

Supplementary Online Content

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

eTable 1. Specific Criteria Used to Assess for the Presence of Worsening Heart Failure

Worsening heart failure definition: ≥ 1 Symptom, ≥ 2 Objective Findings (including ≥ 1 sign), AND ≥ 1 change in therapy			
Symptoms	Signs	Objective findings	Changes in therapy
Dyspnea/shortness of breath	Lower extremity edema	Tachycardia (HR >100 bpm)	New administration of IV diuretic (≥ 2 doses)
Orthopnea	Pulmonary rales/wheezing	BNP ≥ 100 ng/L	Receipt of hemodialysis/continuous renal replacement therapy
Paroxysmal nocturnal dyspnea	Jugular venous distension	Pulmonary edema on chest X-ray	
Fatigue	Third heart sound (S3)	Pleural effusion on chest X-ray	
Recent weight gain/bloating	Hepatomegaly	Cardiomegaly on chest X-ray	
Tachypnea/respiratory effort	Abdominal swelling		

Abbreviations: HR = heart rate; BNP = b-type natriuretic peptide; IV = intravenous.

eTable 2. Operational Ontologies for Specific Criteria Included the Definition of Worsening Heart Failure Using Natural Language Processing (NLP)

*indicates any character

^indicates including common word variations and conjugates

NLP query	Ontology
Shortness of breath	shor*s* of breath *dys*n*ea breathless* SOB DOE SOBOE difficult* breathing (unordered) Regex: dysp[^h]w*c
Orthopnea	Orthopnea [shortness of breath term] [lay*, lie, ly*] [down, flat] (3 words, unordered) Pillow sleep (3 words, unordered)
Paroxysmal nocturnal dyspnea	parox* nocturnal [dyspnea term] PND [Negated: clinical negations, morning, today, doesn't, (number) am] *wak* [shortness of breath term] [Negated: clinical negations, morning, today, doesn't, (number) am] *wok* [shortness of breath term]
Fatigue	fatigue letharg* no/low energy [Negated: body part term, neuro*, R, L] weakness
Weight gain	weight gain* (3 words, unordered) wt gain* (3 words, unordered) weight retain^ (3 words, unordered) wt retain^ (3 words, unordered)
Tachypnea	tach*n* [respiratory, ambulation, breathe^] [effort, work, hard, rapid, distress, labor*, difficult*] [Negated: normal, good, nl*, unlabored] (3 words, unordered) Increa* resp* rate
Rales	crackl* rhonc* rale* wheez* crepitus
Third heart sound	third* heart sound s3 s3+

NLP query	Ontology
	s3,* gall*p*
Lower extremity edema	edema* oedema* swell* fluid retain^ Additional negations: (body part term except [pedal, leg, ankle*, shin, *calf, knee, BLE, RLE, LLE]), pulm*, subcut*, scrot*, scort*, UE, LUE, RUE, dorsal, tongue, shoulder, CXR
Jugular venous distension	jug* diste*n* [jug*, neck] [venous, vei*] diste*n* *jvd* *jvp* [elev*, incr*] [venous pressure*, vei* pressure*] Additional negations: flat, marginal, [not, hard, unable, can't*, cannot*, difficult] [appre*, asses*, examin*, see*, perceive, elevate*, determine, ascertain, visual*e, judge, visible*, evaluate*, discern]
Hepatomegaly	hepato*aly* enlarge^ [no negation] liver (4 words) [Negated: /, S1, S2, S3, S4, rhythm, rrr, mu*r*] HSM
Abdominal swelling	[Negated: IVC, EJ, [JVD term]] distend^ [Negated: IVC, EJ, [JVD term]] abd* [Negated: body parts] swell^ edema
Pulmonary edema (on CXR notes only)	[pulmonary, interst*, alveolar, air*, vascular] [*dema, congestion, infiltrate] kerley B line* opacities^
Pleural effusion (on CXR notes only)	pl*u*r* [eff*s*n*, fluid] [Negated: pericardial] eff*s*n*
Cardiomegaly (on CXR notes only)	Cardiomegaly [enlarge^, large^, prominent^] [heart, card*, chamber]
Clinical Negations	Regex: \d+\d+\d+ (dates) Regex: \d+\d+ Regex: [^a-zA-Z\d\s:]no (-) [-] no [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* [him her patient pt "the patient" "the pt"] out for [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* [him her patient pt "the patient" "the pt"] out not reveal rules* the patient out for [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* out sufficient to rules* [him her patient pt "the patient" "the pt"] out adequate to rules* the patient out against rules* [him her patient pt "the patient" "the pt"] out for

NLP query	Ontology
	<p> sufficient to rules* the patient out for ought to be rules* out for rules* out not associated with resolved discontinue did rules* out rules* [him her patient pt "the patient" "the pt"] out against cannot negative for sufficient to rules* [him her patient pt "the patient" "the pt"] out against no suggestion of not rules* [him her patient pt "the patient" "the pt"] out adequate to rules* [him her patient pt "the patient" "the pt"] out did rules* the patient out against [him her patient pt "the patient" "the pt"] was not no suspicious no evidence to suggest declines* [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* the patient out for did rules* the patient out sufficient to rules* [him her patient pt "the patient" "the pt"] out for not had adequate to rules* out no other evidence test for [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* the patient out against didn't want to declined denies [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* the patient out borderline avoid [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* [him her patient pt "the patient" "the pt"] out against rat[him her patient pt "the patient" "the pt"] than not exhibit checked for did rules* the patient out for -ve </p>

NLP query	Ontology
	<p>denied evaluate for ro adequate to rules* the patient out for unwilling to might be rules* out for no findings to indicate should be rules* out for did rules* [him her patient pt "the patient" "the pt"] out against [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* out against no [sign evidence suggestion appearance symptom "clinical symptom" "other symptom"] of rules* out for will be rules* out for [without wo w/o "w / o"] sign of eval for no new adequate to rules* the patient out no cause of sufficient to rules* the patient out against not have discontinued what must be rules* out is did rules* out against did rules* [him her patient pt "the patient" "the pt"] out for rules* the patient out against no new evidence no significant not know of may be rules* out for adequate to rules* [him her patient pt "the patient" "the pt"] out for free of sufficient to rules* the patient out is to be rules* out for rules* the patient out must be rules* out for no complaints of [without wo w/o "w / o"] any evidence of [without wo w/o "w / o"] indication of r/o no radiographic evidence of not appear [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] rules* out for</p>

NLP query	Ontology
	<p>[without wo w/o "w / o"] evidence never had adequate to rules* out for not see fails to reveal to exclude rules* out against unremarkable for not feel not appreciate not complain of not demonstrate not to be not a candidate for be rules* out for absence of no mammographic evidence of denying deny* did rules* [him her patient pt "the patient" "the pt"] out cannot see no with no sufficient to rules* out no signs of no findings of not want to could be rules* out for r / o no abnormal did rules* out for [can "can be" could "could be" should "should be" must "must be" would "would be" will "will be" was] be rules* out for not known to have no evidence never developed [without wo w/o "w / o"] sufficient to rules* out against sufficient to rules* out for never</p>

eTable 3. Performance of Natural Language Processing (NLP) Queries for Specific Criteria Included the Definition of Worsening Heart Failure as Compared to Physician Manual Adjudication of Medical Records in the Validation Sample of 200 Hospitalizations

NLP query	Adjudicated positive, n (%)	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Shortness of breath	119 (59.5)	96.0	90.5	94.5	93.1
Orthopnea	40 (20)	86.4	97.4	90.5	96.2
Paroxysmal nocturnal dyspnea	15 (7.5)	90.0	98.9	90	98.9
Fatigue	63 (31.5)	86.5	99.1	98.7	90.2
Weight gain	23 (11.5)	83.3	100	100	97.1
Tachypnea	64 (32)	72.0	97.5	95.2	83.3
Rales	112 (56)	96.8	96.0	97.6	94.7
Third heart sound	2 (1)	100	100	100	100
Lower extremity edema	109 (54.5)	94.5	91.8	95.2	90.5
Jugular venous distension	35 (17.5)	88.1	97.5	90.2	96.9
Hepatomegaly	1 (0.5)	100	100	100	100
Abdominal swelling	28 (14)	86.5	98.8	94.1	97
Pulmonary edema	81 (40.5)	88.9	99.0	98.9	90.1
Pleural effusion	79 (39.5)	88.4	98.3	97.4	91.8
Cardiomegaly	88 (44)	88.2	100	100	90.7
Structured data element					
Hypoxemia (<92%)	95 (47.5)	78.7	100	100	73
Tachycardia (>100 bpm)	50 (25)	98.1	100	100	97.9
Elevated BNP (>100 ng/L)	127 (63.5)	95.3	95.9	97.6	92.1
Therapy (IV diuretics/CRRT)	138 (69)	74.6	95.2	97.2	62.8

eTable 4. Baseline Characteristics of the Cohort Based on Principal or Secondary Discharge Diagnosis of Heart Failure and Confirmed Worsening Heart Failure (WHF) Status by Natural Language Processing (NLP) Algorithm (ie, Mutually Exclusive Categories)

