; 197.1; 197.4; 197.5; 197.2; 197.3; 197.8; 197.6; 197.7; 198.0; 198.3; 198.4; 198.5; 198.6; 198.7; 198.81; 198.82; 198.89; 198.2; 198.1; 199.0; 199.1; 199.2; 200.28; 200.30; 200.27; 200.33; 200.34; 200.21; 200.22; 200.23; 200.24; 200.25; 200.26; 200.42; 200.43; 200.44; 200.31; 200.32; 200.47; 200.48; 200.35; 200.36; 200.37; 200.38; 200.40; 200.41; 200.56; 200.57; 200.58; 200.60; 200.61; 200.62; 200.63; 200.64; 200.65; 200.66; 200.67; 200.68; 200.70; 200.71; 200.72; 200.73; 200.74; 200.75; 200.76; 200.77; 200.78; 200.80; 200.81; 200.82; 200.83; 200.84; 200.85; 200.86; 200.87; 200.88; 200.45; 200.46; 200.00; 200.01; 200.50; 200.51; 200.52; 200.53; 200.54; 200.55; 200.10; 200.11; 200.12; 200.13; 200.14; 200.15; 200.16; 200.17; 200.18; 200.20; 200.04; 200.05; 200.06; 200.07; 200.08; 200.02; 200.03; 201.92; 201.93; 201.96; 201.97; 201.94; 201.95; 201.76; 201.77; 201.78; 201.90; 201.91; 201.51; 201.52; 201.00; 201.01; 201.02; 201.03; 201.98; 201.44; 201.45; 201.46; 201.47; 201.48; 201.50; 201.11; 201.12; 201.13; 201.14; 201.15; 201.16; 201.17; 201.18; 201.20; 201.21; 201.22; 201.23; 201.24; 201.25; 201.26; 201.27; 201.28; 201.40; 201.41; 201.42; 201.43; 201.04; 201.05; 201.06; 201.07; 201.08; 201.10; 201.65; 201.66; 201.67; 201.53; 201.54; 201.55; 201.56; 201.73; 201.74; 201.75; 201.60; 201.61; 201.62; 201.63; 201.64; 201.72; 201.68; 201.70; 201.71; 201.57; 201.58; 202.08; 202.00; 202.03; 202.04; 202.05; 202.06; 202.07; 202.37; 202.38; 202.40; 202.41; 202.42; 202.43; 202.01; 202.02; 202.32; 202.33; 202.34; 202.35; 202.36; 202.52; 202.53; 202.10; 202.11; 202.12; 202.13; 202.44; 202.45; 202.46; 202.47; 202.48; 202.50; 202.51; 202.22; 202.23; 202.24; 202.25; 202.26; 202.27; 202.28; 202.30; 202.31; 202.75; 202.76; 202.77; 202.78; 202.80; 202.81; 202.82; 202.83; 202.84; 202.85; 202.86; 202.87; 202.88; 202.90; 202.91; 202.92; 202.93; 202.94; 202.95; 202.96; 202.54; 202.55; 202.56; 202.57; 202.14; 202.15; 202.16; 202.17; 202.18; 202.20; 202.21; 202.65; 202.66; 202.67; 202.68; 202.70; 202.71; 202.72; 202.73; 202.74; 202.60; 202.61; 202.62; 202.63; 202.64; 202.97; 202.98; 202.58; 203.00; 203.82; 203.81; 203.10; 203.11; 203.01; 203.02; 203.12; 203.80; 204.02; 204.10; 204.01; 204.00; 204.21; 204.11; 204.12; 204.20; 204.91; 204.81; 204.82; 204.90; 204.92; 204.22; 204.80; 205.10; 205.02; 205.91; 205.00; 205.01; 205.20; 205.21; 205.11; 205.12; 205.31; 205.32; 205.80; 205.81; 205.82; 205.90; 205.22; 205.92; 205.30; 206.81; 206.00; 206.01; 206.82; 206.10; 206.11; 206.12; 206.20; 206.21; 206.22; 206.80; 206.90; 206.91; 206.92; 206.02; 207.81; 207.00; 207.10; 207.11; 207.12; 207.20; 207.21; 207.22; 207.80; 207.82; 207.02; 207.01; 208.82; 208.01; 208.02; 208.00; 208.12; 208.20; 208.21; 208.22; 208.80; 208.81; 208.92; 208.10; 208.90; 208.91; 208.11; 209.41; 209.51; 209.42; 209.43; 209.50; 209.55; 209.56; 209.57;

