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Comparative Effectiveness of Beta-Adrenergic Antagonists on the Risk of Rehospitalization in Adults With Heart Failure

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Abstract

Background. Placebo-controlled randomized trials have demonstrated the efficacy of selected β-blockers on outcomes in adults with heart failure, but the relative effectiveness of different β-blockers outside of the clinical trial setting is not well understood.

Methods and Results. We compared the 12-month risk of rehospitalization associated with receipt of different β-blockers among adults hospitalized for heart failure within two large not-for-profit health plans between January 1, 2001 and December 31, 2003. Exposure to β-blockers was ascertained from electronic pharmacy databases and readmissions within 12 months after discharge from the index hospitalization were identified from hospital discharge and billing claims databases. Demographic and clinical characteristics and receipt of other medications were identified from health plan administrative, ambulatory visit, hospital discharge, and pharmacy databases. Multivariable extended Cox regression was used to examine the association between receipt of different β-blockers and outcomes. We identified 11,396 adult members hospitalized for heart failure who had at least 12 months of continuous membership and drug benefit before the index hospitalization and during followup until being censored or experiencing an outcome event. During the analysis period between 2001 and 2003, there were 4877 person-years of exposure to β-blockers (37.7% atenolol, 44.8% metoprolol tartrate, 13.2% carvedilol, and 4.4% other). Crude rates of readmissions for heart failure were high overall during the first 12 months post-discharge (42.6 per 100 person-years) and did vary significantly among patients receiving different β-blockers (atenolol: 30.5; metoprolol tartrate: 45.3, and carvedilol 53.5). After adjustment for potential confounders, cumulative exposure to each β-blocker, and the propensity to receive carvedilol, the adjusted risks of readmission were not significantly different compared with atenolol for metoprolol tartrate (adjusted hazard ratio 0.97, 95% confidence interval [CI]: 0.87-1.08) or for carvedilol (adjusted hazard ratio 0.96, 95% CI: 0.78-1.18). Results were similar in analyses in the subgroup of patients receiving concurrent digoxin therapy, which was used as a proxy for reduced left ventricular systolic function and/or more severe heart failure.

Conclusions. In a contemporary cohort of high-risk patients hospitalized with heart failure, we found that the adjusted risks of rehospitalization for heart failure within 12 months were not significantly different among patients receiving atenolol, shorter-acting metoprolol tartrate or carvedilol.

Keywords: β-adrenergic receptor antagonist; heart failure, congestive; hospitalization; pharmacoepidemiology; quality of care.

Introduction

Background

Chronic heart failure affects more than five million Americans currently and despite recent therapeutic advances, it remains the leading cause of hospitalization and a major cause of death among Medicare beneficiaries,(1) with substantial excess direct and indirect medical costs expected to be $27.9 billion in 2005.(1) Furthermore, heart failure predominantly affects elderly persons aged 65 years or older, which make up approximately 75% of the heart failure population nationwide. Unlike other major cardiovascular conditions, the burden of heart failure has continued to increase substantially over the past several decades. The reasons for this are unclear but the parallel epidemics of hypertension, obesity, and diabetes mellitus as well as possibly improved survival from acute myocardial infarction and improved treatment of existing patients with heart failure are important contributors. Better preventive and therapeutic strategies are clearly warranted to reduce the burden of heart failure and its associated complications.

Context

Various angiotensin-converting enzyme (ACE) inhibitors,(2-4) aldosterone receptor antagonists,(5, 6) and angiotensin II receptor blockers(7-11) have beneficial effects on mortality and morbidity in patients with heart failure, especially in those with left ventricular systolic dysfunction (i.e., left ventricular ejection fraction <35% or <40%). While other medications are also commonly used for heart failure-related symptom control (e.g., digoxin and diuretics), a major addition to the pharmacological armamentarium has been β-adrenergic receptor antagonists (β-blockers). β-blockers are potent inhibitors of sympathetic nervous system activation which is a major contributor in the complications of heart failure. For example, neurohormonal activation associated with the failing heart can lead to excessive peripheral arterial vasoconstriction and promotion of ventricular dilatation (12). Other complications associated with overactivity of the sympathetic nervous system include development of cardiac hypertrophy, coronary artery vasoconstriction with associated cardiac ischemia, increased vulnerability to the initiation and propagation of malignant ventricular arrhythmias, impaired renal function, and enhanced cardiac myocyte apoptosis. These negative effects are largely mediated through interactions with the α1-, β1-, and β2-adrenergic receptors. Advances in our understanding of the contribution of neurohormonal dysregulation to excess morbidity and mortality led to the conduct of several notable randomized trials of the efficacy of β-blockers in heart failure.

The major randomized clinical trials proving the favorable effect of β-blockers on adverse outcomes in patients with heart failure have primarily been placebo-controlled evaluations of extended-release metoprolol succinate (Metoprolol CR/XL)(13), bisoprolol,(14) and carvedilol(15, 16). Recently, one of the only randomized trials focused on the elderly with heart failure, the SENIORS study, assigned 2128 persons age ≥ 70 years and a hospitalization for heart failure during the prior year and/or left ventricular ejection fraction ≤ 35% to receive either nebivolol (1.25 to 10 mg per day) or placebo.(17) Patients in the nebivolol arm had a 14% (P=0.039) lower relative risk of the primary outcome (death or cardiovascular hospitalization)

compared with placebo, but there was no significant benefit for all-cause mortality alone (adjusted hazard ratio 0.88, 95% CI: 0.71-1.08; P=0.21).(17) Despite these generally positive findings for selected β-blockers, arguments against a general class effect come from negative placebo-controlled trials of other β-blockers for the outcome of total mortality, including bucindolol(18) and xamoterol(19) in patients with New York Heart Association (NYHA) Class III/IV heart failure. Specific reasons for why certain β-blockers would not be beneficial compared with others are poorly understood.

Overall, there have been few head-to-head comparisons among the available set of oral β-blockers. The COMET randomized trial compared carvedilol (25 mg per day) against metoprolol tartrate (50 mg twice daily) in 1518 patients with NYHA Class II-IV heart failure and reduced systolic function. It showed that carvedilol provided a modest incremental benefit on all-cause mortality (hazard ratio 0.83, 95% CI: 0.74-0.93), but carvedilol did not significantly reduce the risk of rehospitalization for heart failure (hazard ratio 0.98, 95% CI: 0.86-1.02) and there were no significant differences in resting heart rate between the two agents.(20) In addition, carvedilol is substantially more expensive that other β-blockers and it is not clear whether the relatively low dose of metoprolol tartrate used as the comparator arm explained, at least in part, the observed findings in the COMET study. A small randomized, non-blinded trial in Serbia of 150 patients with heart failure being treated with an ACE inhibitor and a diuretic observed a higher 12-month overall survival with metoprolol [type not specified] (88%) and atenolol (78%) compared with no β-blocker (47%).(21) However, there are no published large-scale evaluations of clinical outcomes that compare the collective set of available β-blockers, including the widely used generic β-blocker, atenolol, or higher doses of shorter-acting metoprolol tartrate that are often prescribed in clinical practice. Given that many β-blockers are already in generic formulations, it is highly unlikely that they will be systematically evaluated in future industry-sponsored randomized clinical trials.