Characteristics, n (%)	WHF with Primary Discharge Diagnosis (N=58,042)	WHF with Secondary Discharge Diagnosis (N=62,764)	No WHF with Primary Discharge Diagnosis (N=7,315)	No WHF with Secondary Discharge Diagnosis (N=159,871)
Demographics				
Age, years, mean (SD)	75.2 (13.7)	75.0 (13.2)	74.0 (14.7)	76.1 (12.7)
Gender				
Men	30,587 (52.7)	31,775 (50.6)	3821 (52.2)	81,020 (50.7)
Women	27,452 (47.3)	30,982 (49.4)	3494 (47.8)	78,837 (49.3)
Other	1 (0.0)	1 (0.0)	0 (0.0)	2 (0.0)
Unknown/Not Reported	2 (0.0)	6 (0.0)	0 (0.0)	12 (0.0)
Self-reported race				
White	32,707 (56.4)	38,744 (61.7)	4147 (56.7)	100,242 (62.7)
Black	8911 (15.4)	6562 (10.5)	1176 (16.1)	18,254 (11.4)
Asian/Pacific Islander	6253 (10.8)	6850 (10.9)	806 (11.0)	14,542 (9.1)
Multiracial	4639 (8.0)	4899 (7.8)	565 (7.7)	13,349 (8.3)
American Indian/Alaska Native	299 (0.5)	376 (0.6)	32 (0.4)	948 (0.6)
Unknown	5233 (9.0)	5333 (8.5)	589 (8.1)	12,536 (7.8)
Hispanic ethnicity	3145 (5.4)	3902 (6.2)	374 (5.1)	7524 (4.7)
Heart failure characteristics				
Left ventricular ejection fraction category				
<40%	18,701 (32.2)	13,471 (21.5)	2601 (35.6)	25,094 (15.7)
40-49%	7389 (12.7)	7601 (12.1)	847 (11.6)	17,522 (11.0)
≥50%	27,755 (47.8)	34,973 (55.7)	2975 (40.7)	76,647 (47.9)
Unknown	4197 (7.2)	6719 (10.7)	892 (12.2)	40,608 (25.4)
Left ventricular ejection fraction, %				
Mean (SD)	46.4 (16.9)	50.5 (15.0)	44.3 (17.1)	51.4 (14.2)
Missing	4197 (7.2)	6719 (10.7)	892 (12.2)	40,608 (25.4)
Symptoms				
Shortness of breath	57,400 (98.9)	59,786 (95.3)	5680 (77.6)	102,277 (64.0)
Orthopnea	28,285 (48.7)	16,488 (26.3)	2002 (27.4)	13,366 (8.4)
Paroxysmal nocturnal dyspnea	13,675 (23.6)	7381 (11.8)	1021 (14.0)	6347 (4.0)
Tachypnea	22,975 (39.6)	27,501 (43.8)	1706 (23.3)	28,918 (18.1)
Weight Gain	14,498 (25.0)	6161 (9.8)	708 (9.7)	4164 (2.6)
Fatigue	14,157 (24.4)	16,178 (25.8)	1588 (21.7)	30,570 (19.1)
Signs				
Hypoxia (SpO ₂ <94%)	29,827 (51.4)	40,849 (65.1)	2634 (36.0)	64,309 (40.2)
Rales	51,037 (87.9)	51,036 (81.3)	4313 (59.0)	64,582 (40.4)
S3 gallop	1857 (3.2)	1040 (1.7)	175 (2.4)	861 (0.5)
Lower extremity edema	52,335 (90.2)	50,730 (80.8)	4702 (64.3)	81,536 (51.0)

Characteristics, n (%)	WHF with Primary Discharge Diagnosis (N=58,042)	WHF with Secondary Discharge Diagnosis (N=62,764)	No WHF with Primary Discharge Diagnosis (N=7,315)	No WHF with Secondary Discharge Diagnosis (N=159,871)
Jugular vein distension	23,276 (40.1)	15,862 (25.3)	1842 (25.2)	11,450 (7.2)
Hepatomegaly	660 (1.1)	655 (1.0)	73 (1.0)	1019 (0.6)
Abdominal swelling	10,718 (18.5)	10,232 (16.3)	616 (8.4)	18,161 (11.4)
Objective Findings				
Tachycardia (HR > 100 bpm)	27,833 (48.0)	39,037 (62.2)	3089 (42.2)	75,551 (47.3)
B-type natriuretic peptide ≥100 ng/L	54,846 (94.5)	50,396 (80.3)	5471 (74.8)	60,827 (38.0)
Pulmonary edema on Chest X-ray	39,390 (67.9)	43,850 (69.9)	3845 (52.6)	60,263 (37.7)
Cardiomegaly on Chest X-ray	38,994 (67.2)	37,584 (59.9)	3841 (52.5)	53,554 (33.5)
Pleural effusion on Chest X-ray	47,787 (82.3)	51,230 (81.6)	4953 (67.7)	90,801 (56.8)
Therapies				
≥2 administrations of IV diuretic	57,945 (99.8)	61,888 (98.6)	1136 (15.5)	5838 (3.7)
Dialysis or CRRT	378 (0.7)	1647 (2.6)	21 (0.3)	293 (0.2)
≥1 Symptom	58,042 (100.0)	62,764 (100.0)	5854 (80.0)	117,510 (73.5)
≥1 Sign	58,042 (100.0)	62,764 (100.0)	6064 (82.9)	126,446 (79.1)
≥1 Objective	57,798 (99.6)	62,057 (98.9)	6549 (89.5)	130,922 (81.9)
≥1 Therapy	58,042 (100.0)	62,764 (100.0)	1149 (15.7)	6085 (3.8)
Tobacco use				
Current Smoker	4652 (8.0)	5267 (8.4)	641 (8.8)	11,322 (7.1)
Former Smoker	29,620 (51.0)	32,662 (52.0)	3601 (49.2)	82,507 (51.6)
Never Smoker	23,770 (41.0)	24,835 (39.6)	3073 (42.0)	66,042 (41.3)
Medical history				
Atrial fibrillation or flutter	31,047 (53.5)	30,578 (48.7)	3616 (49.4)	77,922 (48.7)
Ventricular fibrillation or tachycardia	3571 (6.2)	3047 (4.9)	589 (8.1)	9256 (5.8)
Ischemic stroke or transient ischemic attack	5363 (9.2)	5580 (8.9)	674 (9.2)	21,038 (13.2)
Acute myocardial infarction	6312 (10.9)	9742 (15.5)	901 (12.3)	20,088 (12.6)
Prior documented heart failure	46,959 (80.9)	37,884 (60.4)	5966 (81.6)	109,648 (68.6)
Mitral or aortic valvular disease	17,264 (29.7)	16,651 (26.5)	2189 (29.9)	37,155 (23.2)
Venous thromboembolism	7040 (12.1)	8240 (13.1)	916 (12.5)	21,750 (13.6)
Hospitalized bleed	5109 (8.8)	6161 (9.8)	586 (8.0)	20,518 (12.8)
Diabetes mellitus	30,035 (51.7)	30,742 (49.0)	3340 (45.7)	74,747 (46.8)
Hypertension	49,030 (84.5)	50,854 (81.0)	5894 (80.6)	132,042 (82.6)
Dyslipidemia	50,263 (86.6)	52,234 (83.2)	6151 (84.1)	136,542 (85.4)
Hyperthyroidism	3211 (5.5)	3516 (5.6)	454 (6.2)	10,605 (6.6)
Hypothyroidism	14,052 (24.2)	14,718 (23.4)	1752 (24.0)	39,479 (24.7)
Chronic kidney disease	37,210 (64.1)	34,247 (54.6)	4364 (59.7)	84,133 (52.6)
Chronic liver disease	4525 (7.8)	4888 (7.8)	546 (7.5)	13,100 (8.2)

Characteristics, n (%)	WHF with Primary Discharge Diagnosis (N=58,042)	WHF with Secondary Discharge Diagnosis (N=62,764)	No WHF with Primary Discharge Diagnosis (N=7,315)	No WHF with Secondary Discharge Diagnosis (N=159,871)
Chronic lung disease	30,613 (52.7)	34,036 (54.2)	3508 (48.0)	83,023 (51.9)
Diagnosed depression	11,870 (20.5)	12,966 (20.7)	1553 (21.2)	38,930 (24.4)
Diagnosed dementia	5216 (9.0)	5530 (8.8)	764 (10.4)	20,782 (13.0)
Vital signs (pre-admission)				
Body mass index, kg/m ²				
Mean (SD)	29.6 (8.8)	29.6 (8.7)	28.0 (7.7)	28.4 (8.0)
Missing	4865 (8.4)	6152 (9.8)	814 (11.1)	14,233 (8.9)
Systolic blood pressure, mmHg				
Mean (SD)	123.3 (22.7)	124.7 (21.9)	122.0 (23.1)	125.3 (21.2)
Missing	4051 (7.0)	4982 (7.9)	686 (9.4)	10,995 (6.9)
Laboratory values				
Hemoglobin, g/dL				
Mean (SD)	11.5 (2.1)	11.6 (2.2)	11.8 (2.0)	11.9 (2.0)
Missing,	8372 (14.4)	10,492 (16.7)	1266 (17.3)	23,272 (14.6)
Hemoglobin A1C, %				
Mean (SD)	6.8 (1.5)	6.7 (1.4)	6.7 (1.5)	6.7 (1.5)
Missing	18,969 (32.7)	22,082 (35.2)	2771 (37.9)	57,165 (35.8)
Serum creatinine, mg/dL				
Mean (SD)	1.7 (1.1)	1.5 (1.1)	1.5 (1.0)	1.3 (0.8)
Missing	5676 (9.8)	7477 (11.9)	892 (12.2)	15,556 (9.7)
Estimated glomerular filtration rate, mL/min/1.73m ²				
Mean (SD)	47.4 (23.9)	52.8 (25.0)	50.4 (23.8)	56.2 (24.1)
Missing	5676 (9.8)	7477 (11.9)	892 (12.2)	15,556 (9.7)
B-type natriuretic peptide, pg/mL				
Mean (SD)	1075.1 (967.0)	865.4 (868.4)	1025.6 (975.9)	641.7 (748.0)
Missing	2518 (4.3)	3300 (5.3)	469 (6.4)	20,025 (12.5)
Medications				
Angiotensin-converting enzyme inhibitor	28,463 (49.0)	27,889 (44.4)	3656 (50.0)	75,552 (47.3)
Angiotensin II receptor blocker	16,456 (28.4)	15,872 (25.3)	1988 (27.2)	41,485 (25.9)
Angiotensin receptor-neprilysin inhibitor	393 (0.7)	210 (0.3)	68 (0.9)	506 (0.3)
Aldosterone receptor antagonist	10,792 (18.6)	8012 (12.8)	1495 (20.4)	20,744 (13.0)
Diuretic	49,056 (84.5)	48,202 (76.8)	5825 (79.6)	119,080 (74.5)
Beta-blocker	45,991 (79.2)	45,418 (72.4)	5644 (77.2)	120,198 (75.2)
Calcium channel blocker	25,173 (43.4)	26,285 (41.9)	2809 (38.4)	61,928 (38.7)
Antiarrhythmic drug	9328 (16.1)	8712 (13.9)	1299 (17.8)	22,446 (14.0)
Oral anticoagulant	24,778 (42.7)	23,892 (38.1)	2926 (40.0)	62,890 (39.3)
Antiplatelet drug	10,453 (18.0)	10,881 (17.3)	1310 (17.9)	30,515 (19.1)
Any anti-hypertensive drugs	51,743 (89.1)	53,690 (85.5)	6377 (87.2)	140,684 (88.0)

