

Causes and Predictors of 30-Day Readmission in Patients With Syncope/Collapse: A Nationwide Cohort Study

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Background—Syncope accounts for 0.6% to 1.5% of hospitalizations in the United States. We sought to determine the causes and predictors of 30-day readmission in patients with syncope.

Methods and Results—We identified 323 250 encounters with a primary diagnosis of syncope/collapse in the 2013–2014 Nationwide Readmissions Database. We excluded patients younger than 18 years, those discharged in December, those who died during hospitalization, hospital transfers, and those whose length of stay was missing. We used multivariable logistic regression analysis to evaluate the association between baseline characteristics and 30-day readmission. A total of 282 311 syncope admissions were included. The median age was 72 years (interquartile range, 58–83), 53.9% were women, and 9.3% had 30-day readmission. The most common cause of 30-day readmissions was syncope/collapse, followed by cardiac, neurological, and infectious causes. Characteristics associated with 30-day readmissions were age 65 years and older (odds ratio [OR], 0.7; 95% confidence interval [CI], 0.6–0.7), female sex (OR, 0.9; 95% CI, 0.8–0.9), congestive heart failure (OR, 1.5; 95% CI, 1.2–1.9), atrial fibrillation/flutter (OR, 1.3; 95% CI, 1.3–1.4), diabetes mellitus (OR, 1.2; 95% CI, 1.2–1.3), coronary artery disease (OR, 1.2; 95% CI, 1.2–1.3), anemia (OR, 1.4; 95% CI, 1.4–1.5), chronic obstructive pulmonary disease (OR, 1.4; 95% CI, 1.3–1.4), home with home healthcare disposition (OR, 1.5; 95% CI, 1.5–1.6), leaving against medical advice (OR, 1.7; 95% CI, 1.6–1.9), length of stay of 3 to 5 days (OR, 1.5; 95% CI, 1.4–1.6) or >5 days (OR, 2; 95% CI, 1.8–2), and having private insurance (OR, 0.6; 95% CI, 0.6–0.7).

Conclusions—The 30-day readmission rate after syncope/collapse was 9.3%. We identified causes and risk factors associated with readmission. Future prospective studies are needed to derive risk-stratification models to reduce the high burden of readmissions. (*J Am Heart Assoc.* 2018;7:e009746. DOI: 10.1161/JAHA.118.009746.)

Key Words: 30-day readmission • hospitalization • quality improvement • syncope

Syncope accounts for 3% of total emergency department visits¹ and 0.6% to 1.5% of hospitalizations in the United States.^{2,3} For the year of 2000, the total cost of care attributed to the treatment of syncope was estimated at \$2.4 billion annually, with a mean cost of \$5400 per hospitalization.⁴ Despite a decreasing trend of syncope hospitalization over the past decade, patients admitted with syncope became more likely to have higher comorbidities, and the adjusted hospitalization cost increased by 44%.⁵ This reported cost likely underestimates the financial burden, as it accounts for index syncope admissions only rather than readmissions and subsequent costs. Additionally, factors

associated with early readmission related to syncope have not been adequately identified.

In general, readmission has an adverse effect on patients by increasing the risk of nosocomial infection, higher cost of care, and worsening patient quality of life. One fifth of all-cause hospitalized Medicare beneficiaries had 30-day readmission, and more than one third had 90-day readmission⁶; thus, taking measures to decrease early readmissions is becoming a national priority. However, syncope is an under-recognized cause of frequent admission and is not a current area of focus for the Centers of Medicare & Medicare Services (CMS).⁷

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An accompanying Table S1 is available at <https://www.ahajournals.org/doi/suppl/10.1161/JAHA.118.e009746>

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Clinical Perspective

What Is New?

- The rate of readmissions after experiencing an episode of syncope was substantial: 9.3% at 30 days.
- Recurrent syncope was the most common primary diagnosis for readmission. Cardiac and infectious causes were the leading causes for readmission.

What Are the Clinical Implications?

- Short-term syncope readmission rates are high, and strategies to reduce the burden on the patient and healthcare systems are lacking.
- Identification of patients at risk for early readmission will help augment efforts to reduce early readmission.
- Leveraging electronic medical records in identifying such patients might help reduce early readmission but requires further investigation.

Many studies have focused on short-term hard outcomes^{3,8,9}; however, very few have focused on readmission. In a Canadian national study, 9% of patients hospitalized for syncope were readmitted,¹⁰ while readmission rates ranged from 2% to 3% in small-sample studies,^{11,12} and in a higher-risk population (those who presented with syncope and acute coronary syndrome) the rate reached 30%.¹³ However, these studies were not representative of a US cohort of patients. Thus, using the Nationwide Readmissions Database (NRD), we sought to estimate the incidence rate, risks, and predictors of 30-day readmission after an index hospitalization for syncope.

Methods

We performed an observational cohort study of patients admitted with syncope/collapse in the NRD for the years 2013–2014. The NRD is part of the Healthcare Cost and Utilization Project, which is sponsored by the Agency for Healthcare Research and Quality. The NRD provides discharge data from 22 states, accounting for 51.2% of the total US resident population and 49.3% of all US hospitalizations, and national US estimates were produced by using sampling weights provided by the NRD.¹⁴ Syncope/collapse admissions were identified by *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* diagnosis code 780.2 (“syncope or collapse”). We identified the index syncope/collapse admission and the immediate readmission within 30 days, which we labeled as all-cause readmission. The data, analytic methods, and study materials will not be made available to other researchers for purposes of reproducing the results or replicating the procedure. These data are deidentified and publically available and thus exempt

from institutional review board approval, and the need for informed consent was waived.

Our study included patients admitted with a primary diagnosis of syncope/collapse. We excluded patients younger than 18 years, patients who died during hospitalization, same-day readmissions, patients with missing data, and patients who were admitted in December as it would be unknown whether the patient was readmitted in January of the following year. Every NRD data set is a unique data set where the records are linked within that year from January to December, but this linkage does not extend before or after. Patient demographics, payer, income, length of stay (LOS), hospital, and disposition were obtained from the database. Comorbidities were identified according to their *ICD-9* codes, clinical classification software codes, and/or Elixhauser comorbidity variables when appropriate (Table S1). When a readmission occurred within 30 days, the cause of readmission was identified by the primary diagnosis, as indicated by the assigned *ICD-9* code. LOS values were categorized into groups (<1 day, 1 or 2, 3 or 5, and >5 days). Elixhauser readmission index scores were calculated by using the 29 weighted Elixhauser comorbidity variables.¹⁵ Furthermore, to assess the burden of syncope/collapse readmission compared with that of conditions targeted by the CMS-implemented Hospital Readmission Reduction Program, we collected published readmission incident rates of these conditions from 2013–2014. We matched each study year and primary expected payer, and calculated syncope/collapse readmission incidence accordingly.

Statistical Analysis

Continuous variables were described as medians and interquartile ranges (IQRs), and categorical variables were described as percentages. To compare variables, we used chi-square and Fisher exact tests whenever appropriate for categorical variables and Mann–Whitney test for continuous variables. Bivariable and multivariable logistic regression analyses were used to evaluate the association between patient characteristics and all-cause 30-day readmissions. Variables with a $P < 0.2$ in bivariable analysis were considered eligible to enter the multivariable model. The associations were expressed as odds ratios (ORs) with their 95% confidence intervals (CIs). A $P < 0.05$ was considered statistically significant. Statistical analyses were performed with SPSS version 23.0 (IBM).