Significance

With the expanding heart failure population nationally, the health care system faces tremendous challenges in providing optimal medical care to reduce both morbidity and mortality associated with this condition. Rollout of Part D of Section 1013 of the Medicare Modernization Act of 2003 emphasizes the need to find cost-effective preventive and therapeutic strategies for high-risk Medicare populations such as those with heart failure. Previous studies have shown that elderly patients with heart failure are often undertreated, and provision of the Medicare prescription drug benefit will facilitate expanded use of heart failure therapies. For the drug class of β-blockers, this is particularly relevant given that only the more expensive β-blockers have been tested in clinical trials in adequate numbers using clinically relevant endpoints. Yet, it is critical for payors, clinicians and patients to know whether the commonly prescribed generic formulations provide similar clinical benefit.

Objectives of the Study

To address these issues, we conducted a retrospective cohort study of the association between receipt of different types of β-blockers and the risk of rehospitalization for heart failure among a large, contemporary sample of adults hospitalized for heart failure. We also examined

differences in characteristics between patients who did or did not receive β-blockers at the time of discharge from a hospitalization for heart failure.

Methods

Settings

Patients were identified from two geographically diverse sites within the HMO Research Network Center for Education and Research on Therapeutics (CERTs) DEcIDE Center sponsored by the Agency for Healthcare Research and Quality (AHRQ). Kaiser Permanente of Northern California is a large integrated health care delivery system that provides comprehensive inpatient and ambulatory care for more than 3.2 million members in the San Francisco and greater Bay area, and its population is highly representative of the local and surrounding state population other than slightly lower representation at the extremes of age and income.(22) Harvard Pilgrim Health Care is a not-for-profit network-based health care plan operating in Massachusetts, New Hampshire, and Maine providing care to more than 900,000 members. HPHC includes a health maintenance organization (HMO), a point-of-service (POS), a preferred provider organization (PPO) plan and a Medicare benefit.

Human Subjects Review

The study was approved by institutional review boards at the Kaiser Foundation Research Institute and Harvard Pilgrim Health Care. Waiver of informed consent was obtained because of the nature of the study.

Participants

Using hospital discharge databases within each participating site, we identified all adults hospitalized between January 1, 2001 and December 31, 2003 with a primary discharge diagnosis of heart failure based on the following *International Classification of Diseases, Ninth Edition, Clinical Modification* (ICD-9-CM) codes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 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 and 428.9 (See **Appendix I** for detailed description of codes and cohort assembly methods). These codes have been shown to have a positive predictive value of more than 95% for clinical heart failure using Framingham criteria derived from medical records review.(23) We excluded patients if they were less than 18 years old on the date of admission for the index hospitalization, had a length of stay in the index hospital plus any contiguous hospital lasting less than 24 hours, or were known to have died during the index hospitalization. We next excluded individuals who did not have continuous membership and a pharmacy drug benefit for at least 12 months before the admission date in all patients. Comprehensive information on the occurrence and timing of death was available through 2004 in one participating health plan and through 2003 in the other participating health plan. Thus, for all patients whose index date was between 2001 and 2003, we required at least 12

months of continuous membership and pharmacy benefit after the discharge date of the index hospitalization or until the date of death if it occurred before the end of followup. However, for individuals whose index date occurred in 2003, we applied the post-discharge membership and pharmacy benefit requirement only for patients receiving care in the health plan with complete mortality data through 2004.

Study Design

We conducted a retrospective cohort study with outcomes up to 12 months following discharge from an index hospitalization for heart failure.

Data Sources

The primary data sources were automated clinical and administrative electronic databases that included diagnosis, procedure, and medication-related information that were collected as part of routine clinical care at both sites for hospital-based and ambulatory settings. Relevant diagnoses were identified using ICD-9 codes and procedures were identified using both ICD-9-CM and current procedural terminology (CPT) codes.

Identification of deaths among cohort members occurring at Kaiser Permanente of Northern California between 2001 through 2004 was based on health plan databases along with California State death certificate registry files (24). Deaths from any cause were identified using Massachusetts State death files for cohort members identified at Harvard Pilgrim Health Care.

Interventions

This was an observational study of the comparative effectiveness of different β-blockers among patients discharged alive following a hospitalization for heart failure, so there were no interventions.

Measures

Receipt of β-Blockers

The primary exposure of interest was time-dependent receipt of β-blockers. We searched automated pharmacy databases during the 12 months before and after the index hospitalization to determine the receipt of any oral β-blocker, which included acebutolol, atenolol, bisoprolol, carvedilol, labetalol, metoprolol succinate, metoprolol tartrate, nadolol, pindolol, propranolol, sotalol, and timolol. These agents represented the available set of oral β-blockers within the participating health plans and were confirmed based on a search of pharmacy databases for all generic and brand name formulations, including both individual and combination therapies, supplemented by NDC and American Hospital Formulary Service (AHFS) codes. Of note, there were no formulary restrictions for use of these β-blockers at either participating health plan.

We used data on filled outpatient prescriptions for β-blockers and estimated the timing and duration of receipt of β-blockers based on estimated day supply per prescription and refill patterns. For any two consecutive prescriptions, we examined the time (in days) between the

projected end date of the first prescription and the date of the next filled prescription. Given that dose adjustment is not uncommon in the use of cardiovascular therapies, we allowed a "grace period" of 14 days between prescriptions. Thus, if the time between the projected end date of the first prescription and fill date of the next prescription was 14 days or less, we considered that individual continually receiving β-blocker therapy. If the refill interval was more than 14 days, then the individual was considered off β-blocker therapy starting the day after the projected end date of the first prescription until the date of next filled prescription, if any. For patients with more than one β-blocker prescription filled on the same day, we used the prescription with the longest estimated day supply. As concurrent use of multiple β-blockers in the setting of heart failure is not clinically indicated,(25) if we observed that a patient filled a prescription for a different β-blocker before the projected end date for an existing β-blocker prescription, the patient was considered off the previous β-blocker as of the fill date of the later prescription for the different β-blocker.

We also classified the total duration (in days) of exposure to each of the different β-blockers during the 12 months before and up to 12 months after the index hospitalization using the methods described above and subtracting the total number of hospital days during this period as it is unlikely that patients would be taking their own medications during an acute hospitalization. In addition, for each of the different β-blockers, we calculated the proportion of days covered after discharge from the index hospitalization among patients receiving the various agents as another proxy for medication adherence.

Followup

Cohort members were followed for up to 12 months after discharge from the index hospitalization. Patients were censored due to death or the end of followup. As noted previously, all cohort members had to have continuous health plan membership during the 12 months after the index hospitalization or until an outcome event or a censoring event.

Rehospitalization for Heart Failure

The primary outcome of interest was rehospitalization for heart failure during the first 12 months following the index hospitalization during the study period. We identified readmissions for heart failure based on hospitalizations with a primary discharge diagnosis of heart failure using the same ICD-9-CM codes described for identifying the cohort: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 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 and 428.9. Consecutive hospitalizations in which the admission date of the second hospitalization was within three calendar days of the discharge date of the first hospitalization were considered a single clinical episode.

Covariates

Sociodemographic characteristics included age, gender, and time-updated insurance type (Medicare+Choice, commercial, self-pay, MediCal/Medicaid, or other) identified from administrative health plan databases. To account for possible temporal trends in heart failure

severity, treatment or outcomes, we also included calendar year of the index hospitalization as well as the index hospitalization length of stay (in days).