Characteristics, n (%)	WHF with Primary Discharge Diagnosis (N=58,042)	WHF with Secondary Discharge Diagnosis (N=62,764)	No WHF with Primary Discharge Diagnosis (N=7,315)	No WHF with Secondary Discharge Diagnosis (N=159,871)
Statins	43,674 (75.2)	44,113 (70.3)	5231 (71.5)	115,323 (72.1)
Other lipid-lowering drugs	3360 (5.8)	3368 (5.4)	455 (6.2)	10,089 (6.3)
Nitrates	23,047 (39.7)	19,368 (30.9)	2828 (38.7)	48,012 (30.0)
Vasodilators	27,396 (47.2)	23,616 (37.6)	3300 (45.1)	58,463 (36.6)
Any diabetic therapy	23,336 (40.2)	23,868 (38.0)	2593 (35.4)	56,765 (35.5)
Sodium-glucose cotransporter-2 inhibitors	59 (0.1)	39 (0.1)	7 (0.1)	115 (0.1)

Abbreviations: N = number; SD = standard deviation; HR = heart rate; IV = intravenous; CRRT = continuous renal

replacement therapy

eTable 5. List of Top 300 Principal Diagnoses for Hospitalizations for Worsening Heart Failure With a Secondary Discharge Diagnosis Code for Heart Failure

Code	Code Type	Description	N	Percent
A41.9	ICD10	Sepsis, Unspecified Organism	6546	10.43
38.9	ICD9	Unspecified Septicemia	5878	9.37
410.71	ICD9	Subendocardial Infarction, Initial Episode of Care	2968	4.73
I21.4	ICD10	Non-ST Elevation Myocardial Infarction (NSTEMI)	2487	3.96
518.84	ICD9	Acute and Chronic Respiratory Failure	1846	2.94
J96.01	ICD10	Acute Respiratory Failure with Hypoxia	1744	2.78
518.81	ICD9	Acute Respiratory Failure	1647	2.62
427.31	ICD9	Atrial Fibrillation	1592	2.54
J96.21	ICD10	Acute and Chronic Respiratory Failure with Hypoxia	1444	2.3
486	ICD9	Pneumonia, Organism Unspecified	1380	2.2
I48.91	ICD10	Unspecified Atrial Fibrillation	881	1.4
J18.9	ICD10	Pneumonia, Unspecified Organism	837	1.33
584.9	ICD9	Acute Kidney Failure, Unspecified	805	1.28
J44.1	ICD10	Chronic Obstructive Pulmonary Disease with (Acute) Exacerbation	745	1.19
N17.9	ICD10	Acute Kidney Failure, Unspecified	721	1.15
491.21	ICD9	Obstructive Chronic Bronchitis with (Acute) Exacerbation	687	1.09
424.1	ICD9	Aortic Valve Disorders	628	1
J96.22	ICD10	Acute and Chronic Respiratory Failure with Hypercapnia	530	0.84
493.22	ICD9	Chronic Obstructive Asthma with (Acute) Exacerbation	447	0.71
J96.00	ICD10	Acute Respiratory Failure, Unspecified Whether with Hypoxia or Hypercapnia	443	0.71
414.01	ICD9	Coronary Atherosclerosis of Native Coronary Artery	432	0.69
I35.0	ICD10	Non-rheumatic Aortic (Valve) Stenosis	426	0.68
I48.0	ICD10	Paroxysmal Atrial Fibrillation	402	0.64
682.6	ICD9	Cellulitis and Abscess of Leg, Except Foot	344	0.55
38.42	ICD9	Septicemia Due to Escherichia Coli [E. Coli]	328	0.52
507	ICD9	Pneumonitis Due to Inhalation of Food or Vomitus	322	0.51
424	ICD9	Mitral Valve Disorders	319	0.51
A41.51	ICD10	Sepsis Due to Escherichia Coli [E. Coli]	307	0.49
415.19	ICD9	Other Pulmonary Embolism and Infarction	296	0.47
I25.10	ICD10	Atherosclerotic Heart Disease of Native Coronary Artery without Angina Pectoris	284	0.45
J96.20	ICD10	Acute and Chronic Respiratory Failure, Unspecified Whether with Hypoxia or Hypercapnia	262	0.42
I34.0	ICD10	Non-rheumatic Mitral (Valve) Insufficiency	245	0.39
578.9	ICD9	Hemorrhage of Gastrointestinal Tract, Unspecified	242	0.39
434.91	ICD9	Cerebral Artery Occlusion, Unspecified with Cerebral Infarction	241	0.38
J69.0	ICD10	Pneumonitis Due to Inhalation of Food and Vomit	232	0.37
I26.99	ICD10	Other Pulmonary Embolism without Acute Cor Pulmonale	216	0.34
38	ICD9	Streptococcal Septicemia	211	0.34
J96.02	ICD10	Acute Respiratory Failure with Hypercapnia	199	0.32
410.11	ICD9	Acute Myocardial Infarction of Other Anterior Wall, Initial Episode of Care	193	0.31

Code	Code Type	Description	N	Percent
A41.89	ICD10	Other Specified Sepsis	193	0.31
I48.92	ICD10	Unspecified Atrial Flutter	187	0.3
K92.2	ICD10	Gastrointestinal Hemorrhage, Unspecified	185	0.29
38.49	ICD9	Other Septicemia Due to Gram-Negative Organisms	171	0.27
427.32	ICD9	Atrial Flutter	171	0.27
I47.2	ICD10	Ventricular Tachycardia	159	0.25
250.4	ICD9	Diabetes with Renal Manifestations, Type II or Unspecified Type, Not Stated as Uncontrolled	158	0.25
I48.2	ICD10	Chronic Atrial Fibrillation	158	0.25
426	ICD9	Atrioventricular Block, Complete	154	0.25
L03.116	ICD10	Cellulitis of Left Lower Limb	153	0.24
427.1	ICD9	Paroxysmal Ventricular Tachycardia	148	0.24
I44.2	ICD10	Atrioventricular Block, Complete	146	0.23
I63.9	ICD10	Cerebral Infarction, Unspecified	143	0.23
E87.1	ICD10	Hypo-Osmolality and Hyponatremia	141	0.22
599	ICD9	Urinary Tract Infection, Site Not Specified	139	0.22
I16.1	ICD10	Hypertensive Emergency	137	0.22
250.8	ICD9	Diabetes with Other Specified Manifestations, Type II or Unspecified Type, Not Stated as Uncontrolled	135	0.22
511.9	ICD9	Unspecified Pleural Effusion	135	0.22
427.89	ICD9	Other Specified Cardiac Dysrhythmias	133	0.21
I21.09	ICD10	ST Elevation Myocardial Infarction (STEMI) Involving Other Coronary Artery of Anterior Wall	133	0.21
416.8	ICD9	Other Chronic Pulmonary Heart Diseases	130	0.21
820.21	ICD9	Closed Fracture of Intertrochanteric Section of Neck Of Femur	130	0.21
J90	ICD10	Pleural Effusion, Not Elsewhere Classified	130	0.21
434.11	ICD9	Cerebral Embolism with Cerebral Infarction	126	0.2
L03.115	ICD10	Cellulitis of Right Lower Limb	126	0.2
E11.22	ICD10	Type 2 Diabetes Mellitus with Diabetic Chronic Kidney Disease	124	0.2
996.64	ICD9	Infection and Inflammatory Reaction Due to Indwelling Urinary Catheter	118	0.19
410.91	ICD9	Acute Myocardial Infarction of Unspecified Site, Initial Episode of Care	117	0.19
584.5	ICD9	Acute Kidney Failure with Lesion of Tubular Necrosis	117	0.19
38.11	ICD9	Methicillin Susceptible Staphylococcus Aureus Septicemia	116	0.18
280.9	ICD9	Iron Deficiency Anemia, Unspecified	105	0.17
A41.01	ICD10	Sepsis Due to Methicillin Susceptible Staphylococcus Aureus	105	0.17
A41.59	ICD10	Other Gram-Negative Sepsis	105	0.17
I25.110	ICD10	Atherosclerotic Heart Disease of Native Coronary Artery with Unstable Angina Pectoris	104	0.17
276.1	ICD9	Hyposmolality and/or Hyponatremia	103	0.16
820.8	ICD9	Closed Fracture of Unspecified Part of Neck of Femur	102	0.16
410.41	ICD9	Acute Myocardial Infarction of Other Inferior Wall, Initial Episode Of Care	101	0.16
N39.0	ICD10	Urinary Tract Infection, Site Not Specified	101	0.16
J44.0	ICD10	Chronic Obstructive Pulmonary Disease with (Acute) Lower Respiratory Infection	99	0.16
N17.0	ICD10	Acute Kidney Failure with Tubular Necrosis	98	0.16
427.81	ICD9	Sinoatrial Node Dysfunction	97	0.15