Results

A total of 323 250 syncope/collapse hospitalizations were recorded in the NRD from 2013–2014. We excluded patients younger than 18 years ($n=5160$), hospitalized patients discharged in December ($n=25\ 618$), patients who died during hospitalization or had missing mortality data ($n=767$), patients

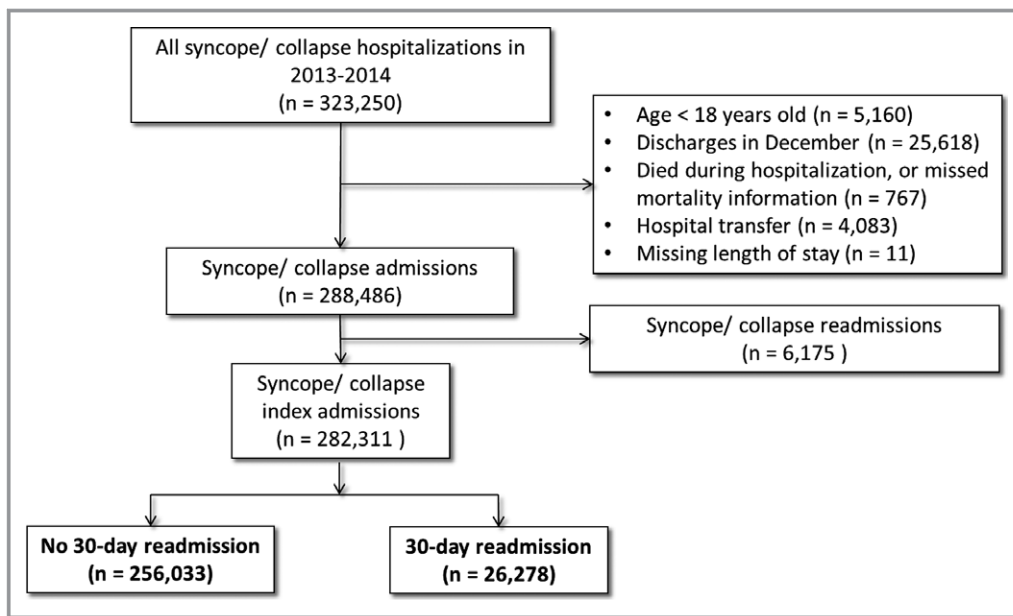


Figure 1. Flow diagram of the screened and enrolled population.

who were transferred to another hospital ($n=4083$), and patients with missing LOS ($n=11$). To include index admissions only, readmission due to syncope/collapse ($n=6175$) were censored from all syncope/collapse admissions, and the final cohort consisted of 282 311 index syncope/collapse admissions (Figure 1). The 30-day readmission rates post-syncope/collapse were 9.3% in the whole cohort, 6.2% in patients with private insurance, and 11.3% and 10.2% in Medicaid and Medicare beneficiary patients, respectively.

The median patient age was 72 years (IQR, 58–83), the median LOS was 2 days (IQR 1–4), and women accounted for 53.9% of the patients (Table 1). The most common comorbidities were hypertension (69%), followed by hyperlipidemia (43%), coronary artery disease (30%), and diabetes mellitus (28%). Medicare was the major primary expected payer (65%), and most of the admissions occurred during a weekday (73%). Most of the hospitalizations occurred in teaching hospitals (55%). The median age of all-cause 30-day readmission patients was 73 years (IQR, 59–83), while for the patient group who was not readmitted within 30 days, the median age was 72 years (IQR, 58–82), with a median difference of 1 ($P<0.001$). The median Elixhauser readmission index score for all-cause 30-day readmission patient group was 15 (IQR, 7–26), while for the patient group who was not readmitted within 30 days, the median Elixhauser readmission index score was 9 (IQR, 4–19) with a median difference of 6 ($P<0.001$).

In the total cohort, syncope/collapse was the single most common primary diagnosis cause of 30-day readmission (7.9%), while combined cardiac causes accounted for 17.2% (arrhythmia, 7.2%; congestive heart failure [CHF], 3.7%; coronary artery disease, 3.4%), followed by 13.7% infectious

causes (septicemia, 3.7%; urinary tract infection, 2.9%; pneumonia 2.7%), and 10.9% neurological causes (acute cerebrovascular disease, 3.2%; seizures, 2.2%) (Table 2, Figure 2). In patients younger than 40 years, syncope/collapse accounted for 12.9% of all-cause readmission, and combined neurological causes (13.8%) were the most common cause of 30-day readmission. While in patients 40 years or older, syncope/collapse accounted for 7.8% of all-cause readmission, and combined cardiac causes (17.2%) were the most common cause of 30-day readmission. The median cost of index syncope/collapse admissions was \$19 439 (IQR, \$12 000–31 054), the median cost of all-cause 30-day readmission was \$26 127 (IQR, \$14 962–47 561), and the total weighted cost of index syncope/collapse admission and 30-day readmissions was \$5 607 879 354 and \$722 098 026, respectively.

In multivariable analysis, the risk of all-cause 30-day readmission was lower in women (OR, 0.86; 95% CI, 0.83–0.88), patients with dehydration (OR, 0.95; 95% CI, 0.91–0.99), weekend admissions (OR, 0.93; 95% CI, 0.91–0.96), private insurance (OR, 0.62; 95% CI, 0.59–0.65) compared with Medicare, and patients 65 years and older (OR, 0.65; 95% CI, 0.62–0.71) compared with those aged 18 to 39 years (Table 3). On the other hand, the risk of all-cause 30-day readmission was higher in patients with high-risk comorbidities such as cardiac disease: CHF (OR, 1.52; 95% CI, 1.19–1.92), atrial fibrillation/flutter (OR, 1.34; 95% CI, 1.29–1.38), and coronary artery disease (OR, 1.23; 95% CI, 1.2–1.27); diabetes mellitus (OR, 1.22; 95% CI 1.19–1.26), chronic obstructive pulmonary disease (OR, 1.38; 95% CI, 1.33–1.43), and anemia (OR, 1.42; 95% CI, 1.38–1.47); discharge to

Table 1. Characteristics of Syncope/Collapse Index Admissions

Characteristics	Overall (N=282 311)	30-d Readmission (n=26 278)	No 30-d Readmission (n=256 033)	P Value
Age in y				
Median, IQR	72 (58–83)	73 (59–83)	72 (58–82)	<0.01
Mean, SD	68.9 (16.6)	69.9 (16.1)	68.8 (16.7)	<0.01
Age groups, %				
18–39 y	6	5.1	6.1	<0.01
40–64 y	30	28.9	30.1	
≥65 y	64	66.1	63.8	
Female sex, %	53.9	50.9	54.2	<0.01
Secondary diagnosis				
Hypertension, %	69.3	72.5	69.3	<0.01
Hyperlipidemia, %	43.4	43.2	43.4	0.4
Diabetes mellitus, %	28.4	35.0	27.7	<0.01
Coronary artery disease, %	29.9	37.5	29.7	<0.01
Hypothyroidism, %	15.4	16.6	15.2	<0.01
Atrial fibrillation/flutter, %	14.9	20.4	14.3	<0.01
Dehydration, %	11.9	11.6	11.9	0.17
Congestive heart failure, %	0.1	0.3	0.1	<0.01
Acute cerebrovascular diseases, %	5.7	6.7	5.6	<0.01
Anemia, %	17.5	24.8	16.7	<0.01
Depression, %	12.7	14.6	12.5	<0.01
Anxiety disorders, %	11.7	13.3	11.6	<0.01
Chronic obstructive pulmonary disease, %	11.4	16.8	10.9	<0.01
Acute kidney failure, %	8.2	10.1	8.2	<0.01
Postural tachycardia syndrome, %	1	1	1	0.67
Orthostatic hypotension, %	2.2	2.6	2.2	<0.01
Elixhauser readmission index score, median (IQR)	10 (4–20)	15 (7–26)	9 (4–19)	<0.01
Weekend admission, %	27.2	25.8	27.3	<0.01
Primary expected payer, %				
Medicare	65.4	71.9	64.8	<0.01
Medicaid	9.2	11.2	9	
Private insurance	17.8	11.9	18.5	
Self-pay/no charge/other	7.5	5	7.7	
Disposition, %				
Discharged home with self-care	71.2	60	72.4	<0.01
Discharge to extended-care facility	12.5	16.4	12.1	
Home health care	12.7	18.6	12.1	
Against medical advice	2.8	3.8	2.7	
Discharge alive, destination unknown	0.7	1.3	0.7	
Median household income national quartile for patient zip code, %				
0–25th percentile	30.1	32.1	29.9	
26th–50th percentile	25.5	26	25.5	