We used hospital discharge diagnoses or inpatient billing claims to identify hospitalizations for heart failure occurring during the 12 months before the index hospitalization using the same ICD-9-CM codes described above. To ascertain relevant coexisting illnesses, we used relevant hospital discharge diagnoses/procedures or inpatient claims and ambulatory diagnoses or outpatient physician diagnosis claims during the 12 months before the index hospitalization for the following conditions (see **Appendix II** for detailed description of ICD-9-CM and CPT codes as well as corresponding data sources). Prior cardiovascular disease included acute coronary syndrome (acute myocardial infarction or unstable angina), angina or diagnosed coronary artery disease, percutaneous coronary intervention, coronary artery bypass surgery, ischemic stroke or transient ischemic attack, and peripheral arterial disease.

We used a previously validated approach (26) to identify diabetes mellitus that was based on meeting any of the following: primary hospital discharge diagnosis for diabetes mellitus or diabetic complication, two or more outpatient diagnoses of diabetes mellitus, or a filled prescription for an anti-diabetic medication. Female patients who were identified only as having gestational diabetes were not considered as having diabetes mellitus. Hypertension was based on having either two or more outpatient diagnoses of hypertension or one outpatient diagnosis plus a filled prescription for an antihypertensive medication.(27) Dyslipidemia was defined as having an outpatient diagnosis for dyslipidemia and/or receipt of a lipid-lowering medication.(27) End-stage renal disease was identified either by documented receipt of renal replacement therapy (hemodialysis, peritoneal dialysis or renal transplantation) or a diagnosis of chronic renal failure. We also identified prior chronic lung disease (asthma, reactive airway disease, or chronic obstructive pulmonary disease), chronic liver disease (chronic hepatitis or cirrhosis), diagnosed atrial fibrillation or atrial flutter, known systemic cancer (other than non-melanoma skin cancer), diagnosed dementia or psychiatric disorder, and diagnosed depression.

We also used data from filled outpatient prescriptions found in pharmacy databases to assign prior and post-discharge receipt of other cardiovascular medications that may influence outcomes including angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARB), digoxin, thiazide and loop diuretics, nitrates, hydralazine, aldosterone receptor antagonists, calcium channel blockers, α-adrenergic receptor antagonists, 3-hydroxy-methylglutaryl-coenzyme A reductase inhibitors (statin), and other lipid-lowering agents. We used the same approach as described above for β-blockers to characterize time-dependent exposure to these medications.

Statistical Analyses

All analyses were performed using SAS statistical software, version 9.0 (Cary, N.C.). A two-sided P value less than 0.05 was considered significant. Continuous variables were reported as means with standard deviations or medians with interquartile ranges, as appropriate. Categorical variables were reported as frequencies and proportions. We compared baseline characteristics between patients receiving or not receiving a β-blocker using Student's t-test or Wilcoxon rank sum test for continuous variables and chi-square test for categorical variables. We also used the same methods to compare characteristics among patients by health plan, and by type of β-blocker received in the subgroup of patients receiving any β-blocker.

For rate calculations and subsequent multivariable modeling, we used the following categories for β-blocker exposure: atenolol, metoprolol tartrate, carvedilol, other β-blockers, and no β-blocker. While use of long-acting metoprolol succinate was an *a priori* interest, it was included in the category of "other β-blockers" because too few cohort members received this agent to allow for stable point estimates. Crude rates (per 100 person-years) of rehospitalization for heart failure during the first 12 months following the index hospitalization by β-blocker exposure category were calculated using Poisson regression with generalized estimating equations to account for clustering effects within subjects for exposure to specific β-blockers and for repeated non-fatal hospitalizations for heart failure.

As an observational study of treatment and outcomes in clinical practice, there is a concern about treatment selection bias contributing to the observed results. Our primary goal was to examine differences in readmission rates among patients with heart failure receiving different types of β-blockers, rather than a treatment vs. no treatment comparison. This removes a major source of treatment selection bias. However, receipt of different types of β-blockers among β-blocker users may be non-random, so we calculated the likelihood of receiving carvedilol (the most specific β-blocker for heart failure) using propensity score methodology.(28) For the propensity score logistic regression model, all baseline characteristics listed in **Table 1** were included as candidate variables.

Multivariable regression was performed using extended Cox models in the overall cohort as well as the subgroup of patients receiving concurrent digoxin therapy. For the latter subgroup analysis, receipt of digoxin was used as a proxy for symptomatic heart failure with probable reduced left ventricular systolic function—one of the primary reasons for its use in the setting of heart failure (25)—because we did not have information on level of left ventricular ejection fraction or fractional shortening. Selection of covariates for the final model was based on variables previously reported to be associated with either receipt of heart failure therapies or adverse outcomes in persons with heart failure. Specifically, we adjusted for the following covariates: health plan, age, sex, calendar year of cohort entry, time-varying Medicare insurance status, index hospitalization length of stay, prior hospitalization for heart failure, cardiovascular history, other coexisting illnesses, time-varying use of other cardiovascular medications, cumulative exposure to each β-blocker during the period starting 12 months before the index hospitalization and throughout followup, and the baseline propensity score (in quartiles) for receiving carvedilol. For all models, we used a "sandwich" estimate of the variance-covariance matrix to obtain standard errors accommodating the clustering of observations (i.e., non-fatal hospitalizations for heart failure) on subjects.(29) Finally, we conducted an additional model that contained separate interaction terms for β-blocker category and age category, sex, diabetes, and hypertension, which were selected *a priori* as potentially relevant interactions.

Results

Principal Findings

Cohort Assembly and Baseline Characteristics

Between January 1, 2001 and December 31, 2003, we identified a total of 11,396 adult health plan members at the two participating sites who were survivors of a hospitalization for heart failure and met eligibility criteria. The median length of stay for the index hospitalization in the overall cohort was 3 days (interquartile range 2 to 5 days). Only 4.0% of the cohort had a prior documented hospitalization for heart failure during 12 months before the index hospitalization.

Mean age of cohort members was 73.9 years and 78.1% of patients were aged 65 years or older as of their index date (**Table 1**). Nearly half of the cohort were women, and there was a lower proportion of the cohort identified in the latter two years of the inception period: 37.6% in 2001, 32.5% in 2002, and 29.9% in 2003. Overall, more than 75% of the cohort was covered by Medicare and/or Medicaid insurance (**Table 1**). As expected, there was a high prevalence of prior known cardiovascular disease as well as cardiovascular factors (e.g., diabetes, hypertension, and lipid disorders). In addition, diagnosed chronic lung disease (22%) and atrial fibrillation/flutter (25%) were common.

Baseline Characteristics by Health Plan

There were several relevant differences observed between patients in the two participating health plans (**Table 1**). Compared with patients from Kaiser Permanente of Northern California, patients from Harvard Pilgrim Health Care were slightly younger, more likely to have commercial insurance coverage, have a higher median length of stay for the index hospitalization, and a higher prevalence of prior acute coronary syndrome or angina/diagnosed coronary artery disease, peripheral arterial disease, diagnosed hypertension, diagnosis of end-stage renal disease/chronic renal failure, chronic lung disease, known atrial fibrillation or flutter, and diagnoses of systemic cancer. Patients from Harvard Pilgrim Health Care were less likely to have prior coronary revascularization, diabetes mellitus and diagnosed dyslipidemia.