Code	Code Type	Description	N	Percent
I16.0	ICD10	Hypertensive Urgency	95	0.15
I49.5	ICD10	Sick Sinus Syndrome	95	0.15
414	ICD9	Coronary Atherosclerosis of Unspecified Type of Vessel, Native or Graft	92	0.15
786.59	ICD9	Other Chest Pain	92	0.15
R00.1	ICD10	Bradycardia, Unspecified	92	0.15
578.1	ICD9	Blood in Stool	91	0.14
396.2	ICD9	Mitral Valve Insufficiency and Aortic Valve Stenosis	88	0.14
I21.3	ICD10	ST Elevation Myocardial Infarction Of Unspecified Site	88	0.14
D50.9	ICD10	Iron Deficiency Anemia, Unspecified	87	0.14
I21.19	ICD10	ST Elevation Myocardial Infarction (STEMI) Involving Other Coronary Artery of Inferior Wall	86	0.14
E11.649	ICD10	Type 2 Diabetes Mellitus with Hypoglycemia without Coma	84	0.13
38.12	ICD9	Methicillin Resistant Staphylococcus Aureus Septicemia	82	0.13
491.22	ICD9	Obstructive Chronic Bronchitis with Acute Bronchitis	82	0.13
I35.2	ICD10	Non-rheumatic Aortic (Valve) Stenosis with Insufficiency	82	0.13
J81.0	ICD10	Acute Pulmonary Edema	82	0.13
I48.1	ICD10	Persistent Atrial Fibrillation	80	0.13
280	ICD9	Iron Deficiency Anemia Secondary to Blood Loss (Chronic)	77	0.12
515	ICD9	Post-inflammatory Pulmonary Fibrosis	77	0.12
I31.3	ICD10	Pericardial Effusion (Non-inflammatory)	77	0.12
562.12	ICD9	Diverticulosis Of Colon with Hemorrhage	76	0.12
A40.8	ICD10	Other Streptococcal Sepsis	75	0.12
I08.0	ICD10	Rheumatic Disorders of Both Mitral and Aortic Valves	75	0.12
T83.511 A	ICD10	Infection And Inflammatory Reaction Due to Indwelling Urethral Catheter, Initial Encounter	74	0.12
577	ICD9	Acute Pancreatitis	73	0.12
I42.0	ICD10	Dilated Cardiomyopathy	73	0.12
I24.8	ICD10	Other Forms of Acute Ischemic Heart Disease	72	0.11
8.45	ICD9	Intestinal Infection Due to Clostridium Difficile	71	0.11
518.83	ICD9	Chronic Respiratory Failure	71	0.11
T43.621 A	ICD10	Poisoning by Amphetamines, Accidental (Unintentional), Initial Encounter	71	0.11
531.4	ICD9	Chronic or Unspecified Gastric Ulcer with Hemorrhage, without Mention of Obstruction	70	0.11
R57.0	ICD10	Cardiogenic Shock	70	0.11
A41.02	ICD10	Sepsis Due to Methicillin Resistant Staphylococcus Aureus	69	0.11
38.8	ICD9	Other Specified Septicemias	68	0.11
998.59	ICD9	Other Postoperative Infection	68	0.11
780.2	ICD9	Syncope and Collapse	67	0.11
A41.81	ICD10	Sepsis Due to Enterococcus	67	0.11
532.4	ICD9	Chronic or Unspecified Duodenal Ulcer with Hemorrhage, without Mention of Obstruction	66	0.11
427.41	ICD9	Ventricular Fibrillation	65	0.1
A41.50	ICD10	Gram-Negative Sepsis, Unspecified	64	0.1
I21.A1	ICD10	Myocardial Infarction Type 2	64	0.1
I08.3	ICD10	Combined Rheumatic Disorders of Mitral, Aortic and Tricuspid Valves	63	0.1

Code	Code Type	Description	N	Percent
I25.118	ICD10	Atherosclerotic Heart Disease of Native Coronary Artery with Other Forms of Angina Pectoris	63	0.1
J45.901	ICD10	Unspecified Asthma with (Acute) Exacerbation	62	0.1
285.9	ICD9	Anemia, Unspecified	60	0.1
560.9	ICD9	Unspecified Intestinal Obstruction	59	0.09
403.9	ICD9	Hypertensive Chronic Kidney Disease, Unspecified, with Chronic Kidney Disease Stage I Through Stage IIV, or Unspecified	58	0.09
421	ICD9	Acute and Subacute Bacterial Endocarditis	58	0.09
K92.1	ICD10	Melena	58	0.09
276.7	ICD9	Hyperpotassemia	56	0.09
493.92	ICD9	Asthma, Unspecified Type, with (Acute) Exacerbation	56	0.09
R55	ICD10	Syncope and Collapse	56	0.09
I35.1	ICD10	Non-rheumatic Aortic (Valve) Insufficiency	55	0.09
I51.81	ICD10	Takotsubo Syndrome	53	0.08
A40.1	ICD10	Sepsis Due to Streptococcus, Group B	52	0.08
I21.02	ICD10	ST Elevation Myocardial Infarction (STEMI) Involving Left Anterior Descending Coronary Artery	52	0.08
I46.9	ICD10	Cardiac Arrest, Cause Unspecified	52	0.08
I47.1	ICD10	Supraventricular Tachycardia	52	0.08
I33.0	ICD10	Acute and Subacute Infective Endocarditis	51	0.08
410.01	ICD9	Acute Myocardial Infarction of Anterolateral Wall, Initial Episode of Care	50	0.08
R07.89	ICD10	Other Chest Pain	50	0.08
431	ICD9	Intracerebral Hemorrhage	49	0.08
820.09	ICD9	Other Closed Transcervical Fracture of Neck of Femur	49	0.08
997.1	ICD9	Cardiac Complications, Not Elsewhere Classified	49	0.08
I12.9	ICD10	Hypertensive Chronic Kidney Disease with Stage 1 Through Stage 4 Chronic Kidney Disease, or Unspecified Chronic Kidney Disease	49	0.08
I25.119	ICD10	Atherosclerotic Heart Disease of Native Coronary Artery with Unspecified Angina Pectoris	49	0.08
285.21	ICD9	Anemia in Chronic Kidney Disease	48	0.08
276.69	ICD9	Other Fluid Overload	47	0.07
403.91	ICD9	Hypertensive Chronic Kidney Disease, Unspecified, with Chronic Kidney Disease Stage V or End Stage Renal Disease	47	0.07
466	ICD9	Acute Bronchitis	47	0.07
I08.1	ICD10	Rheumatic Disorders of Both Mitral And Tricuspid Valves	47	0.07
K25.4	ICD10	Chronic or Unspecified Gastric Ulcer with Hemorrhage	47	0.07
537.83	ICD9	Angiodysplasia of Stomach And Duodenum with Hemorrhage	46	0.07
I24.9	ICD10	Acute Ischemic Heart Disease, Unspecified	46	0.07
38.2	ICD9	Pneumococcal Septicemia [Streptococcus Pneumoniae Septicemia]	45	0.07
38.43	ICD9	Septicemia Due to Pseudomonas	45	0.07
285.1	ICD9	Acute Post-hemorrhagic Anemia	45	0.07
427	ICD9	Paroxysmal Supraventricular Tachycardia	45	0.07
429.83	ICD9	Takotsubo Syndrome	45	0.07
786.09	ICD9	Other Respiratory Abnormalities	45	0.07
253.6	ICD9	Other Disorders of Neurohypophysis	44	0.07
518.4	ICD9	Acute Edema of Lung, Unspecified	44	0.07
572.2	ICD9	Hepatic Encephalopathy	44	0.07