Continued

Table 1. Continued

Characteristics	Overall (N=282 311)	30-d Readmission (n=26 278)	No 30-d Readmission (n=256 033)	P Value
51st–75th percentile	22.2	21.6	22.2	
76th–100th percentile	22.2	20.4	22.4	<0.01
Hospital type, %				
Metropolitan nonteaching	36.2	35.4	36.3	<0.01
Metropolitan teaching	54.6	55.6	54.4	
Nonmetropolitan	9.1	9	9.2	
Length of stay, d, %				
<1	4.4	3.4	4.5	<0.01
1–2	58.4	48	59.4	
3–5	30.5	36.8	29.8	
>5	6.8	11.9	6.3	

IQR indicates interquartile range.

extended-care facility (OR, 1.21; 95% CI, 1.17–1.26), to home with home health care (OR, 1.51; 95% CI, 1.46–1.57), or leaving against medical advice (OR, 1.74; 95% CI, 1.62–1.88) compared with home with self-care disposition; and LOS of 3 to 5 days (OR, 1.48; 95% CI, 1.38–1.6) or >5 days (OR, 1.95; 95% CI, 1.8–2.12) compared with <1 day.

Discussion

Main Findings

Our study highlights the incidence rate, causes, and predictors of 30-day readmission for syncope/collapse in a large nationally representative administrative sample. The incidence rate of syncope/collapse 30-day readmission was 9.3%, and syncope/collapse was the most common primary diagnosis of readmission at 30 days, while cardiac and infectious causes were the leading systemic causes of readmissions. Meanwhile, other disorders expected to overlap with syncope/collapse, such as postural orthostatic tachycardia syndrome and orthostatic hypotension, had lower prevalence in this cohort as they usually present in younger patients who are managed in outpatient settings. Patients with chronic comorbidities (eg, CHF, coronary artery disease, atrial fibrillation/flutter, chronic obstructive pulmonary disease), those with disposition other than home with self-care, and patients with prolonged hospital stays had a higher risk of 30-day readmissions.

Syncope/Collapse Readmission Rates

We found that 30-day readmission rate post-syncope/collapse was 9.3% in the overall cohort and 10.2% to

11.3% in patients who were CMS beneficiaries. Studies evaluating syncope/collapse outcomes in general and readmission in particular vary in what they report according to the study population and methodology; thus, a wide range of readmission rates have been reported in the literature. Khera et al¹¹ reported a 24-month readmission rate of 3% among elderly populations. Sule et al¹² studied 242 patients with syncope and reported a 17-month readmission rate of 2%. Sandhu et al¹⁰ studied the nationwide trend of syncope admissions in Canada over a 10-year period and reported an all-cause 30-day readmission rate of 9%. Anderson et al¹³ studied outcomes in patients with obstructive coronary artery diseases presenting with syncope and found that the 90-day readmission rate was 28.2% and 30.3% in patients managed by conservative and invasive approaches, respectively.

In an attempt to reduce early readmissions and improve quality of care, CMS implemented the Hospital Readmission Reduction Program for patients with CHF, acute myocardial infarction, coronary artery bypass graft, pneumonia, chronic obstructive pulmonary disease, and knee or hip replacements.^{7,16} Published data for these conditions using the NRD show that readmission rates were 4% and 6.6% within 90 days following knee and hip replacement, respectively, while the 30-day readmission rates were 14.9% post-acute myocardial infarction, 16.1% post-pneumonia, 19.2% post-chronic obstructive pulmonary disease, and 20% to 21% post-CHF hospitalizations (Table 4).^{17–22} This is in comparison to our findings in patients with syncope/collapse who benefited from the CMS program and reported readmission rates of 10.2% to 11.3%.

Despite the high rates of early readmission, efforts to reduce these rates are still lacking, and further studies

Table 2. Causes of 30-Day Readmissions

All-Cause 30-d Readmission*	Total (%) (N=26 278)	Age <40 y (%) (n=1338)	Age ≥40 y (%) (n=24 940)
Cardiac causes, %	17.2	13.1	17.2
Arrhythmia/conduction disease	(7.2)	(6.9)	(7.2)
Congestive heart failure	(3.7)	(1.8)	(3.9)
Coronary artery disease (including acute myocardial infarction)	(3.4)	(0.8)	(3.4)
Hypertension complications	(1.4)	(1.4)	(1.4)
Valvular heart disease	(0.6)	(0.2)	(0.6)
Infectious causes, %	13.7	8.8	14.1
Septicemia	(3.7)	(1.1)	(3.9)
Urinary tract infection	(2.9)	(0.6)	(3.1)
Pneumonia	(2.7)	(2.2)	(2.8)
Skin infection	(1.4)	(0.8)	(1.4)
Neurological causes, %	10.9	13.8	10.5
Acute cerebrovascular disease (transient ischemic attack/stroke)	(3.2)	(0.7)	(3.3)
Seizure disorder	(2.2)	(6.4)	(1.9)
Delirium/dementia/altered mental status	(2)	(0.3)	(2.1)
Headache/migraine	(0.4)	(1.8)	(0.4)
Multiple sclerosis	(0.1)	(0.5)	(0.1)
Syncope/collapse, %	7.9	12.9	7.8
Gastrointestinal, hepatic, and pancreatic causes, %	7.5	9.2	7.5
Gastrointestinal bleeding	(1.5)	(0.6)	(1.6)
Abdominal pain, nausea, or vomiting	(0.9)	(4.1)	(0.84)
Respiratory causes, %	5.8	2.8	6.1
Chronic obstructive pulmonary disease/asthma	(2.4)	(0.6)	(2.5)
Pulmonary embolism	(1)	(0.4)	(1)
Respiratory failure	(1)	(0.8)	(1)
Hematologic and oncology-related causes (mainly anemia and cancer), %	4.2	2.9	4.3
Fall and injury	3.4	1	3.5
Bone fracture	(2.4)	(0.5)	(2.5)
Spinal cord and intracranial injury	(0.7)	...	(0.8)
Hypotension, %	3.4	2	3.5
Orthostatic hypotension	(2.2)	(1.4)	(2.3)
Renal and genitourinary causes, %	3.3	1.6	3.5
Acute kidney injury	(2.5)	(0.1)	(2.7)
Fluid, electrolytes, or nutritional causes, %	3.1	1.6	3.3
Psychiatric causes (mood disorder, schizophrenia, anxiety disorder), %	3.1	9.5	2.4
Chest pain, %	2.9	5.2	2.7
Peripheral vascular disease, %	2.8	0.4	3
Precerebral arterial stenosis	(1)	...	(1)
Deep vein thrombosis	(0.6)	(0.3)	(0.7)
Endocrine causes, %	2.2	2.4	2.2

Continued

Table 2. Continued

All-Cause 30-d Readmission*	Total (%) (N=26 278)	Age <40 y (%) (n=1338)	Age ≥40 y (%) (n=24 940)
Substance or medication intoxication/withdrawal	2.1	5.4	2
Alcohol related	(0.9)	(1.6)	(0.9)
Rheumatologic causes (rhabdomyolysis, systemic lupus, gout, and osteoarthritis)	1.7	1.3	1.8
Back problems and pathologic fractures	1.1	0.4	1.2
Dizziness/fatigue	1.1	1.6	1.1
Obstetrics and gynecological diseases	0.2	1	0.1
Miscellaneous	2.4	3.3	2.4

*There were 1473 primary diagnosis *International Classification of Diseases, Ninth Revision (ICD-9)*, codes identified, and we reported the most common causes.

should examine patients who are admitted for syncope to identify risk factors that predict readmission. Such data would be useful to risk-stratify these patients and to support additional measures to reduce the burden of early readmission.