Baseline β-Blocker and Cardiovascular Medication Use

In the overall cohort, 35.0% of patients received atenolol, 42.4% received metoprolol tartrate, 0.3% received metoprolol succinate, and 13.0% received carvedilol within 30 days prior to admission for the index hospitalization; other β-blockers were infrequently used (**Table 2**). There were no material differences in the distribution of the rate of use and type of β-blockers at baseline between health plans. Compared with patients from Kaiser Permanente of Northern California, patients from Harvard Pilgrim Health Care were less likely to receive ACE inhibitors, digoxin, diuretic, nitrates, hydralazine, aldosterone receptor antagonists, calcium channel blockers, α-adrenergic receptor antagonists, and statins (**Table 2**).

Predictors of Receiving ß-Blockers at Hospital Discharge or During Followup

Overall, 70.4% of patients received a β-blocker at discharge and/or during the 12 months following discharge from the index hospitalization. We compared baseline characteristics between patients who were received β-blockers at discharge or during followup and those patients who did not receive any β-blocker (**Table 3**). Patients receiving a β-blocker were an average of 2.9 years younger, and less likely to be female, to be identified early in the study period, and to have Medicare+Choice insurance coverage. There was no difference in the median length of stay for the index hospitalization or likelihood of prior hospitalization for heart failure. Conversely, patients receiving a β-blocker were more likely to have prior diagnosed cardiovascular disease of all types, diabetes, hypertension, diagnosed or treated dyslipidemia, end-stage renal disease/chronic renal failure, atrial fibrillation or flutter, and cancer (**Table 3**). Receipt of β-blockers at hospital discharge or during followup was also associated with use of β-blockers before admission as well as prior receipt of ACE inhibitors, ARBs, diuretics, nitrates, Hydralazine, aldosterone receptor antagonists, calcium channel blockers, α-adrenergic receptor antagonists, and statins or other lipid-lowering agents (**Table 3**).

We next performed a multivariable logistic regression model to identify independent predictors of receiving a β-blocker at discharge from the index hospitalization; all baseline characteristics were considered as candidate variables for the model (**Table 4**). Characteristics associated with lower odds of receiving a β-blocker at discharge included older age, index hospitalization in 2002, and having prior angina or coronary artery disease, diabetes or chronic lung disease. Variables associated with higher odds of receiving a β-blocker at discharge included prior admission for acute coronary syndrome, prior coronary revascularization, known hypertension, prior receipt of certain heart failure-related medications (ACE inhibitors, ARBs, digoxin, diuretics, and nitrates) and prior receipt of statins.

Baseline Characteristics by Type of ß-Blocker Received

At discharge from the index hospitalization or during followup, 8029 cohort members received one or more β-blockers. **Table 5** shows the distribution of baseline characteristics among treated patients who received atenolol, metoprolol tartrate, carvedilol, or other β-blockers. The primary comparisons of interest were metoprolol tartrate vs. atenolol and carvedilol vs. atenolol. Compared with patients receiving atenolol, minimal differences were noted for patients receiving metoprolol tartrate, who were slightly younger and male; more likely to have a history of acute coronary syndrome, diagnosed kidney disease and chronic lung disease; receive digoxin and aldosterone receptor antagonists; but less likely to have known hypertension or receive calcium channel blockers. However, compared with atenolol, those receiving carvedilol were more likely to be significantly younger and male, to have commercial insurance coverage, and to have a lower prevalence of prior acute coronary syndrome, angina or coronary artery disease, prior stroke or transient ischemic attack, diagnosed hypertension, end-stage renal disease/chronic renal failure, atrial fibrillation or flutter, diagnosed dementia or psychiatric disorders, and baseline calcium channel blocker or α-adrenergic receptor antagonists (**Table 5**). On the other hand, those receiving carvedilol were more likely to receive ACE inhibitors, ARBs, digoxin, hydralazine, and aldosterone receptor antagonists at baseline (**Table 5**).

Outcomes

Rates of Rehospitalization for Heart Failure Within 12 Months

We analyzed the 12-month rates of rehospitalization for heart failure by type of β-blocker received as well as for periods off β-blockers among the 7883 cohort members identified between 2001 and 2002 who had complete outcome and censoring data for the 12 months following the index hospitalization. The crude rate (per 100 person-years) of rehospitalization for heart failure was lowest for treatment with atenolol (30.5), followed by other β-blockers (32.5), metoprolol tartrate (45.3), carvedilol (53.5) (**Figure 1**). Observed differences compared with atenolol were statistically significant for metoprolol tartrate and carvedilol. Compared with atenolol, the crude rate of hospitalization was also higher for periods off β-blockers ($P<0.001$) (**Figure 1**).

Comparative Effectiveness of β-Blockers on Rehospitalization for Heart Failure

We next conducted a series of multivariable analyses in the overall cohort of the comparable effectiveness of metoprolol tartrate and carvedilol versus atenolol on the primary outcome of interest (**Table 6**). After adjustment for site, calendar year of entry, demographic features and insurance status, prior hospitalization for heart failure, prior cardiovascular history, index hospitalization length of stay, and other comorbid conditions, time-varying use of other cardiovascular medications, baseline propensity to receive carvedilol, and cumulative duration of exposure to each β-blocker before and after the index hospitalization, there was no significant difference in the relative risk of rehospitalization for metoprolol tartrate (adjusted hazard ratio 0.97) or carvedilol (adjusted hazard ratio 0.96) compared with receipt of atenolol (**Table 6**). Of note, there was a 28-29% higher adjusted relative risks of rehospitalization associated with receiving other β-blockers or not receiving β-blockers during followup that were statistically significant. We did not find any significant interaction between β-blocker category and age group, sex, diabetes status, or the presence or absence of known hypertension (data not shown).

We also performed similar multivariable analyses in the subgroup of 1683 patients who received concurrent digoxin therapy, which was used as a possible proxy for patients that may have reduced left ventricular systolic function and/or more severe heart failure (**Table 6**). In this subgroup, after extensive adjustment for potential confounders, baseline propensity to receive carvedilol, and cumulative exposure to each β-blocker, we observed no significant differences in the risk of rehospitalization with receipt of either metoprolol tartrate or carvedilol compared with atenolol. In this subgroup analysis, there were also no significant adjusted differences in the outcome of interest associated with receipt of other β-blockers or not receiving β-blockers.

Discussion

Conclusions

Within a large cohort of insured older adults recently hospitalized with heart failure within two geographically diverse health plans, we examined the patterns and correlates of β-blocker use as well as the comparative effectiveness of different β-blockers among treated patients. We found that a large majority of the cohort received a β-blocker at hospital discharge and/or during the first 12 months after discharge, with the most frequently used β-blockers in our study population being atenolol, shorter-acting metoprolol tartrate, and carvedilol, respectively. The main independent correlates of receiving β-blockers at hospital discharge included prior acute coronary syndrome or revascularization, hypertension, and concurrent treatment with other selected heart failure or cardiovascular therapies. On the other hand, older age was independently associated with not receiving β-blockers, along with having known diabetes mellitus or chronic lung disease. Of note, few trials have examined the efficacy of β-blockers for heart failure in the very elderly, but β-blockers have been shown to reduce adverse events in patients who have heart failure with or without diabetes.(25) Chronic lung disease with a significant reactive airway component is considered a relative or absolute contraindication to β-blockers depending on the severity of the reactive airway disease.(25) Among the subgroup of patients with heart failure receiving β-blockers, there were also notable differences in demographic and clinical characteristics among patients receiving different β-blockers, with carvedilol-treated patients being significantly younger and having a lower comorbidity burden but also receiving heart failure-related therapies more frequently than those receiving atenolol or metoprolol tartrate.