Comorbidity	Variable	ICD9
		209.60; 209.61; 209.62; 209.63; 209.64; 209.65; 209.66; 209.67; 209.69; 209.70; 209.71; 209.72; 209.73; 209.74; 209.75; 209.79; 209.22; 209.23; 209.24; 209.25; 209.26; 209.27; 209.29; 209.30; 209.31; 209.32; 209.33; 209.34; 209.35; 209.36; 209.40; 209.02; 209.03; 209.10; 209.11; 209.12; 209.52; 209.53; 209.54; 209.16; 209.17; 209.20; 209.00; 209.01; 209.13; 209.14; 209.15; 209.21; 235.9; 235.1; 235.0; 235.5; 235.2; 235.3; 235.4; 235.6; 235.7; 235.8; 236.0; 236.2; 236.3; 236.4; 236.1; 236.6; 236.7; 236.90; 236.5; 236.99; 236.91; 237.2; 237.3; 237.1; 237.0; 237.6; 237.70; 237.4; 237.5; 237.73; 237.79; 237.71; 237.72; 237.9; 238.2; 238.3; 238.0; 238.1; 238.8; 238.9; 238.4; 238.5; 238.6; 238.71; 238.72; 238.73; 238.74; 238.75; 238.76; 238.77; 238.79; 239.6; 239.9; 239.7; 239.81; 239.2; 239.3; 239.4; 239.89; 239.5; 239.0; 239.1
Diabetes	diab	250.00; 250.01; 250.02; 250.03; 250.10; 250.11; 250.12; 250.13; 250.20; 250.21; 250.22; 250.23; 250.30; 250.31; 250.32; 250.33; 250.40; 250.41; 250.42; 250.43; 250.50; 250.51; 250.52; 250.53; 250.60; 250.61; 250.62; 250.63; 250.70; 250.71; 250.72; 250.73; 250.80; 250.81; 250.82; 250.83; 250.90; 250.91; 250.92; 250.93
HF	hf	428.0; 428.1; 428.20; 428.21; 428.22; 428.23; 428.30; 428.31; 428.32; 428.33; 428.40; 428.41; 428.42; 428.43; 428.9
HIV	hiv	042
Hyperlipidemia	lipid	272.0; 272.1; 272.2; 272.3; 272.4; 272.5; 272.6; 272.7; 272.8; 272.9
Hypertension	hyper	401.0; 401.1; 401.9; 402.00; 402.01; 402.10; 402.11; 402.90; 402.91; 403.00; 403.01; 403.10; 403.11; 403.90; 403.91; 404.00; 404.01; 404.02; 404.03; 404.10; 404.11; 404.12; 404.13; 404.90; 404.91; 404.92; 404.93; 405.01; 405.09; 405.11; 405.19; 405.91; 405.99
Parkinson	park	332.0; 332.1
Sleep Apnea	osa	327.23
Stroke	stroke	433.01; 433.11; 433.21; 433.31; 433.81; 433.91; 434.01; 434.11; 434.91
TIA	tia	434.01; 434.11; 434.91

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Cause of CV death (ICD-10)

Show 16 entries

Search:

Appendix Table 2: CID-10 codes for cause of death

Diagnosis	ICD-10
Major cardiovascular diseases	I00-I78
Diseases of heart	I00-I09, I11, I13, I20-I51
Hypertensive heart disease with or without renal disease	I11,I13
Ischemic heart diseases	I20-I25
Other diseases of heart	I00-I09,I26-I51
Essential (primary) hypertension and hypertensive renal disease	I10,I12
Cerebrovascular diseases	I60-I69
Atherosclerosis	I70
Other diseases of circulatory system	I71-I78

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Previous 1 Next

Abbreviations

Code

Session Info

Code

```

R version 3.6.0 (2019-04-26)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 7 x64 (build 7601) Service Pack 1

Matrix products: default

locale:
[1] LC_COLLATE=English_United States.1252  LC_CTYPE=English_United States.1252    LC_MONETARY=English_United States.1252
[4] LC_NUMERIC=C                           LC_TIME=English_United States.1252

attached base packages:
[1] stats      graphics  grDevices  utils      datasets  methods   base

other attached packages:
[1] icd.data_1.0      icd_4.0.6      knitr_1.23      ggplot2_3.1.1    DT_0.6      data.table_1.12.2

loaded via a namespace (and not attached):
 [1] Rcpp_1.0.1      pillar_1.4.1    compiler_3.6.0  later_0.8.0     plyr_1.8.4     tools_3.6.0     digest_0.6.19
 [8] jsonlite_1.6    tibble_2.1.2    gtable_0.3.0    pkgconfig_2.0.2  rlang_0.3.4    shiny_1.3.2     rstudioapi_0.
10
[15] crosstalk_1.0.0  yaml_2.2.0      xfun_0.7        withr_2.1.2     dplyr_0.8.1    htmlwidgets_1.3  rappdirs_0.3.
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[22] grid_3.6.0      tidyselect_0.2.5 glue_1.3.1      R6_2.4.0        purrr_0.3.2    magrittr_1.5     promises_1.0.
1
[29] scales_1.0.0     htmltools_0.3.6 assertthat_0.2.1 xtable_1.8-4     mime_0.6        colorspace_1.4-1 httpuv_1.5.1
[36] labeling_0.3     lazyeval_0.2.2  munsell_0.5.0   crayon_1.3.4

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