Predictors of Early Syncope/Collapse Readmission

Published reports have shown that male sex, older age, history of drug abuse, and major comorbidities such as CHF

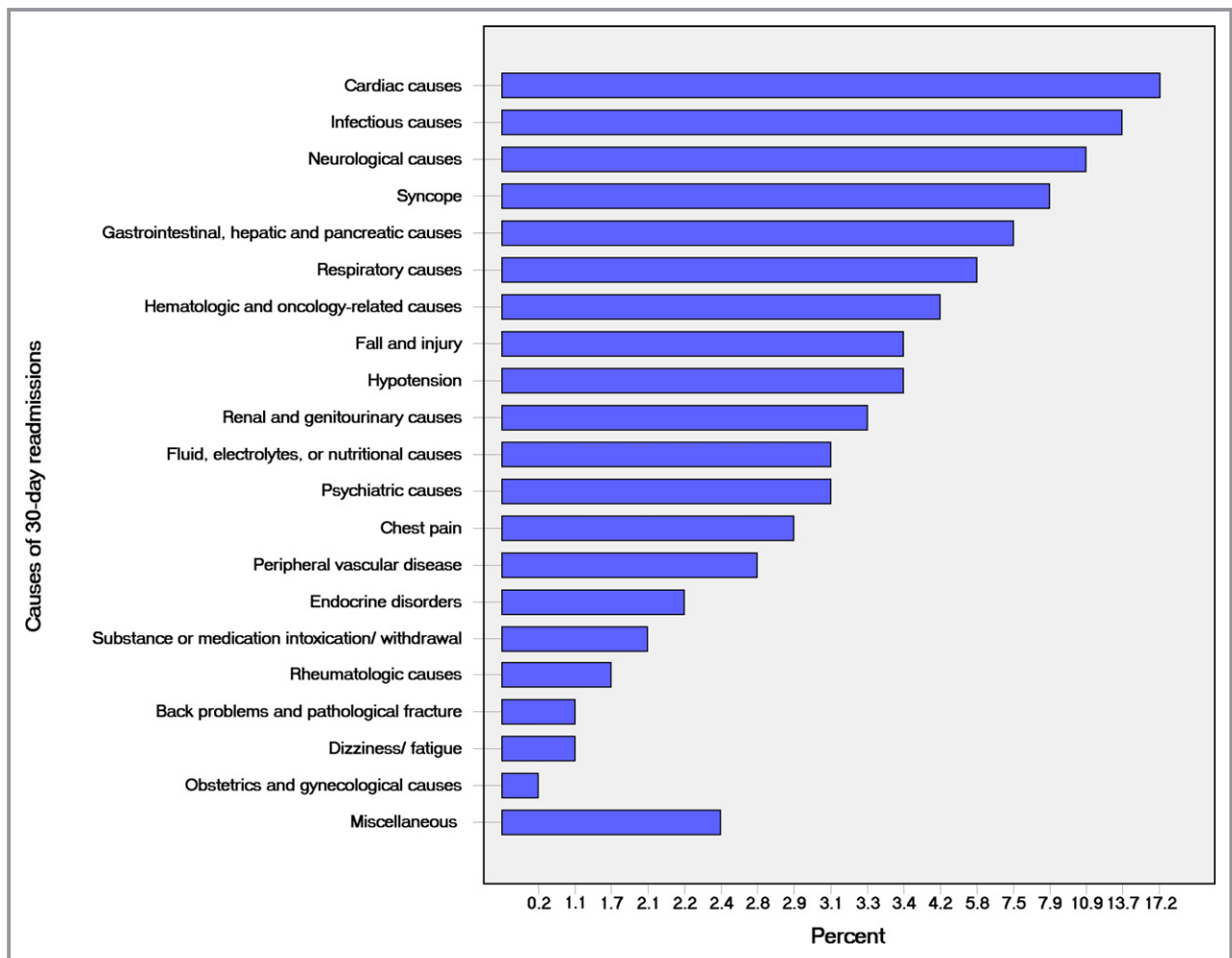


Figure 2. Causes of 30-day readmissions.

Table 3. Bivariable and Multivariable Association Between Patient Characteristics and All-Cause 30-Day Readmissions

Characteristics	Bivariable Analysis OR (95% CI)	P Value	Multivariable Analysis OR (95% CI)	P Value
Age groups, y				
18–39	Reference	<0.01	Reference	
40–64	1.15 (1.08–1.22)		0.9 (0.854–0.96)	<0.01
≥65	1.24 (1.17–1.32)		0.65 (0.62–0.71)	<0.01
Female sex	0.88 (0.86–0.9)	<0.01	0.86 (0.83–0.88)	<0.01
Hypertension	1.17 (1.14–1.2)	<0.01	1.02 (0.99–1.05)	0.3
Hyperlipidemia	0.99 (0.96–1.02)	0.39
Diabetes mellitus	1.41 (1.37–1.46)	<0.01	1.22 (1.19–1.26)	<0.01
Coronary atherosclerosis	1.48 (1.44–1.52)	<0.01	1.23 (1.2–1.27)	<0.01
Hypothyroidism	1.11 (1.07–1.15)	<0.01	1.07 (1.04–1.11)	<0.01
Atrial fibrillation/flutter	1.53 (1.48–1.58)	<0.01	1.34 (1.29–1.38)	<0.01
Dehydration	0.97 (0.94–1.01)	0.16	0.95 (0.91–0.99)	0.02
Congestive heart failure	2.63 (2.09–3.333)	<0.01	1.52 (1.19–1.92)	<0.01
Acute cerebrovascular diseases	1.21 (1.15–1.28)	<0.01	1.06 (1.01–1.12)	0.03
Anemia	1.64 (1.59–1.69)	<0.01	1.42 (1.38–1.47)	<0.01
Depression	1.19 (1.15–1.23)	<0.01	1.09 (1.04–1.13)	<0.01
Anxiety disorders	1.185 (1.13–1.22)	<0.01	1.18(1.13–1.23)	<0.01
Chronic obstructive pulmonary disease	1.66 (1.60–1.71)	<0.01	1.38 (1.33–1.43)	<0.01
Acute kidney failure	1.29 (1.23–1.35)	<0.01	1.03 (0.99–1.08)	0.17
Postural tachycardia syndrome	1.03 (0.9–1.17)	0.7
Orthostatic hypotension	1.2 (1.1–1.3)	<0.01	1.05 (0.96–1.14)	0.27
Admission day				
Weekday	Reference	<0.01	Reference	<0.01
Weekend	0.92 (0.9–0.95)		0.93 (0.91–0.96)	
Primary expected payer				
Medicare	Reference	<0.01	Reference	
Medicaid	1.12 (1.08–1.17)		1.03 (0.98–1.09)	0.25
Private insurance	0.58 (0.56–0.6)		0.62 (0.59–0.65)	<0.01
Self-pay/no charge/other	0.59 (0.55–0.62)		0.59 (0.551–0.63)	<0.01
Disposition				
Discharged home with self-care	Reference	<0.01	Reference	
Discharge to extended-care facility	1.63 (1.58–1.69)		1.21 (1.17–1.26)	<0.01
Home health care	1.85 (1.79–1.92)		1.51 (1.46–1.57)	<0.01
Against medical advice	1.65 (1.54–1.77)		1.74 (1.62–1.88)	<0.01
Discharge alive, destination unknown	2.27 (2.02–2.55)		2.06 (1.83–2.33)	<0.01
Median household income national quartile for patient zip code				
0–25th percentile	Reference	<0.01	Reference	
26th–50th percentile	0.95 (0.92–0.98)		0.99 (0.95–1.02)	0.47
51st–75th percentile	0.9 (0.87–0.94)		0.97 (0.93–1)	0.71
76th–100th percentile	0.85 (0.82–0.88)		0.930 (0.896–0.965)	<0.01