Rehospitalization for heart failure within the first 12 months occurred in nearly 43% of the cohort—highlighting the large burden and resource utilization in this population despite frequent use of various pharmacological agents. Overall, over 70% of the cohort was exposed to β-blockers at discharge and/or during followup. Interestingly, compared with atenolol, the unadjusted rate of rehospitalization for heart failure was significantly higher for metoprolol tartrate and carvedilol (**Figure 1**). However, these differences were no longer significant after adjusting for potential confounding variables, baseline propensity to receive carvedilol, and the cumulative exposure to each β-blocker (**Table 6**). Furthermore, there were no relevant two-way interactions between type of β-blocker and age, sex, diabetes status, and the presence or absence of hypertension. In addition, we observed similar results in the subgroup of patients concurrently receiving digoxin, which was used to identify patients that may have had reduced left ventricular systolic function and/or more severe heart failure.

Strengths and Limitations

Our study had several strengths including the relatively large sample size of patients receiving β-blockers, geographic diversity, and comprehensive longitudinal data on prescription medications as well as an important clinical outcome of rehospitalization. However, there were also several limitations that are detailed below:

- Incomplete spectrum of type of β-blockers used and detailed dose information. Despite the size of our heart failure cohort and geographic diversity, we found that only a selected

number of specific β-blockers were used in each health plan population. Specifically, atenolol, shorter-acting metoprolol tartrate, and carvedilol were the three primary β-blockers prescribed, while longer-acting metoprolol succinate—which is one of the two β-blockers in the U.S. that has an approved indication for heart failure—was used in a very small minority of patients. This precluded our evaluation of the comparable effectiveness of metoprolol succinate in our populations with heart failure. In addition, detailed information on the actual dose being taken for the various medications was not available.

- Accuracy of assessment of exposure to β-blockers. We implemented methods to assign time-dependent exposure to medications based on our prior work using data from filled prescription and refill patterns from health plan outpatient pharmacy databases. However, future validation studies of the database algorithm of drug exposure are needed to confirm its accuracy for assigning the timing and duration of use of β-blockers and other medications in populations with heart failure.
- Unavailable data on level of left ventricular systolic function. An important variable missing from the automated databases available for this study is information on left ventricular systolic function, which is an important prognostic variable and related to current treatment recommendations for the use of β-blockers (i.e., reduced left ventricular ejection fraction <40%).(25) We attempted to partially address this by identifying patients who may have had reduced left ventricular systolic function based on the concurrent use of digoxin, which is a positive inotrope typically prescribed in this setting.(25) Data were not systematically available on selected relevant drugs including over-the-counter aspirin and non-steroidal anti-inflammatory drugs (NSAIDs), as well as other lifestyle factors (e.g., smoking and alcohol use, diet and physical activity patterns) and other potentially relevant clinical characteristics (e.g., body mass index and level of systolic or diastolic blood pressure).
- Representativeness of the study population. The study population included the two largest health plans within the HMO Research Network CERT DEcIDE Center from the west and east coasts. However, while an even larger sample size with additional geographic and practice pattern diversity would have provided an opportunity to examine clinical outcomes associated with less frequently used but important β-blockers (e.g., longer-acting metoprolol succinate), funding constraints precluded inclusion of additional sites for the current study. Our results may not be completely generalizable to uninsured populations or other health care settings.
- Residual confounding or selection bias. As with any observational study of drug effectiveness outside of the randomized clinical trial setting, it is vulnerable to residual confounding and/or treatment selection bias. To mitigate this, we relied on several different methods. First, we focused only on patients receiving β-blockers at discharge and during followup which removes a major treatment selection bias. Second, we identified and statistically adjusted for key potential confounding variables, including patient characteristics, type of medical insurance, longitudinal use of other cardiovascular medications, and cumulative duration of exposure to different β-blockers. Third, we further attempted to reduce residual selection bias using propensity score methodology.(28) However, despite these efforts, we cannot rule out the effects of residual unmeasured confounding.

Significance

To our knowledge, this study is the first evaluation of the comparable effectiveness of different β-blockers in a high-risk elderly population following a hospitalization for heart failure within usual care clinical settings. Given that heart failure remains the leading cause of hospitalization among Medicare beneficiaries and the high associated costs of prescription medications in this population, our study provides new insights in that we observed similar adjusted rates of short-term rehospitalization for heart failure with receipt of two generic β-blockers, atenolol and metoprolol tartrate, compared with carvedilol (brand name: Coreg®) which is FDA-approved for the treatment of mild to severe heart failure.

Implications and Future Directions

Our findings suggest that the β-blockers atenolol, metoprolol tartrate, and carvedilol may be similarly effective for reducing the 12-month risk of readmission following hospitalization for heart failure. However, our results should be interpreted cautiously and additional observational studies as well as possible future randomized comparisons should be performed that include a broad set of different generic and brand name β-blockers in this population. If our observations are confirmed, it would have important clinical and economic implications for optimizing the treatment and outcomes in high-risk patients with heart failure.

Given that a large-scale definitive randomized clinical trial comparing the efficacy of multiple β-blockers for heart failure will not be completed in the near term, followup studies using other designs could yield additional important data that may influence clinical recommendations on this critical therapeutic question. Based on our results and capabilities within the HMO Research Network CERT DEcIDE Center, a natural followup study would include a nested case-control evaluation of the comparative effectiveness of different β-blockers for heart failure that involves a larger set of health plans which would leverage the existing work and methodology based on automated databases as well as our ability to efficiently access paper-based medical records. Specifically, among patients recently hospitalized for heart failure who were exposed to β-blockers during followup, case subjects who were rehospitalized for heart failure and/or died during the subsequent 12 months would be compared with control subjects who were alive at the time of the matching case's readmission but who had not been rehospitalized to that point. Targeted inpatient and outpatient medical records review for important confounders (e.g., left ventricular systolic and diastolic function status, additional comorbid conditions, confirmation of specific therapies being taken, etc.) combined with extensive automated data would overcome several of the limitations of the present analysis. The anticipated results would provide additional key insights into the robustness of our findings that could help to guide clinical practice and also yield important knowledge about the utility of database approaches for evaluating comparative effectiveness of therapies.

Translation of the Findings

Chronic heart failure is a condition in which the heart is not able to keep up with the body's needs that commonly leads to symptoms of fatigue, shortness of breath, fluid retention, and less ability to exercise. Chronic heart failure is a major and growing public health problem that affects more than 5 million Americans currently and an additional 550,000 newly diagnosed patients each year. Chronic heart failure is also associated with a high risk of death and the need for hospitalization. Different classes of medications such as angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers, and recently β-blockers have been shown to improve outcomes in selected patients with chronic heart failure. Researchers from the HMO Research Network CERT DEcIDE Center studied nearly 12,000 adults who were hospitalized for heart failure to determine whether the effectiveness of β-blockers for preventing the need to be rehospitalized within 12 months varied by type of β-blocker (atenolol, shorter-acting metoprolol tartrate or carvedilol). The study found that nearly 43% of patients were rehospitalized for heart failure within the first 12 months after discharge, which emphasizes the large burden of heart failure for individuals and the health care system. After accounting for differences in characteristics and other treatments received between patients using the various β-blockers, the researchers found that the risks of rehospitalization were similar for atenolol, metoprolol tartrate, and carvedilol, while the adjusted risk of rehospitalization was higher during periods not receiving β-blockers. Overall, this study suggests three commonly used β-blockers—atenolol, metoprolol tartrate, and carvedilol—may have similar effectiveness for reducing rehospitalization for heart failure. These findings, if confirmed by additional studies and possibly randomized trials that simultaneously evaluate the broader set of different oral β-blockers, could have important clinical and economic implications for the management of the growing population of high-risk elderly patients who suffer from heart failure.