Code	Code Type	Description	N	Percent
D64.9	ICD10	Anemia, Unspecified	44	0.07
E87.5	ICD10	Hyperkalemia	44	0.07
J12.1	ICD10	Respiratory Syncytial Virus Pneumonia	44	0.07
K31.811	ICD10	Angiodysplasia of Stomach and Duodenum with Bleeding	44	0.07
396.3	ICD9	Mitral Valve Insufficiency and Aortic Valve Insufficiency	43	0.07
996.71	ICD9	Other Complications Due to Heart Valve Prosthesis	43	0.07
D50.0	ICD10	Iron Deficiency Anemia Secondary to Blood Loss (Chronic)	43	0.07
I27.2	ICD10	Other Secondary Pulmonary Hypertension	43	0.07
E87.70	ICD10	Fluid Overload, Unspecified	42	0.07
J10.00	ICD10	Influenza Due to Other Identified Influenza Virus with Unspecified Type Of Pneumonia	42	0.07
T82.857 A	ICD10	Stenosis of Other Cardiac Prosthetic Devices, Implants and Grafts, Initial Encounter	42	0.07
423.9	ICD9	Unspecified Disease of Pericardium	41	0.07
782.3	ICD9	Edema	41	0.07
K57.31	ICD10	Diverticulosis of Large Intestine without Perforation or Abscess with Bleeding	41	0.07
250.7	ICD9	Diabetes with Peripheral Circulatory Disorders, Type II or Unspecified Type, Not Stated as Uncontrolled	40	0.06
574	ICD9	Calculus of Gallbladder with Acute Cholecystitis, without Mention of Obstruction	40	0.06
786.5	ICD9	Chest Pain, Unspecified	39	0.06
996.83	ICD9	Complications of Transplanted Heart	39	0.06
I44.1	ICD10	Atrioventricular Block, Second Degree	39	0.06
411.1	ICD9	Intermediate Coronary Syndrome	38	0.06
R41.82	ICD10	Altered Mental Status, Unspecified	38	0.06
S72.141 A	ICD10	Displaced Intertrochanteric Fracture of Right Femur, Initial Encounter for Closed Fracture	38	0.06
S72.142 A	ICD10	Displaced Intertrochanteric Fracture Of Left Femur, Initial Encounter for Closed Fracture	38	0.06
A41.52	ICD10	Sepsis Due to Pseudomonas	37	0.06
K62.5	ICD10	Hemorrhage of Anus And Rectum	37	0.06
R07.9	ICD10	Chest Pain, Unspecified	37	0.06
I25.5	ICD10	Ischemic Cardiomyopathy	36	0.06
I95.9	ICD10	Hypotension, Unspecified	36	0.06
396.8	ICD9	Multiple Involvement of Mitral and Aortic Valves	35	0.06
780.97	ICD9	Altered Mental Status	35	0.06
996.61	ICD9	Infection and Inflammatory Reaction Due to Cardiac Device, Implant, and Graft	35	0.06
998.11	ICD9	Hemorrhage Complicating A Procedure	35	0.06
D62	ICD10	Acute Post-hemorrhagic Anemia	35	0.06
K26.4	ICD10	Chronic or Unspecified Duodenal Ulcer with Hemorrhage	35	0.06
S72.001 A	ICD10	Fracture of Unspecified Part of Neck of Right Femur, Initial Encounter for Closed Fracture	35	0.06
969.72	ICD9	Poisoning by Amphetamines	34	0.05
I49.01	ICD10	Ventricular Fibrillation	34	0.05
285.29	ICD9	Anemia of Other Chronic Disease	33	0.05
397	ICD9	Diseases of Tricuspid Valve	33	0.05

Code	Code Type	Description	N	Percent
480.1	ICD9	Pneumonia Due to Respiratory Syncytial Virus	33	0.05
J11.00	ICD10	Influenza Due to Unidentified Influenza Virus with Unspecified Type of Pneumonia	33	0.05
414.8	ICD9	Other Specified Forms of Chronic Ischemic Heart Disease	32	0.05
482.42	ICD9	Methicillin Resistant Pneumonia Due to Staphylococcus Aureus	32	0.05
514	ICD9	Pulmonary Congestion and Hypostasis	31	0.05
562.11	ICD9	Diverticulitis of Colon (without Mention of Hemorrhage)	31	0.05
569.85	ICD9	Angiodysplasia of Intestine with Hemorrhage	31	0.05
733.13	ICD9	Pathologic Fracture of Vertebrae	31	0.05
780.09	ICD9	Other Alteration of Consciousness	31	0.05
J96.91	ICD10	Respiratory Failure, Unspecified with Hypoxia	31	0.05
T82.7X XA	ICD10	Infection and Inflammatory Reaction Due to Other Cardiac and Vascular Devices, Implants and Grafts, Initial Encounter	31	0.05
415	ICD9	Acute Cor Pulmonale	30	0.05
786.05	ICD9	Shortness of Breath	30	0.05
A40.3	ICD10	Sepsis Due to Streptococcus Pneumoniae	30	0.05
J10.1	ICD10	Influenza Due to Other Identified Influenza Virus with Other Respiratory Manifestations	30	0.05
S72.002 A	ICD10	Fracture of Unspecified Part of Neck of Left Femur, Initial Encounter for Closed Fracture	30	0.05
38.19	ICD9	Other Staphylococcal Septicemia	29	0.05
38.3	ICD9	Septicemia Due to Anaerobes	29	0.05
410.72	ICD9	Subendocardial Infarction, Subsequent Episode of Care	29	0.05
487	ICD9	Influenza with Pneumonia	29	0.05
560.81	ICD9	Intestinal or Peritoneal Adhesions with Obstruction (Postoperative) (Post-infection)	29	0.05
852.21	ICD9	Subdural Hemorrhage Following Injury without Mention of Open Intracranial Wound, with No Loss of Consciousness	29	0.05
E22.2	ICD10	Syndrome of Inappropriate Secretion of Antidiuretic Hormone	29	0.05
275.42	ICD9	Hypercalcemia	28	0.04
A40.0	ICD10	Sepsis Due to Streptococcus, Group A	28	0.04
J11.1	ICD10	Influenza Due to Unidentified Influenza Virus with Other Respiratory Manifestations	28	0.04
J15.9	ICD10	Unspecified Bacterial Pneumonia	28	0.04
J84.9	ICD10	Interstitial Pulmonary Disease, Unspecified	28	0.04
K70.31	ICD10	Alcoholic Cirrhosis of Liver with Ascites	28	0.04
K72.90	ICD10	Hepatic Failure, Unspecified without Coma	28	0.04
482.9	ICD9	Bacterial Pneumonia, Unspecified	27	0.04
I13.10	ICD10	Hypertensive Heart and Chronic Kidney Disease without Heart Failure, with Stage 1 Through Stage 4 Chronic Kidney Disease, or Unspecified Chronic Kidney Disease	27	0.04
I21.11	ICD10	ST Elevation Myocardial Infarction (STEMI) Involving Right Coronary Artery	27	0.04
I27.21	ICD10	Secondary Pulmonary Arterial Hypertension	27	0.04
I63.412	ICD10	Cerebral Infarction Due to Embolism of Left Middle Cerebral Artery	27	0.04
K80.00	ICD10	Calculus of Gallbladder with Acute Cholecystitis without Obstruction	27	0.04
S06.5X 0A	ICD10	Traumatic Subdural Hemorrhage without Loss of Consciousness, Initial Encounter	27	0.04
511.81	ICD9	Malignant Pleural Effusion	26	0.04

Code	Code Type	Description	N	Percent
R60.1	ICD10	Generalized Edema	26	0.04
162.9	ICD9	Malignant Neoplasm of Bronchus and Lung, Unspecified	25	0.04
250.42	ICD9	Diabetes With Renal Manifestations, Type II or Unspecified Type, Uncontrolled	25	0.04
396	ICD9	Mitral Valve Stenosis and Aortic Valve Stenosis	25	0.04
425.4	ICD9	Other Primary Cardiomyopathies	25	0.04
427.5	ICD9	Cardiac Arrest	25	0.04
I63.511	ICD10	Cerebral Infarction Due to Unspecified Occlusion or Stenosis of Right Middle Cerebral Artery	25	0.04
N04.9	ICD10	Nephrotic Syndrome with Unspecified Morphologic Changes	25	0.04
R78.81	ICD10	Bacteremia	25	0.04
T81.4X XA	ICD10	Infection Following a Procedure, Initial Encounter	25	0.04
T82.6X XA	ICD10	Infection and Inflammatory Reaction Due to Cardiac Valve Prosthesis, Initial Encounter	25	0.04
276.51	ICD9	Dehydration	24	0.04
410.51	ICD9	Acute Myocardial Infarction of Other Lateral Wall, Initial Episode Of Care	24	0.04
423.2	ICD9	Constrictive Pericarditis	24	0.04
571.2	ICD9	Alcoholic Cirrhosis of Liver	24	0.04
996.02	ICD9	Mechanical Complication Due to Heart Valve Prosthesis	24	0.04
997.39	ICD9	Other Respiratory Complications	24	0.04
A41.1	ICD10	Sepsis Due to Other Specified Staphylococcus	24	0.04
E66.2	ICD10	Morbid (Severe) Obesity with Alveolar Hypoventilation	24	0.04
F10.239	ICD10	Alcohol Dependence with Withdrawal, Unspecified	24	0.04
410.31	ICD9	Acute Myocardial Infarction of Inferoposterior Wall, Initial Episode of Care	23	0.04
411.89	ICD9	Other Acute and Subacute Forms of Ischemic Heart Disease, Other	23	0.04
441.01	ICD9	Dissection of Aorta, Thoracic	23	0.04
557	ICD9	Acute Vascular Insufficiency of Intestine	23	0.04
575	ICD9	Acute Cholecystitis	23	0.04
682.7	ICD9	Cellulitis and Abscess of Foot, Except Toes	23	0.04
715.36	ICD9	Osteoarthritis, Localized, Not Specified Whether Primary or Secondary, Lower Leg	23	0.04
790.7	ICD9	Bacteremia	23	0.04
799.02	ICD9	Hypoxemia	23	0.04
I12.0	ICD10	Hypertensive Chronic Kidney Disease with Stage 5 Chronic Kidney Disease or End Stage Renal Disease	23	0.04
I27.29	ICD10	Other Secondary Pulmonary Hypertension	23	0.04
K29.71	ICD10	Gastritis, Unspecified, with Bleeding	23	0.04
153.6	ICD9	Malignant Neoplasm of Ascending Colon	22	0.04
410.7	ICD9	Subendocardial Infarction, Episode of Care Unspecified	22	0.04
453.41	ICD9	Acute Venous Embolism and Thrombosis of Deep Vessels of Proximal Lower Extremity	22	0.04
535.51	ICD9	Unspecified Gastritis and Gastroduodenitis, with Hemorrhage	22	0.04
571.5	ICD9	Cirrhosis of Liver without Mention of Alcohol	22	0.04
I63.512	ICD10	Cerebral Infarction Due to Unspecified Occlusion or Stenosis of Left Middle Cerebral Artery	22	0.04
J80	ICD10	Acute Respiratory Distress Syndrome	22	0.04