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Table 3. Continued

Characteristics	Bivariable Analysis OR (95% CI)	P Value	Multivariable Analysis OR (95% CI)	P Value
Hospital type				
Metropolitan nonteaching	Reference	<0.01	Reference	
Metropolitan teaching	1.05 (1.02–1.07)		1.04 (1.01–1.06)	0.02
Nonmetropolitan	1.01 (0.96–1.06)		0.98 (0.93–1.03)	0.32
Length of stay, d				
<1	Reference	<0.01	Reference	
1–2	1.08 (1.01–1.16)		1.12 (1.04–1.2)	<0.01
3–5	1.65 (1.54–1.77)		1.48 (1.38–1.6)	<0.01
>5	2.54 (2.35–2.75)		1.95 (1.8–2.12)	<0.01

CI indicates confidence interval; OR, odds ratio.

and cerebrovascular disease correlate with higher risk of short-term adverse outcomes.^{8,10,11,23} In our study, we noticed similar outcomes, as male sex, high-risk comorbidities (especially cardiovascular diseases), and prolonged LOS were all found to have a higher risk of 30-day readmission. Furthermore, patients discharged to an extended-care facility or to home with home health care were at a higher risk of 30-day readmission. These patients are more likely to have higher comorbidities and thus a higher risk of readmission.

On the other hand, we found that patients with higher socioeconomic status and those with private insurance had a lower risk for 30-day readmission, which we presume to be related to having better healthcare access. Also, patients with dehydration were found to be at lower risk for readmission, as the syncope/collapse episode would be related to a reversible pathology. This shows that syncope/collapse could be considered as a symptom rather than as a disease itself, as

the severity and recurrence depend on the underlying pathology behind transient brain hypoperfusion. Accordingly, the outcome of syncope/collapse (eg, mortality or readmission) would be influenced by pathophysiology (eg, cardiogenic, neurogenic, neurocardiogenic) and comorbidities.

Although readmission rates in our study were significantly higher in older populations, we found that when all other variables were adjusted for, advanced age was associated with lower risk of readmission. In a Danish study, the risk of syncope in patients with cardiovascular disease was significantly higher in younger age groups,²⁴ while Sandhu et al¹⁰ found that advancing age was a risk factor for all-cause 30-day readmissions. However, the latter study included hospitalizations for syncope/collapse as either a primary or secondary diagnosis and the outcome was only adjusted for sex and Charlson Comorbidity Index. Moreover, Costantino et al⁹ found that male sex, ECG, trauma, and absence of

Table 4. Studies Published Using Nationwide Readmissions Database on Hospital Readmission Reduction Program–Targeted Diseases

Study Name	Population	Year	Diagnosis	Readmission, %	Our Matched Cohort Syncope/Collapse 30-d Readmission, %
Sukul et al, 2017 ¹⁷	Medicare beneficiary	2014	Acute myocardial infarction	14.9*	10.4
			Heart failure	20.7	
			Pneumonia	16.1	
Shah et al, 2018 ¹⁸	General population	2013–2014	Acute myocardial infarction with cardiogenic shock	20.2*	9.6
Arora et al, 2017 ¹⁹	General population	2013–2014	Diastolic heart failure	21.27*	9.6
Jacobs et al, 2018 ²⁰	General population	2013–2014	Chronic obstruction lung disease exacerbation	19.2*	9.6
Urish et al, 2018 ²¹	General population	2014	Elective total knee replacement	4 [†]	9.6
Cary et al, 2018 ²²	General population	2014	Total hip replacement	6.6 [†]	9.6

*30-day readmission.

[†]90-day readmission.

prodromal symptoms were associated with worse short-term outcomes, while patients older than 65 years and those with neoplasms, cerebrovascular diseases, structural heart disease, or ventricular arrhythmias were associated with worse mortality and long-term adverse outcomes. Thus, it seems that age is significantly affected by many confounders (mainly by complexity of comorbidities) when predicting readmission. When predicting readmission, it would be beneficial to use all available variables, which hospitals can do by using electronic medical record systems. This would help to flag patients with syncope/collapse who are at a higher risk of early readmission, to support these patients to prevent potentially reversible causes of early readmission.

Syncope/Collapse Risk Stratification and Readmission Prevention Models

Few syncope risk stratification and readmission prevention models have been proposed. Parry et al²⁵ proposed an algorithm when triaging patients with syncope or fall focusing on history and physical examination; this algorithm showed a 12% reduction in 30-day readmission rate. However, the authors excluded patients with acute identifiable events such as stroke, pneumonia, or myocardial infarction, which renders the algorithm useful only in patients with fall or unknown cause of syncope. The Boston Syncope Criteria was proposed to triage patients with syncope and was shown to have a sensitivity of 97% and specificity of 62% in predicting 30-day adverse outcomes or critical interventions; however, readmission was not included as an adverse outcome.²⁶ Other models, such as the San Francisco Syncope Rule and Osservatorio Epidemiologico sulla Sincope nel Lazio scores, have been used to risk-stratify patients for long-term adverse outcomes. In one meta-analysis, the sensitivity of the San Francisco Syncope Rule for predicting serious outcomes was 86% with a specificity of 49%, while the sensitivity of the Osservatorio Epidemiologico sulla Sincope nel Lazio score was 95% with a specificity of 31%.²⁷ However, in a validation study, both scoring systems failed to flag the patients who were readmitted within 10 days (2/488 patients), and it should be noted that these scoring systems were validated as predictive of medium- and long-term prognoses rather than short-term outcomes.^{9,27–29} Therefore, it should be taken into consideration that predictors of short-term outcomes tend to differ from those of long-term outcome, and these models would not be that helpful to risk-stratify the patients for 30-day readmission.

Study Limitations

Our study has several limitations, most of which are inherent to the administrative nature of using a database such as the NRD: reliance on reported *ICD-9* codes to identify primary and

secondary diagnoses and the absence of important information related to patients' physical examination, medications, and laboratory results. Also, we used the *ICD-9* code that includes both syncope and collapse. This code is not entirely specific to syncope and is a limitation of the use of administrative data. However, a previous report showed a 96% positive predictive value and a 63% sensitivity of this *ICD-9* code.³⁰ Furthermore, the underlying mechanism of syncope in these admissions is not clearly stated. Moreover, observation stays are not part of the NRD, and the cost and outcomes could be shifted. It should be noted that the NRD runs from January to December of each year, and the readmissions are linked within that year only. Finally, the NRD tracks patients admitted within the same state and does not track death that occurs outside of the hospital or emergency department. However, many of these limitations are balanced by the large and nationally represented patient group in this study.