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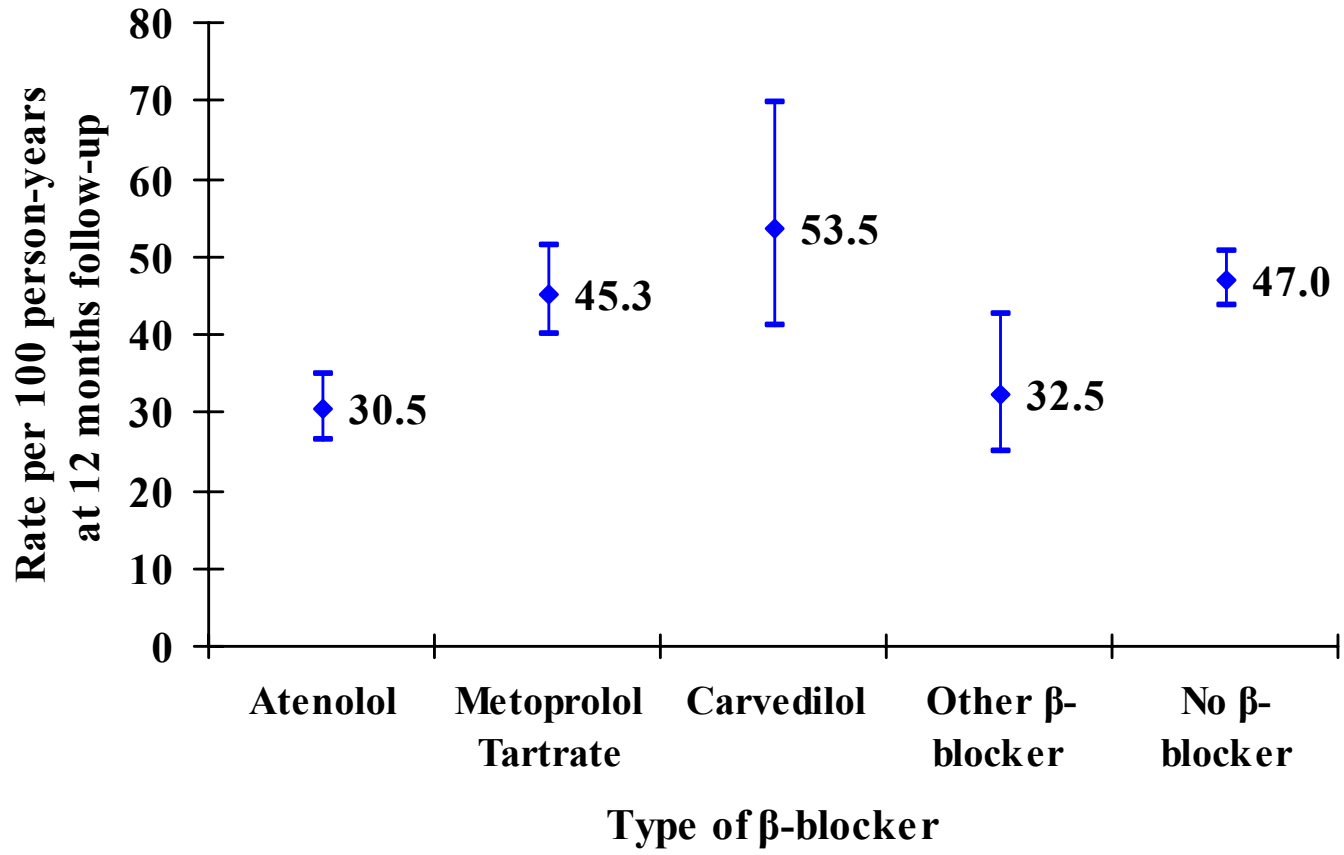
Figure

Figure 1. Crude rate of hospitalization for heart failure by type of β-blocker received during the first 12 months following discharge among 7883 adults hospitalized for heart failure between January 1, 2001 and December 31, 2002. Rates were calculated using Poisson regression with generalized estimating equations.



Compared with Atenolol: Metoprolol Tartrate (P<0.001); Carvedilol (P<0.001); Other β-Blockers (P=0.34); No β-Blockers (P<0.001)

Tables

Table 1. Baseline characteristics of 11,396 adult members hospitalized with heart failure between January 1, 2001 and December 31, 2003 within Kaiser Permanente of Northern California (KPNC) and Harvard Pilgrim Health Care (HPHC) health plans.

*Baseline defined as admission date for the index hospitalization.

Characteristic	Overall (N=11,396)	KPNC (N=9,844)	HPHC (N=1,552)	P value (KPNC vs. HPHC)
Mean ± SD age, yr	73.9 12.4	74.0 12.4	73.1 ± 12.4	0.008
Age group, yr				
<50	488 (4.3)	418 (4.2)	70 (4.5)	<0.001
50 to 64	2,021 (17.7)	1,694 (17.2)	327 (21.1)	<0.001
65 to 74	2,891 (25.4)	2,499 (25.4)	392 (25.3)	<0.001
75 to 84	3,961 (34.8)	3,444 (35.0)	517 (33.3)	<0.001
85+	2,035 (17.9)	1,789 (18.2)	246 (15.9)	<0.001
Women, N (%)	5,617 (49.3)	4,869 (49.5)	748 (48.2)	<0.001
Calendar year of entry, N (%)				<0.001
2001	4,096 (35.9)	3,565 (36.2)	531 (34.2)	
2002	3,787 (33.2)	3,318 (33.7)	469 (30.2)	
2003	3,513 (30.8)	2,961 (30.1)	552 (35.6)	
Insurance type, N (%)				<0.001
Medicare choice	8,500 (74.6)	7,470 (75.9)	1,030 (66.4)	
Commercial	2,560 (22.5)	2,038 (20.7)	522 (33.6)	
Self-pay	161 (1.4)	161 (1.6)	*NA*	
Medi-Cal/Medicaid	166 (1.5)	166 (1.7)	*NA*	
Other	9 (0.1)	9 (0.1)	*NA*	
Median (IQR) index length of stay	3 (2-5)	3 (2-5)	4 (2-7)	<0.001
Median (IQR) hospitalizations for heart failure during prior 12 mos	0 (0-0)	0 (0-0)	0 (0-0)	0.005
Prior cardiovascular disease, N (%)				
Acute coronary syndrome	1,490 (13.1)	1,165 (11.8)	325 (20.9)	<0.001
Angina or coronary artery disease	4,159 (36.5)	3,326 (33.8)	833 (53.7)	<0.001
Percutaneous coronary intervention	337 (3.0)	330 (3.4)	7 (0.5)	<0.001
Coronary artery bypass surgery	910 (8.0)	832 (8.5)	78 (5.0)	<0.001
Ischemic stroke or transient ischemic attack	421 (3.7)	408 (4.1)	13 (0.8)	<0.001
Peripheral arterial disease	703 (6.2)	542 (5.5)	161 (10.4)	<0.001
Medical History, N (%)				
Diabetes mellitus	4,886 (42.9)	4,324 (43.9)	562 (36.2)	<0.001
Hypertension	6,445 (56.6)	5,449 (55.4)	996 (64.2)	<0.001
Dyslipidemia	4,754 (41.7)	4,303 (43.7)	451 (29.1)	<0.001
End-stage renal disease or diagnosed chronic kidney disease	570 (5.0)	378 (3.8)	192 (12.4)	<0.001
Chronic lung disease	2,534 (22.2)	2,096 (21.3)	438 (28.2)	<0.001
Chronic liver disease	198 (1.7)	83 (0.8)	115 (7.4)	<0.001
Atrial fibrillation or flutter	2,889 (25.4)	2,367 (24.0)	522 (33.6)	<0.001