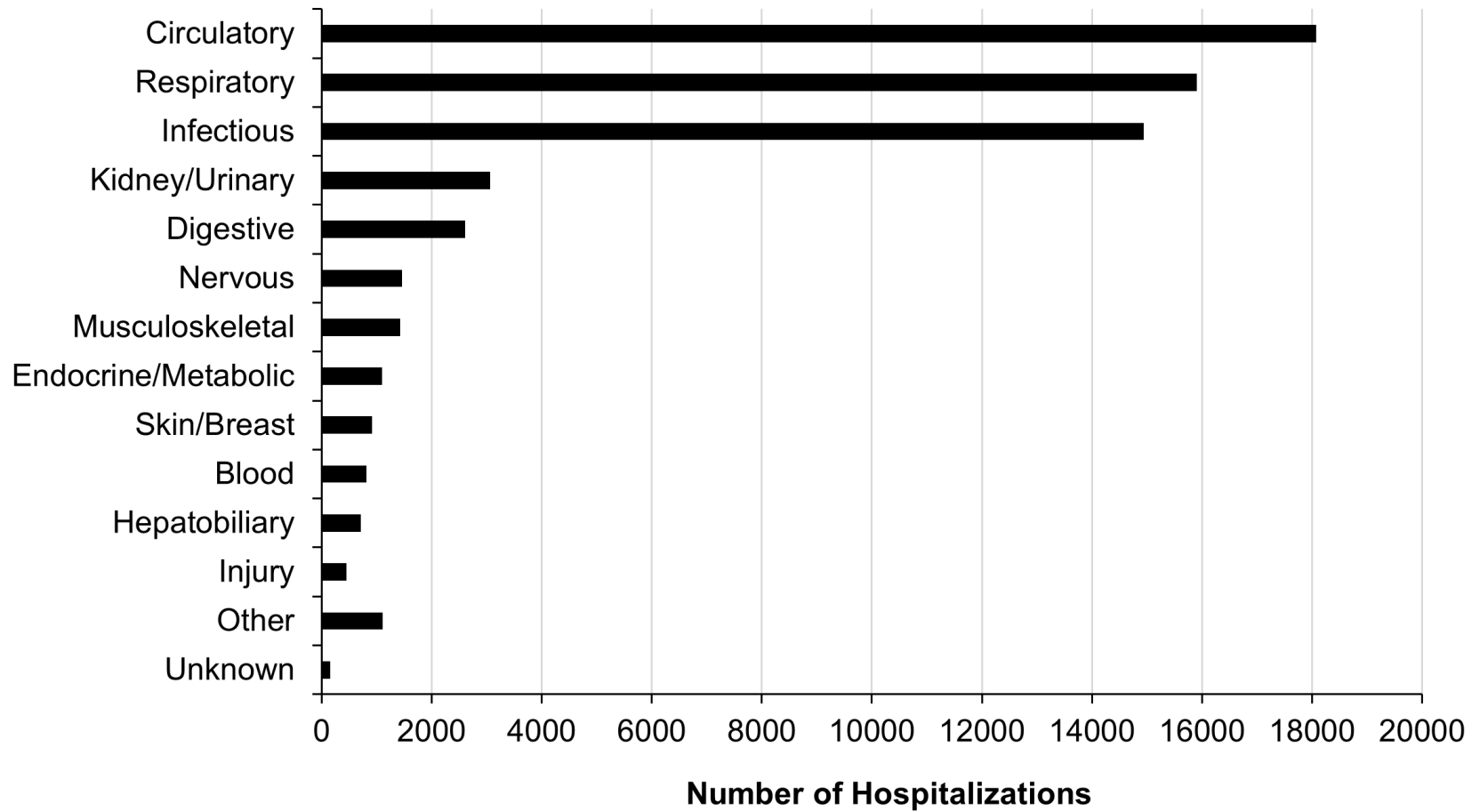
Code	Code Type	Description	N	Percent
Q23.1	ICD10	Congenital Insufficiency of Aortic Valve	22	0.04
R06.02	ICD10	Shortness of Breath	22	0.04
205	ICD9	Acute Myeloid Leukemia, without Mention of Having Achieved Remission	21	0.03
250.6	ICD9	Diabetes with Neurological Manifestations, Type II or Unspecified Type, Not Stated as Uncontrolled	21	0.03
401.9	ICD9	Unspecified Essential Hypertension	21	0.03
432.1	ICD9	Subdural Hemorrhage	21	0.03
435.9	ICD9	Unspecified Transient Cerebral Ischemia	21	0.03
441.4	ICD9	Abdominal Aneurysm without Mention of Rupture	21	0.03
458.9	ICD9	Hypotension, Unspecified	21	0.03
459.81	ICD9	Venous (Peripheral) Insufficiency, Unspecified	21	0.03
496	ICD9	Chronic Airway Obstruction, Not Elsewhere Classified	21	0.03
511.89	ICD9	Other Specified Forms of Effusion, Except Tuberculous	21	0.03
729.92	ICD9	Non-traumatic Hematoma of Soft Tissue	21	0.03
E11.52	ICD10	Type 2 Diabetes Mellitus With Diabetic Peripheral Angiopathy with Gangrene	21	0.03
I27.20	ICD10	Pulmonary Hypertension, Unspecified	21	0.03
I63.40	ICD10	Cerebral Infarction Due to Embolism of Unspecified Cerebral Artery	21	0.03
I71.01	ICD10	Dissection of Thoracic Aorta	21	0.03
K81.0	ICD10	Acute Cholecystitis	21	0.03
O90.3	ICD10	Peripartum Cardiomyopathy	21	0.03
T86.21	ICD10	Heart Transplant Rejection	21	0.03
38.4	ICD9	Septicemia Due to Gram-Negative Organism, Unspecified	20	0.03

eTable 6. Point Estimates and Associated 95% Confidence Intervals for Temporal Trends in Hospitalizations for Worsening Heart Failure, Overall and Stratified by Left Ventricular Ejection Fraction Category (Corresponding to Manuscript Figures 3 And 4)