Conclusions

Despite the relatively high financial burden and readmission rate of syncope, strategies to prevent early readmission are lacking. In a large database that represents a nationwide hospitalized population in the United States, the incidence rate of syncope/collapse 30-day readmission was 9.3%. Syncope/collapse was the most common cause of readmission across age groups. Chronic comorbidities, prolonged hospitalization, and other than home with self-care disposition were all associated with higher risk of 30-day readmission. Identification of risks for early readmission will help healthcare providers to direct further measures and strategies to reduce the burden on patient health, quality of life, and healthcare resources.

Disclosures

None.

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SUPPLEMENTAL MATERIAL

Table S1. ICD-9 comorbidities, etiologies of readmission.

Comorbidity	ICD-9 codes
Acute cerebrovascular disease	346.60, 346.61, 346.62, 346.63, 430, 431, 432.0, 432.1, 432.9, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.0, 434.00, 434.01, 434.1, 434.10, 434.11, 434.9, 434.90, 434.91, 436
Acute kidney failure	584.5, 584.6, 584.7, 584.8, 584.9, 586
Anemia	280.0, 280.1, 280.8, 280.9, 281.0, 281.1, 281.2, 281.3, 281.4, 281.8, 281.9, 282.0, 282.1, 282.2, 282.3, 282.4, 282.40, 282.43, 282.44, 282.45, 282.46, 282.47, 282.49, 282.7, 282.8, 282.9, 283.0, 283.1, 283.10, 283.11, 283.19, 283.2, 283.9, 284.0, 284.01, 284.09, 284.1, 284.11, 284.12, 284.19, 284.2, 284.8, 284.81, 284.89, 284.9, 285.0, 285.21, 285.22, 285.29, 285.8, 285.9, 285.1, 282.41, 282.42, 282.5, 28260, 282.61, 282.62, 282.63, 282.64, 282.68, 282.69, 790.0, 790.9
Anxiety disorders	293.84, 300.00, 300.01, 300.02, 300.09, 300.10, 300.20, 300.21, 300.22, 300.23, 300.29, 300.3, 300.5, 300.89, 300.9, 308.0, 308.1, 308.2, 308.3, 308.4, 308.9, 309.81, 313.0, 313.1, 313.21, 313.22, 313.3, 313.82, 313.83
Atrial fibrillation/flutter	427.31, 437.32
Chronic obstructive pulmonary disease and bronchiectasis	490, 491.0, 491.1, 491.2, 491.20, 491.21, 491.22, 491.8, 491.9, 492.0, 492.8, 494, 494.0, 494.1, 496
Congestive heart failure	398.91, 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
Coronary atherosclerosis and other heart disease	411.0, 411.1, 411.8, 411.81, 411.89, 412, 413.0, 413.1, 413.9, 414.0, 414.00, 414.01, 414.06, 414.2, 414.3, 414.4, 414.8, 414.9, V45.81, V45.82
Diabetes mellitus, with or without complication	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, 249.00, 249.01, 249.10, 249.11, 249.20, 249.21, 249.30, 249.31, 249.40, 249.41, 249.50, 249.51, 249.60, 249.61, 249.70, 249.71, 249.80, 249.81, 249.90, 249.91, 648.00, 648.01, 648.02, 648.03, 648.04
Dehydration	276.51
Depression	300.4, 301.12, 309.0, 309.1, 311
Fluid and electrolyte disorders	276.0, 276.1, 276.2, 276.3, 276.4, 276.5, 276.50, 276.51, 276.52, 276.6, 276.69, 276.7, 27.68, 276.9, 995.1
Hyperlipidemia	2720, 2721, 2722, 2723, 2724
Hypertension	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, 404.01, 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, 437.2, 642.00, 642.01, 642.02, 642.03, 642.04.
Hypothyroidism	243, 244.2, 244.8, 244.9
Orthostatic Hypotension	458.0
Postural tachycardia syndrome	785.0, 427.2
Syncope/ collapse	780.2
Etiologies of 30-day readmissions	
Cardiovascular etiologies	427.31, 427.81, 414.01, 427.89, 428.23, 410.71, 428.33, 428.0, 427.1, 426.0, 424.1, 428.43, 401.9, 403.91, 427.32, 404.91, 414.00, 428.31, 401.0, 427.0, 428.21, 411.1, 426.12, 414.8, 424.0, 426.11, 426.13, 403.90, 403.01, 410.91, 785.0, 410.41, 996.72, 425.11, 996.01, 427.41, 437.2, 428.22, 414.02, 423.9, 428.30, 396.2, 402.91, 426.10, 413.9, 785.1, 427.9, 426.54, 403.00, 426.6, 428.32, 423.2, 404.93, 421.0, 428.20, 996.04, 425.4, 996.83, 745.5, 426.7, 410.11, 429.83, 427.61, 404.01, 427.69, 394.0, 396.0, 426.2, 996.71, 426.53, 391.0,