Characteristic	Overall (N=11,396)	KPNC (N=9,844)	HPHC (N=1,552)	P value (KPNC vs. HPHC)
Systemic cancer	1,166 (10.2)	844 (8.6)	322 (20.7)	<0.001
Diagnosed dementia or psychiatric disorder	557 (4.9)	467 (4.7)	90 (5.8)	0.073
Diagnosed depression	1,313 (11.5)	1,134 (11.5)	179 (11.5)	0.9874

Table 2. Receipt of medications before admission among 11,396 adults hospitalized for heart failure between January 1, 2001 and December 31, 2003 within Kaiser Permanente of Northern California (KPNC) and Harvard Pilgrim Health Care (HPHC) health plans.

Medication	Overall (N=11,396)	KPNC (N=9,844)	HPHC (N=1,552)	P value (KPNC vs. HPHC)
Medications within 30 days before admission, N (%)				
β-blockers				
Acebutolol	7 (0.1)	6 (0.1)	1 (0.1)	0.96
Atenolol	3,986 (35.0)	3,462 (35.2)	524 (33.8)	0.28
Metoprolol tartrate	4,827 (42.4)	4,132 (42.0)	695 (44.8)	0.038
Metoprolol succinate	33 (0.3)	33 (0.3)	0 (0.0)	0.022
Carvedilol	1,486 (13.0)	1,302 (13.2)	184 (11.9)	0.14
Bisoprolol	48 (0.4)	42 (0.4)	6 (0.4)	0.82
Propranolol	172 (1.5)	149 (1.5)	23 (1.5)	0.92
Sotalol	160 (1.4)	135 (1.4)	25 (1.6)	0.46
Labetalol	118 (1.0)	68 (0.7)	50 (3.2)	<0.001
Pindolol	4 (0.0)	3 (0.0)	1 (0.1)	0.51
Nadolol	21 (0.2)	10 (0.1)	11 (0.7)	<0.001
Timolol	2 (0.0)	1 (0.0)	1 (0.1)	0.13
Angiotensin-converting enzyme (ACE) inhibitor	8,060 (70.7)	7,051 (71.6)	1,009 (65.0)	<0.001
Angiotensin II receptor blocker	2,298 (20.2)	1,980 (20.1)	318 (20.5)	0.73
Digoxin	4,823 (42.3)	4,269 (43.4)	554 (35.7)	<0.001
Diuretic	10,691 (93.8)	9,341 (94.9)	1,350 (87.0)	<0.001
Nitrate	6,188 (54.3)	5,529 (56.2)	659 (42.5)	<0.001
Hydralazine	2,402 (21.1)	2,290 (23.3)	112 (7.2)	<0.001
Aldosterone receptor antagonist	2,603 (22.8)	2,345 (23.8)	258 (16.6)	<0.001
Calcium channel blocker	4,669 (41.0)	4,086 (41.5)	583 (37.6)	0.003
α-adrenergic receptor antagonist	2,193 (19.2)	2,035 (20.7)	158 (10.2)	<0.001
Statin	6,307 (55.3)	5,510 (56.0)	797 (51.4)	<0.001
Other lipid-lowering therapy	377 (3.3)	320 (3.3)	57 (3.7)	0.39

Table 3. Baseline characteristics of 11,396 adults hospitalized with heart failure between January 1, 2001 and December 31, 2003 between those receiving or not receiving a β-blocker at discharge and/or during followup.

Characteristic	Overall (N=11,396)	On β-blocker (N=8,029)	Off β-blocker (N=3,367)	P value (β-blocker vs. no β-blocker)
Mean (SD) age, yr	73.9 (12.4)	73.0 (12.3)	75.9 (12.2)	<.001
Age group, yr				
<50	488 (4.3)	379 (4.7)	109 (3.2)	<.001
50 to 64	2,021 (17.7)	1,521 (18.9)	500 (14.9)	<.001
65 to 74	2,891 (25.4)	2,144 (26.7)	747 (22.2)	<.001
75 to 84	3,961 (34.8)	2,722 (33.9)	1,239 (36.8)	0.002
85+	2,035 (17.9)	1,263 (15.7)	772 (22.9)	<.001
Women, N (%)	5,617 (49.3)	3,889 (48.4)	1,728 (51.3)	0.002
Calendar year of entry, N (%)				
2001	4,096 (35.9)	2,655 (33.1)	1,441 (42.8)	<.001
2002	3,787 (33.2)	2,730 (34.0)	1,057 (31.4)	0.003
2003	3,513 (30.8)	2,644 (32.9)	869 (25.8)	<.001
Insurance type, N (%)				
Medicare choice	8,500 (74.6)	5,869 (73.1)	2,631 (78.1)	<.001
Commercial	2,560 (22.5)	1,912 (23.8)	648 (19.2)	<.001
Self-pay	161 (1.4)	122 (1.5)	39 (1.2)	0.058
Medi-Cal/Medicaid	166 (1.5)	118 (1.5)	48 (1.4)	0.428
Other	9 (0.1)	8 (0.1)	1 (0.0)	0.064
Median (IQR) index length of stay	3 (2-5)	3 (2-5)	3 (2-6)	<0.001
Median (IRQ) hospitalizations for HF during 12 months before baseline, N (%)	0 (0-0)	0 (0-0)	0 (0-0)	<0.001
Prior cardiovascular disease, N (%)				
Acute coronary syndrome	1,490(13.1)	1,285(16.0)	205(6.1)	<0.001
Angina or coronary artery disease	4,159(36.5)	3,248(40.5)	911(27.1)	<0.001
Percutaneous coronary intervention	337(3.0)	300(3.7)	37(1.1)	<0.001
Coronary artery bypass surgery	910(8.0)	759(9.5)	151(4.5)	<0.001
Ischemic stroke or transient ischemic attack	421(3.7)	304(3.8)	117(3.5)	0.4214
Peripheral arterial disease	703(6.2)	495(6.2)	208(6.2)	0.9799
Medical History, N (%)				
Diabetes mellitus	4,886(42.9)	3,596(44.8)	1,290(38.3)	<0.001
Hypertension	6,445(56.6)	4,866(60.6)	1,579(46.9)	<0.001