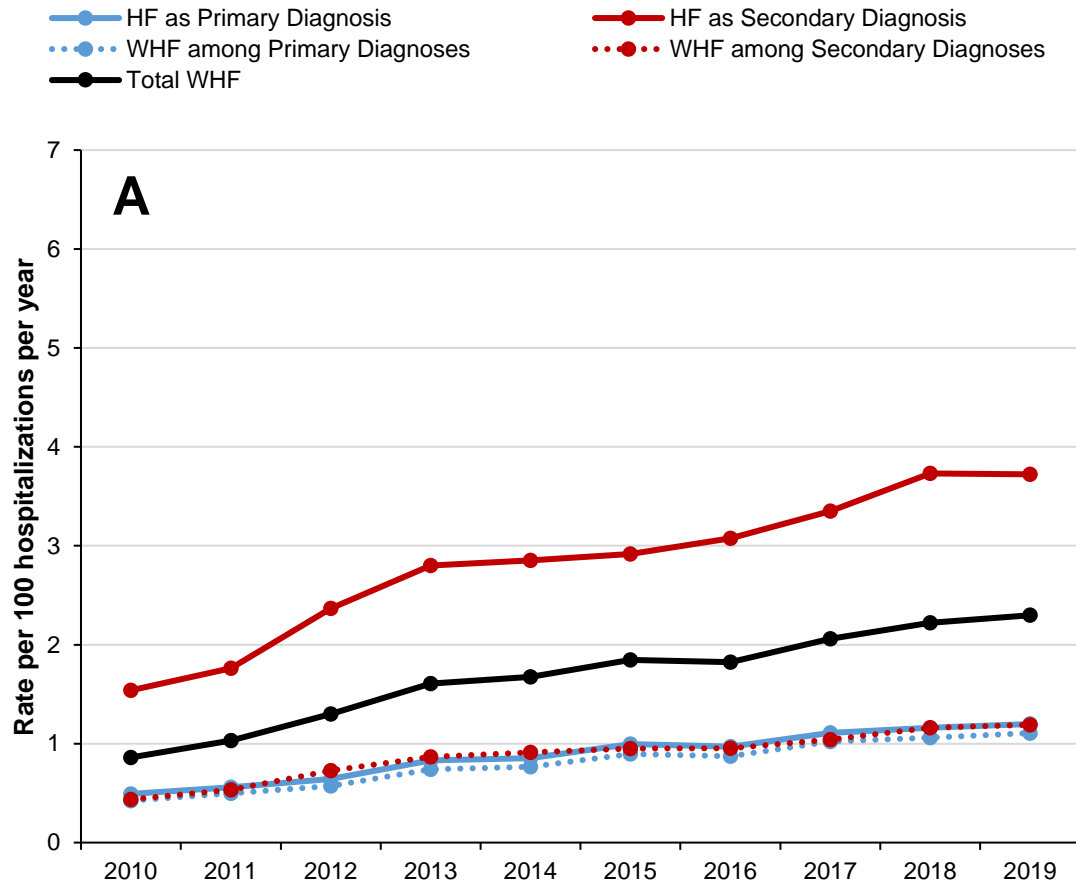
Year	Rate per 100 hospitalizations per year (95% CI)				
	HF as a Principal Discharge Diagnosis	HF as a Secondary Discharge Diagnosis	WHF among Primary Discharge Diagnoses	WHF among Secondary Discharge Diagnoses	Total WHF
Overall					
2010	3.00 (2.93, 3.08)	10.84 (10.71, 10.98)	2.54 (2.47, 2.61)	2.67 (2.60, 2.74)	5.22 (5.12, 5.31)
2011	2.95 (2.87, 3.02)	11.00 (10.86, 11.14)	2.55 (2.48, 2.62)	2.90 (2.83, 2.98)	5.45 (5.35, 5.56)
2012	2.75 (2.67, 2.82)	10.81 (10.67, 10.95)	2.38 (2.31, 2.45)	2.87 (2.80, 2.95)	5.26 (5.15, 5.36)
2013	3.04 (2.97, 3.12)	11.12 (10.98, 11.27)	2.68 (2.61, 2.76)	3.06 (2.98, 3.14)	5.74 (5.64, 5.85)
2014	3.10 (3.02, 3.18)	10.91 (10.76, 11.05)	2.71 (2.64, 2.78)	3.11 (3.03, 3.19)	5.82 (5.71, 5.92)
2015	3.40 (3.32, 3.48)	11.12 (10.98, 11.26)	3.01 (2.94, 3.09)	3.25 (3.18, 3.33)	6.27 (6.16, 6.38)
2016	3.41 (3.33, 3.49)	11.11 (10.97, 11.25)	3.03 (2.96, 3.11)	3.21 (3.13, 3.29)	6.24 (6.14, 6.35)
2017	3.66 (3.58, 3.75)	11.50 (11.36, 11.63)	3.32 (3.24, 3.39)	3.32 (3.24, 3.40)	6.63 (6.53, 6.74)
2018	3.86 (3.78, 3.94)	12.41 (12.27, 12.55)	3.53 (3.45, 3.61)	3.70 (3.62, 3.78)	7.23 (7.11, 7.34)
2019	4.04 (3.96, 4.12)	12.61 (12.46, 12.75)	3.71 (3.63, 3.79)	3.84 (3.76, 3.93)	7.56 (7.44, 7.67)
HFrEF (LVEF <40%)					
2010	1.01 (0.97, 1.06)	2.00 (1.94, 2.06)	0.85 (0.81, 0.90)	0.60 (0.57, 0.64)	1.46 (1.41, 1.51)
2011	0.96 (0.92, 1.01)	1.92 (1.86, 1.98)	0.82 (0.78, 0.86)	0.61 (0.57, 0.64)	1.43 (1.38, 1.48)
2012	0.89 (0.85, 0.94)	1.85 (1.78, 1.91)	0.75 (0.71, 0.79)	0.62 (0.58, 0.65)	1.37 (1.32, 1.42)
2013	0.99 (0.94, 1.03)	1.84 (1.78, 1.90)	0.87 (0.83, 0.91)	0.61 (0.57, 0.64)	1.48 (1.42, 1.53)
2014	1.08 (1.04, 1.13)	1.93 (1.87, 1.99)	0.93 (0.89, 0.97)	0.67 (0.63, 0.71)	1.60 (1.54, 1.66)
2015	1.13 (1.08, 1.17)	1.95 (1.88, 2.01)	0.99 (0.94, 1.03)	0.68 (0.64, 0.72)	1.67 (1.61, 1.72)
2016	1.10 (1.05, 1.15)	1.99 (1.93, 2.06)	0.98 (0.93, 1.02)	0.74 (0.70, 0.77)	1.71 (1.66, 1.77)
2017	1.22 (1.18, 1.27)	2.05 (1.99, 2.11)	1.09 (1.04, 1.13)	0.74 (0.70, 0.78)	1.83 (1.77, 1.89)
2018	1.24 (1.20, 1.29)	2.16 (2.09, 2.22)	1.13 (1.08, 1.17)	0.82 (0.78, 0.86)	1.94 (1.88, 2.00)
2019	1.20 (1.16, 1.25)	1.97 (1.91, 2.03)	1.10 (1.06, 1.15)	0.77 (0.73, 0.81)	1.87 (1.81, 1.93)
HFmrEF (LVEF 40-49%)					
2010	0.35 (0.32, 0.37)	1.00 (0.95, 1.04)	0.30 (0.28, 0.32)	0.28 (0.26, 0.30)	0.58 (0.55, 0.61)
2011	0.37 (0.34, 0.39)	1.11 (1.06, 1.16)	0.32 (0.30, 0.35)	0.32 (0.29, 0.34)	0.64 (0.60, 0.68)
2012	0.33 (0.30, 0.35)	1.19 (1.14, 1.24)	0.29 (0.26, 0.31)	0.34 (0.32, 0.37)	0.63 (0.60, 0.67)