	423.0, 420.90, 426.3, 747.81, 410.01, 428.40, V53.32, 411.89, 746.89, 425.18, 396.8, 410.51, 428.1, 420.91, 396.3, 429.2, 747.49, 426.89, 414.06, 427.2, 746.81, 423.1, 429.0, 404.11, 428.42, 401.1, 423.8, 404.90, 402.00, 785.51, 426.9, 746.4, 391.9, 404.03, 402.01, 395.2, V71.7, 414.9, 404.00, 426.52, 747.61, 403.11, 794.39, 426.82, 410.81, 794.31
Infectious etiologies	599.0, 038.9, 486, 682.6, 008.45, 038.42, 996.64, 682.3, 466.0, 038.49, 008.8, 998.59, 038.0, 999.32, 996.62, 038.12, 482.83, 996.61, 682.7, 009.0, 042, 038.11, 790.7, 038.40, 590.80, 038.8, 482.9, 682.4, 079.99, 590.10, 682.2, 682.5, 482.42, 487.1, 595.9, 730.27, 011.22, 999.31, 481, 482.1, 135, 070.44, 038.43, 038.2, 707.03, 053.9, 038.3, 707.04, 480.9, 038.10, 070.71, 487.0, 038.19, 009.2, 711.06, 730.07, 682.0, 009.1, 372.39, 682.9, 461.9, 053.79, 707.09, 482.2, 054.3, 681.10, 041.86, 595.0, 996.67, 094.89, 595.82, 465.9, 008.43, 031.0, 682.8, 996.65, 112.5, 571.42, 536.41, 475, 709.2, 705.4, 709.8, 707.13, 996.69, 324.1, 112.84, 707.15, 730.28, 011.75, 608.4, 377.32, 096, 488.81, 682.1, 473.9, 136.9, 694.5, 681.00, 730.05, 485, 008.42, 698.9, 695.13, 070.22, 054.79, 483.0, 601.0, 320.9, 795.39, 705.83, 003.9, 384.4, 488.82, 482.89, 996.63, 462, 707.07, 480.8, 698.8, 053.20, 482.41, 464.00, 473.0, 033.9, 117.3, 782.1, 007.5, 383.00, 595.89, 466.19, 114.5, 054.2, 005.9, 888.1, 031.2, 480.1, 007.4, 607.89, 112.4, 461.9, 323.81, 604.90, 011.23, 094.9, 094.1, 384.1, 482.0, 136.3, 705.1, 473.3, 011.93, 323.82, 473.2, 707.8, 707.19, 686.8, 730.18, 482.30, 696.1, 047.9, 11.94794792
Neurological etiologies	300.11, 307.1, 306.0, 307.81, 306.4, 300.7, 316, 331.0, 294.21, 294.20, 310.2, 290.41, 331.82, 290.40, 293.0, 290.42, 290.20, 294.8, 290.00, 290.21, 310.0, 294.9, 290.3, 290.43, 290.12, 780.97, 783.0, 780.93, 780.52, 780.02, 997.01, 996.2, 438.89, 438.20, 438.19, 438.9, 438.12, 438.82, 435.9, 435.8, 435.3, 435.2, 435.1, 435.0, 437.3, 437.0, 437.9, 437.1, 434.91, 434.11, 432.1, 431, 434.01, 433.11, 432.9, 430, 433.31, 433.01, 433.81, 433.21, 434.90, 436, 348.31, 349.82, 781.2, 348.30, 338.29, 782.0, 338.19, 338.3, 781.0, 781.3, 784.3, 356.9, 348.39, 338.4, 784.59, 359.4, 338.11, 348.0, 338.28, 357.81, 355.8, 347.01, 348.89, 347.00, 784.51, 350.1, 354.3, 357.6, 332.1, 354.2, 355.3, 351.0, 348.9, 358.01, 331.83, 357.7, 356.4, 358.00, 359.81, 348.2, 357.0, 349.89, 356.8, 388.30, 389.18, 372.72, 378.87, 370.06, 368.2, 368.16, 365.9, 365.22, 362.34, 780.09, 348.1, 784.0, 346.90, 346.00, 346.80, 346.30, 346.70, 346.01, 346.11, 339.3, 346.92, 346.20, 346.10, 339.12, 346.93, 780.39, 345.90, 345.80, 345.50, 345.10, 345.40, 345.3, 345.41, 345.00, 345.91, 345.70, 345.11, 345.81, 342.90, 344.1, 342.92, 342.00, 333.0, 337.9, 331.5, 337.01, 331.4, 333.1, 333.2, 331.3, 333.85, 333.90, 333.79, 333.99, 340, 332.0
Syncope/ collapse	780.2
Gastrointestinal, hepatic and pancreatic etiologies	787.01, 787.02, 578.9, 558.9, 577.0, 562.11, 560.9, 562.12, 578.1, 572.2, 569.3, 536.3, 530.81, 569.85, 574.00, 560.1, 535.50, 531.40, 787.91, 564.00, 537.83, 574.10, 578.0, 564.09, 575.0, 532.40, 560.81, 560.32, 560.0, 787.20, 536.2, 574.20, 530.19, 535.40, 530.7, 552.21, 564.1, 571.5, 575.8, 560.2, 535.41, 537.0, 530.21, 576.8, 576.2, 574.51, 535.51, 535.00, 577.1, 553.21, 530.3, 562.13, 570, 569.41, 550.11, 555.9, 569.69, 574.60, 560.89, 574.30, 531.90, 555.0, 540.9, 569.61, 532.90, 555.1, 456.0, 532.00, 556.9, 530.10, 569.1, 530.20, 556.8, 789.59, 530.5, 560.39, 530.85, 572.0, 568.81, 550.92, 556.6, 537.84, V55.2, 566, 562.10, 576.1, 569.83, 535.61, 550.10, 540.1, 579.0, 552.1, 569.82, 553.3, 552.29, 574.01, 552.00, 531.60, 532.50, 574.11, 532.41, 530.12, 574.50, 569.81, 536.8, 552.20, 553.20, 535.60, 534.10, V55.1, 562.02, 574.90, 790.5, 534.00, 531.00, 533.90, 575.10, 555.2, 530.11, 553.8, 567.82, 567.23, 537.9, 574.91, 577.9, 573.0, 574.71, 787.29, 530.82, 534.90, 564.89, 787.22, 787.3, V55.3, 537.3, 571.8, 532.10, 782.4, 577.8, 564.7, 567.22, 540.0, 552.8, 575.4, 569.49, 575.12, 574.70, 535.11, 572.3
Respiratory etiologies	491.21, 415.19, 507.0, 518.81, 518.84, 491.22, 493.22, 493.92, 511.9, 416.8, 784.7, 512.1, 786.05, 490, 415.13, 786.52, 786.30, 512.89, 515, 494.1, 493.21, 493.90, 996.84, 496, 491.20, 786.2, 511.0, 510.9, 514, 516.8, 4162, 519.19, 780.57, 416.0, 518.4, 793.19, 997.39, 786.6, 516.31, 512.0, 518.89, 518.3, 78.609, 786.03, V55.0, 417.8, 519.9, 518.51, 495.9, 278.03, 492.8, 510.0, 519.8, 493.12, 511.89
Hematologic and oncology related etiologies	V58.11, 285.9, 285.1, 198.3, 288.00, 280.9, 238.75, 162.9, 157.9, 162.3, 185, 189.0, 285.29, 197.6, 182.0, 284.11, 203.00, 153.3, 225.2, 280.0, 198.5, 285.21, 205.00, 285.22, 288.03, 157.0, 197.7, 153.4, 282.62, 146.9, 202.80, 191.3, 211.3, 227.3, 197.0, 198.4, 153.6, 162.5, 174.9, 284.19, 155.0, 287.5, 237.5, 196.0, 188.8, 218.9, 146.0, 191.2, 287.31, 220, 183.0, 238.71, 202.88, 191.1, 288.60, 239.0, 196.5, 202.83, 284.81, 151.2, 151.0, 283.0, 151.9,