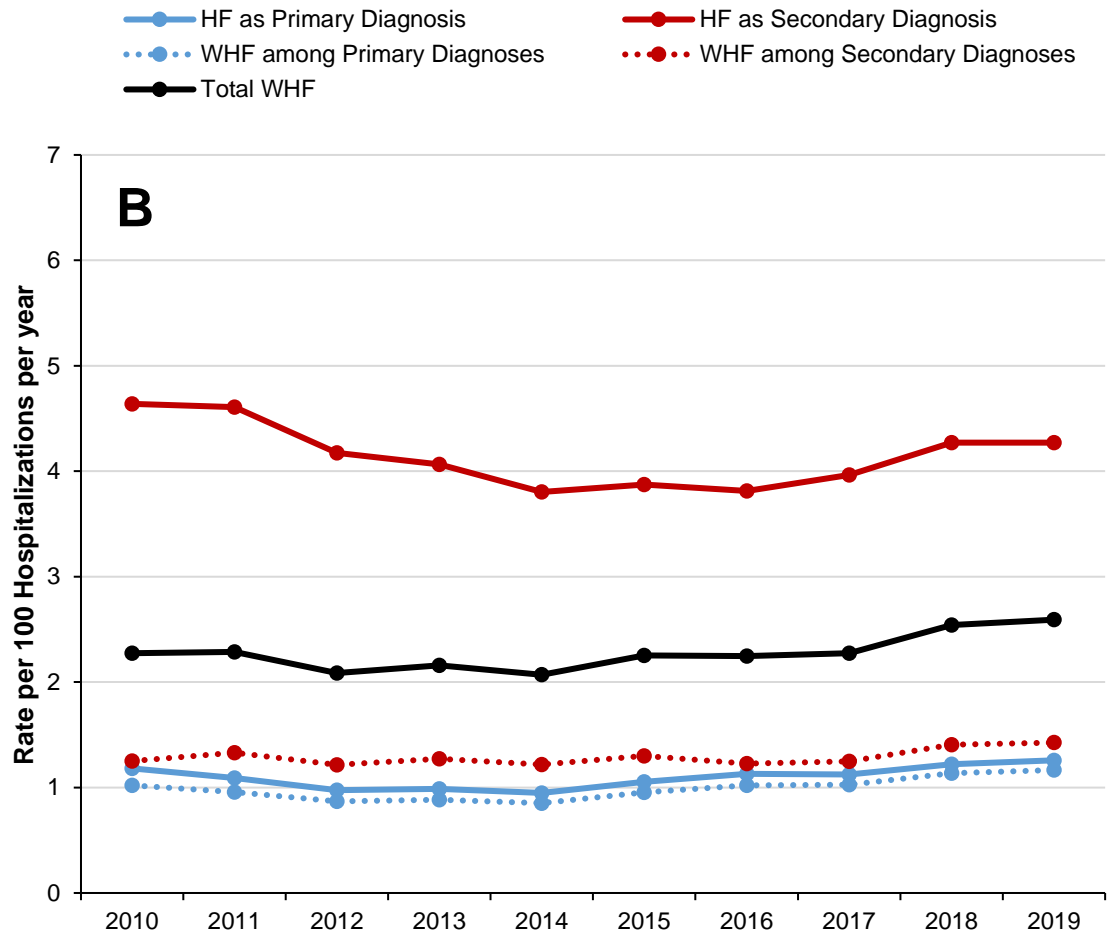
Year	Rate per 100 hospitalizations per year (95% CI)				
	HF as a Principal Discharge Diagnosis	HF as a Secondary Discharge Diagnosis	WHF among Primary Discharge Diagnoses	WHF among Secondary Discharge Diagnoses	Total WHF
2013	0.39 (0.36, 0.42)	1.24 (1.19, 1.30)	0.35 (0.32, 0.37)	0.37 (0.34, 0.40)	0.72 (0.68, 0.76)
2014	0.40 (0.37, 0.43)	1.22 (1.17, 1.27)	0.35 (0.32, 0.38)	0.40 (0.37, 0.43)	0.75 (0.71, 0.79)
2015	0.44 (0.41, 0.47)	1.25 (1.20, 1.30)	0.39 (0.37, 0.42)	0.41 (0.38, 0.44)	0.80 (0.76, 0.84)
2016	0.42 (0.39, 0.45)	1.30 (1.25, 1.35)	0.37 (0.35, 0.40)	0.39 (0.36, 0.42)	0.76 (0.72, 0.80)
2017	0.48 (0.45, 0.51)	1.37 (1.32, 1.42)	0.45 (0.42, 0.47)	0.39 (0.37, 0.42)	0.84 (0.80, 0.88)
2018	0.49 (0.46, 0.52)	1.55 (1.50, 1.61)	0.44 (0.41, 0.47)	0.47 (0.44, 0.50)	0.92 (0.87, 0.96)
2019	0.52 (0.49, 0.55)	1.55 (1.50, 1.61)	0.49 (0.46, 0.52)	0.49 (0.46, 0.52)	0.98 (0.94, 1.02)
HFpEF (LVEF ≥50%)					
2010	1.33 (1.28, 1.38)	5.18 (5.08, 5.28)	1.15 (1.10, 1.19)	1.41 (1.36, 1.46)	2.56 (2.49, 2.62)
2011	1.28 (1.23, 1.33)	5.26 (5.16, 5.36)	1.13 (1.08, 1.18)	1.55 (1.49, 1.60)	2.68 (2.60, 2.75)
2012	1.29 (1.24, 1.34)	5.35 (5.25, 5.45)	1.16 (1.11, 1.20)	1.60 (1.54, 1.66)	2.75 (2.68, 2.83)
2013	1.43 (1.38, 1.48)	5.62 (5.52, 5.73)	1.28 (1.23, 1.33)	1.77 (1.71, 1.83)	3.04 (2.97, 3.12)
2014	1.40 (1.35, 1.46)	5.44 (5.33, 5.54)	1.26 (1.21, 1.32)	1.73 (1.67, 1.79)	3.00 (2.92, 3.07)
2015	1.61 (1.55, 1.67)	5.54 (5.44, 5.64)	1.46 (1.40, 1.51)	1.84 (1.78, 1.90)	3.30 (3.22, 3.38)
2016	1.68 (1.63, 1.74)	5.59 (5.49, 5.69)	1.52 (1.46, 1.57)	1.79 (1.73, 1.85)	3.31 (3.23, 3.39)
2017	1.75 (1.69, 1.81)	5.95 (5.85, 6.05)	1.60 (1.55, 1.66)	1.89 (1.84, 1.95)	3.50 (3.42, 3.57)
2018	1.90 (1.84, 1.96)	6.45 (6.34, 6.56)	1.75 (1.69, 1.81)	2.09 (2.03, 2.16)	3.85 (3.76, 3.93)
2019	1.93 (1.88, 1.99)	6.44 (6.34, 6.55)	1.79 (1.73, 1.84)	2.12 (2.06, 2.19)	3.91 (0.00, 0.00)
Unknown EF					
2010	0.31 (0.29, 0.34)	2.67 (2.59, 2.74)	0.24 (0.22, 0.27)	0.38 (0.35, 0.41)	0.62 (0.59, 0.66)
2011	0.34 (0.31, 0.36)	2.71 (2.63, 2.78)	0.28 (0.25, 0.30)	0.43 (0.40, 0.46)	0.71 (0.67, 0.74)
2012	0.24 (0.21, 0.26)	2.42 (2.35, 2.49)	0.19 (0.17, 0.21)	0.31 (0.29, 0.34)	0.50 (0.47, 0.53)
2013	0.24 (0.22, 0.26)	2.41 (2.34, 2.48)	0.19 (0.17, 0.21)	0.31 (0.29, 0.34)	0.50 (0.47, 0.53)
2014	0.21 (0.19, 0.23)	2.32 (2.25, 2.39)	0.16 (0.14, 0.18)	0.31 (0.28, 0.33)	0.47 (0.44, 0.50)
2015	0.22 (0.20, 0.24)	2.38 (2.31, 2.45)	0.18 (0.16, 0.20)	0.32 (0.30, 0.35)	0.50 (0.47, 0.53)
2016	0.21 (0.19, 0.23)	2.23 (2.16, 2.29)	0.17 (0.15, 0.18)	0.29 (0.27, 0.32)	0.46 (0.43, 0.49)
2017	0.21 (0.19, 0.23)	2.13 (2.07, 2.19)	0.18 (0.16, 0.20)	0.29 (0.27, 0.31)	0.47 (0.44, 0.50)
2018	0.23 (0.21, 0.25)	2.25 (2.19, 2.31)	0.21 (0.19, 0.23)	0.31 (0.29, 0.34)	0.52 (0.49, 0.55)
2019	0.38 (0.35, 0.41)	2.64 (2.57, 2.71)	0.34 (0.31, 0.36)	0.45 (0.43, 0.48)	0.79 (0.00, 0.00)

eFigure 1. Major Diagnostic Categories for the Principal Discharge Diagnosis for Admissions With Heart Failure as a Secondary Discharge Diagnosis Identified as Meeting the Definition for Worsening Heart Failure

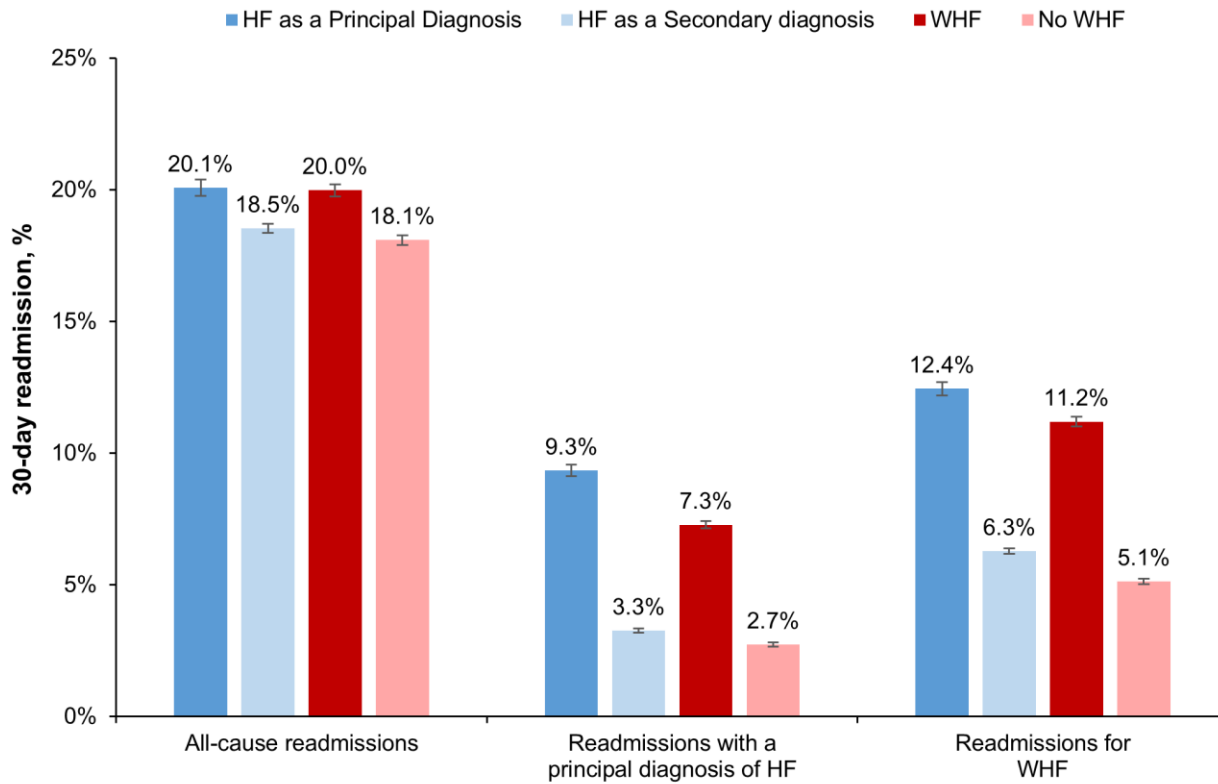


eFigure 2. Temporal Trends in Hospitalizations for Heart Failure Based on Principal Discharge Diagnosis and Diagnostic Criteria for Worsening Heart Failure for (A) Heart Failure With an Ejection Fraction Between 40-60% and (B) Heart Failure With and Ejection Fraction $\geq 60\%$





eFigure 3. All-Cause and Cause-Specific Readmission Rates Based on Principal Discharge Diagnosis and Diagnostic Criteria for Worsening Heart Failure



Abbreviations: HF = heart failure; WHF = worsening heart failure.

30-day readmission type	Overall Hospitalizations (N=287,992)	Principal Discharge Diagnosis (N=65,357)	Secondary Discharge Diagnosis (N=222,635)	Worsening Heart Failure (N=120,806)	No Worsening Heart Failure (N=167,186)
All-cause readmissions	18.9 (18.7-19.0)	20.1 (19.8-20.4)	18.5 (18.4-18.7)	20.0 (19.8-20.2)	18.1 (17.9-18.3)
Readmissions with a principal diagnosis of HF	4.6 (4.6-4.7)	9.3 (9.1-9.6)	3.3 (3.2-3.3)	7.3 (7.1-7.4)	2.7 (2.7-2.8)
Readmissions for worsening heart failure	7.7 (7.6-7.8)	12.4 (12.2-12.7)	6.3 (6.2-6.4)	11.2 (11.0-11.4)	5.1 (5.0-5.2)