	242.00, 227.0, 162.8, 174.0, 227.1, 150.9, 244.9, V58.0, 191.9, 195.0, 153.0, 240.9, 242.20, 193, 191.8, 153.1, 286.59, 151.8, 151.5, 235.9, 156.0, 205.02, 197.1, 155.1, 153.9, 209.00, 239.1, 225.1, 242.90, 211.1, 225.0, 286.9, 189.2, 213.6, 288.50, 171.5, 154.8, 202.02, 214.3, 237.3, 223.0, 162.4, 238.73, 202.86, 175.9, 200.20, 202.70, 239.5, 209.72, 283.19, 173.40, 164.2, 170.0, 198.89, 212.6, 198.6, 218.1, 154.0, 239.6, 188.9, 158.0, 212.7, 188.6, 157.2, 202.91, 511.81, 283.2, 172.8, 241.0, 281.1, 153.7, 188.0, 215.7, 289.51, 281.9, 200.33, 180.8, 204.00, 286.52, 150.4, 154.3, 201.90, 202.81, 189.1, 204.02, 287.49, 203.02, 151.1, 173.71, 238.4, V58.12, 201.92, 202.06, 141.6, 152.0, 202.10, 200.40, 209.29, 225.4, 288.09, 162.2, 197.5, 180.9, 232.4, 459.0, 154.1, 188.2, 205.10, 289.84, 145.6, 245.2
Fall and injury	820.21, 820.8, 852.21, 805.4, 808.2, 805.2, 852.20, 820.09, 820.20, 824.4, 807.03, 852.00, 805.6, 824.8, 812.00, 824.6, 820.22, 851.81, 812.09, 807.02, 920, 852.22, 808.0, 802.0, 924.01, 853.01, 823.02, 820.03, 850.0, 922.1, 812.21, 852.02, 924.11, 807.01, 822.0, 812.01, 805.06, 924.5, 824.5, 825.21, 801.23, 810.02, 952.05, 852.01, 824.0, 821.01, 812.03, 807.00, 802.20, 801.01, 821.21, 824.2, 852.26, 813.05, 813.44, 813.42, 848.8, 851.86, 831.01, 805.01, 823.00, 952.03, 802.22, 813.01, 802.29, 823.22, 823.20, 801.22, 853.00, 805.05, 821.00, 805.02, 807.09, 851.80, 952.2, 812.40, 922.31, 850.5, 802.4, 807.06, 845.09, 848.42, 952.08, 716.15, 839.08, 852.29, 836.0, 923.11, 852.24, 802.6, 820.00, 821.23, 823.82, 853.10, 921.2, 806.00, 852.06, 808.42, 831.00, 807.2, 802.21, 807.04, 807.05, 834.12, 823.01, 813.07, 802.25, 805.00, 853.06, 821.20, 844.8, 806.4, 823.81, 910.0, 812.41, 825.25, 816.01, 805.07, 922.32, 806.05, 802.8, 805.03, 924.00, 823.32, 921.1, 850.9, 852.31, 808.41, 850.11, 820.02
Hypotension	458.0, 458.9, 458.29, 458.21, 458.8, 458.1
Renal and genitourinary etiologies	584.9, 996.73, 600.01, 592.1, 584.5, 592.0, 599.71, 591, 585.6, 593.9, 581.1, 599.70, 580.89, 599.60, 596.0, 598.9, 596.89, 788.20, 593.81, 581.9, 788.29, 596.7, 600.21, 588.89, 588.1, 593.4, V56.0, 788.30, 996.81, 596.1, 594.1, 600.00
Fluid, electrolytes, or nutrition disorders	276.1, 276.51, 276.7, 276.69, 276.8, 783.7, 276.0, 276.50, 276.52, 275.42, 995.1, 276.2, 275.2, 262, 265.1, 263.9, 275.3, 275.49, 275.41, 276.9, 263.8, 276.4
Psychiatric disorders	295.70, 298.9, 295.32, 295.30, 295.74, 295.90, 295.34, 297.1, 295.81, 295.60, 295.72, 295.94, 295.64, 301.51, 296.33, 311, 2962.0, 296.90, 296.34, 296.30, 296.50, 296.32, 296.89, 296.24, 296.53, 296.54, 296.80, 296.40, 296.60, 296.64, 296.23, 296.44, 296.22, 296.63, 296.43, 296.42, 296.52, 296.14, 312.30, 300.00, 300.9, 300.01, 300.02, 309.81, 300.89, 308.3, 309.4, 309.0, 309.24, 309.9, 309.89
Chest pain	786.59, 786.50, 733.6, 786.51
Peripheral vascular disease	433.10, 453.41, 557.9, 453.42, 441.4, 45340, 455.2, 441.2, 440.24, 440.22, 4598.1, 440.21, 433.20, 557.0, 443.9, 444.22, 440.20, 441.01, 433.30, 447.1, 459.2, 453.81, 557.1, 440.1, 440.23, 453.86, 453.89, 453.85, 455.8, 451.82, 443.21, 441.7, 442.3, 453.82, 453.84, 444.81, 453.51, 453.75, 453.2, 456.8, 444.9, 785.4, 453.50, 457.8, 451.2, 441.3, 444.21, 459.33, 454.0, 457.1, 453.71, 441.02, 441.03, 442.2, 440.31, 452, 455.5, 446.6, 440.30, 442.83, 454.2, 444.09, 433.00
Endocrine disorders	250.80, 253.6, 250.60, 250.62, 250.02, 250.13, 250.82, 250.12, 250.70, 255.41, 250.72, 250.22, 251.2, 250.40, 250.92, 250.81, 250.83, 250.21, 255.5, 250.03, 250.61, 256.1, 250.63, 250.43, 250.23, 255.0, 250.10, 249.60, 250.20, 250.42, 250.90, 250.41, 250.50, 790.29, 250.00, 250.73, 251.1
Substance or medication intoxication/withdrawal	291.81, 292.0, 571.2, 969.4, 965.09, 303.91, 291.0, 303.00, 292.81, 965.00, 970.81, 962.3, 977.9, 967.9, 535.30, 304.01, 967.8, 291.2, 972.6, 965.8, 305.01, 965.01, 970.1, 303.01, 965.02, 977.8, 965.4, 571.1, 965.1, 304.21, 971.3, 305.00, 305.90, 304.71, 292.84, 969.00, 969.6, 995.29, 305.40, 969.09, 966.3, 303.90, 969.2, 966.4, 963.0, 305.50, 980.0, 974.4, 969.72, 985.8, 292.85, 291.89, 965.61, 969.05, 965.9, 304.70, 968.0, 969.8, 968.3
Rheumatologic etiologies	715.36, 715.35, 715.96, 996.42, 996.49, 996.66, 719.45, 733.42, 719.41, 715.95, 715.16, 719.7, 715.15, 738.4, 719.46, 996.47, 715.32, 996.41, 733.82, 716.95, 733.49, 718.46, 738.19, 715.31, 733.44, 719.05, 733.81, 736.79, 715.97, 719.49, 716.67, 719.16, 719.11, 728.88, 710.0, 274.01, 728.87, 729.89, 729.92, 729.5, 277.39, 446.5, 726.2, 446.29, 726.33, 274.00, 728.89, 447.6, 279.49, 729.81, 781.99, 727.05, 726.10, 729.39, 725, 446.7, 727.00, 729.2, 277.1, 726.5, 277.30, 710.3, 729.1, 729.72, 728.86, 781.94, 726.65, 277.89

Back problems and pathologic fractures	721.1, 733.13, 724.02, 721.0, 724.2, 723.0, 724.5, 722.52, 721.3, 722.10, 722.0, 723.4, 722.71, 733.11, 723.1, 722.91, 733.19, 724.00, 733.14, 722.93, 722.83, 721.90, 722.73, 721.8, 724.4, 721.42, 722.72, 722.92, 724.3
Dizziness/fatigue	780.4, 780.79, 386.11, 386.10, 386.30, 386.12, 386.00
Obstetrics and gynecological diseases	626.2, 611.0, 616.4, 648.93, 627.1, 619.1, 623.8, 621.2, 621.30, 624.8, 617.0, 618.01
Misc.	V57.89, 780.60, 790.92, 996.1, 693.0, 998.12, 959.01, 997.2, 997.49, 996.74, 998.11, 999.39, 998.13, 327.23, 998.32, 997.5, 799.02, 873.0, 998.51, 867.0, 996.68, 349.0, 996.59, 998.83, 997.62, 782.3, 933.1, 569.62, 278.01, 799.3, 997.1, 996.76, 868.04, 998.89, 935.1, 998.31, V71.4, 780.1, 945.32, 996.39, 273.3, 519.02, V71.89, 536.42, 958.3, 999.33, 867.6, 997.09, 527.3, 784.2, 996.44, 536.49, V63.8, 527.2, 998.2, 526.4, 873.42, 880.10, 692.9, 860.2, 996.77, 861.21, V69.4, 860.1, 928.21, 663.11, 539.89, 873.52, 996.82, 669.23, 866.01, 873.64, 865.03, 997.69, 942.22, 991.6, 349.31, 868.19, 271.3, 998.6, 935.2, 868.13, 996.88, V58.83, 997.02, 891.1, 944.20, 959.11, 569.79, 869.0, 996.79, 996.78, 7080, 59682, 9950, 86229, 86504, 8731, 87341, 95919, 865.01, 999.2, 996.56, 942.42, 879.3, 312.9, 958.7, 780.99, 327.25, 558.3, 903.3, 998.30, 996.75, 860.4, 890.1, V66.0, 959.7, 790.6, 865.00, V63.2, 992.1, 785.6, 955.2, 996.31, 860.0, 881.11