Characteristic	Overall (N=11,396)	On β-blocker (N=8,029)	Off β-blocker (N=3,367)	P value (β-blocker vs. no β-blocker)
Dyslipidemia	4,754(41.7)	3,791(47.2)	963(28.6)	<0.001
End-stage renal disease or chronic kidney disease	570(5.0)	418(5.2)	152(4.5)	0.1222
Chronic lung disease	2,534(22.2)	1,437(17.9)	1,097(32.6)	<0.001
Chronic liver disease	198(1.7)	131(1.6)	67(2.0)	0.1817
Atrial fibrillation or flutter	2,889(25.4)	1,967(24.5)	922(27.4)	0.0012
Systemic cancer	1,166(10.2)	781(9.7)	385(11.4)	0.0061
Diagnosed dementia or psychiatric disorder	557(4.9)	337(4.2)	220(6.5)	<0.001
Diagnosed depression	1,313(11.5)	925(11.5)	388(11.5)	0.9965
Medications at baseline, N (%)				
β-blockers				
Acebutolol	7 (0.1)	7 (0.1)	0 (0)	0.0866
Atenolol	3,986 (35.0)	3,807 (47.4)	179 (5.3)	<0.001
Metoprolol tartrate	4,827 (42.4)	4,487 (55.9)	340 (10.1)	<0.001
Metoprolol succinate	33 (0.3)	32 (0.4)	1 (0.0)	<0.001
Carvedilol	1,486 (13.0)	1,407 (17.5)	79 (2.3)	<0.001
Bisoprolol	48 (0.4)	44 (0.5)	4 (0.1)	0.0012
Propranolol	172 (1.5)	159 (2.0)	13 (0.4)	<0.001
Sotalol	160 (1.4)	154 (1.9)	6 (0.2)	<0.001
Labetalol	118 (1.0)	114 (1.4)	4 (0.1)	<0.001
Pindolol	4 (0.0)	4 (0.0)	0 (0.0)	0.1952
Nadolol	21 (0.2)	20 (0.2)	1 (0.0)	0.0127
Timolol	2 (0.0)	2 (0.0)	0 (0.0)	0.3597
Angiotensin-converting enzyme (ACE) inhibitor	8,060 (70.7)	5,962 (74.3)	2,098 (62.3)	<0.001
Angiotensin II receptor blocker	2,298 (20.2)	1,789 (22.3)	509 (15.1)	<0.001
Digoxin	4,823 (42.3)	3,426 (42.7)	1,397 (41.5)	0.245
Diuretic	10,691 (93.8)	7,665 (95.5)	3,026 (89.9)	<0.001
Nitrate	6,188 (54.3)	4,787 (59.6)	1,401 (41.6)	<0.001
Hydralazine	2,402 (21.1)	1,875 (23.4)	527 (15.7)	<0.001
Aldosterone receptor antagonist	2,603 (22.8)	1,949 (24.3)	654 (19.4)	<0.001
Calcium channel blocker	4,669 (41.0)	3,428 (42.7)	1,241 (36.9)	<0.001
α-adrenergic receptor antagonist	2,193 (19.2)	1,692 (21.1)	501 (14.9)	<0.001
Statin	6,307 (55.3)	5,077 (63.2)	1,230 (36.5)	<0.001
Other lipid-lowering therapy	377 (3.3)	316 (3.9)	61 (1.8)	<0.001

Table 4. Multivariable predictors of receiving a β-blocker at discharge among 11,396 adults hospitalized with heart failure between January 1, 2001 and December 31, 2003.

Variable	Adjusted Odds Ratio (95% Confidence Interval)
Age group, years	
<50	Reference
50-64	0.71 (0.57-0.90)
65-74	0.63 (0.49-0.81)
75-84	0.60 (0.46-0.77)
85 or older	0.51 (0.39-0.67)
Calendar year of entry	
2001	Reference
2002	0.86 (0.77-0.96)
2003	0.94 (0.83-1.05)
Index hospitalization length of stay, per day	0.99 (0.98-0.99)
Medical history	
Prior acute coronary syndrome	1.49 (1.28-1.74)
Prior angina or coronary artery disease	0.83 (0.74-0.92)
Prior percutaneous coronary intervention	1.61 (1.18-2.20)
Prior coronary artery bypass surgery	1.44 (1.10-1.88)
Diabetes mellitus	0.75 (0.68-0.82)
Diagnosed hypertension	1.23 (1.12-1.35)
Chronic lung disease	0.56 (0.50-0.62)
Medications received within 30 days before index hospitalization	
ACE inhibitor	1.68 (1.54-1.85)
Angiotensin II receptor blocker	1.30 (1.10-1.52)
Digoxin	1.24 (1.12-1.38)
Diuretic	1.54 (1.37-1.73)
Nitrate	1.63 (1.47-1.82)
Statin	1.64 (1.41-1.90)

Table 5. Baseline characteristics of 8,029 adults with heart failure between January 1, 2001 and December 31, 2003 and who received a β-blocker at discharge and/or during followup stratified by type of β-blocker received.

*Baseline defined as the first date of known exposure to β-blockers at or after discharge from the index hospitalization.

Characteristic	Atenolol (N=3,085)	Metoprolol Tartrate (N=3,463)	Carvedilol (N=935)	Other β-blocker (N=546)
Mean ± SD age, yr	74.0 ± 11.9	73.3 ± 12.1*	67.8 ± 13.5‡	76.4 ± 11.4‡
Age group, yr			‡	‡
<50	113 (3.7)	152 (4.4)	95 (10.2)	16 (2.9)
50 to 64	546 (17.7)	643 (18.6)	260 (27.8)	67 (12.3)
65 to 74	825 (26.7)	934 (27.0)	259 (27.7)	124 (22.7)
75 to 84	1,053 (34.1)	1,195 (34.5)	260 (27.8)	209 (38.3)
85+	548 (17.8)	539 (15.6)	61 (6.5)	130 (23.8)
Women, N (%)	1,630 (52.8)	1,651 (47.7)‡	309 (33.0)‡	299 (54.8)
Insurance type, N (%)			‡	
Medicare choice	2,301 (74.6)	2,537 (73.3)	551 (58.9)	437 (80.0)
Commercial	595 (19.3)	747 (21.6)	310 (33.2)	83 (15.2)
Self-pay	139 (4.5)	132 (3.8)	54 (5.8)	20 (3.7)
Medi-Cal/Medicaid	47 (1.5)	43 (1.2)	19 (2.0)	6 (1.1)
Other	3 (0.1)	4 (0.1)	1 (0.1)	0 (0.0)
Median (IQR) index length of stay	4 (3-6)	4 (3-6)	4 (3-6)	4 (3-6)
Hospitalization for heart failure during prior 12 months, N (%)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Prior cardiovascular disease, N (%)				
Acute coronary syndrome	473 (15.3)	647 (18.7)‡	108 (11.6)†	57 (10.4)†
Angina or coronary artery disease	1,254 (40.6)	1,459 (42.1)	348 (37.2)	187 (34.2)†
Percutaneous coronary intervention	117 (3.8)	134 (3.9)	33 (3.5)	16 (2.9)
Coronary artery bypass surgery	285 (9.2)	350 (10.1)	91 (9.7)	33 (6.0)*
Ischemic stroke or transient ischemic attack	127 (4.1)	130 (3.8)	22 (2.4)*	25 (4.6)
Peripheral arterial disease	173 (5.6)	230 (6.6)	54 (5.8)	38 (7.0)
Medical History, N (%)				
Diabetes mellitus	1,370 (44.4)	1,561 (45.1)	424 (45.3)	241 (44.1)

Characteristic	Atenolol (N=3,085)	Metoprolol Tartrate (N=3,463)	Carvedilol (N=935)	Other β-blocker (N=546)
Hypertension	2,056 (66.6)	2,053 (59.3)‡	410 (43.9)‡	347 (63.6)
Dyslipidemia	1,464 (47.5)	1,678 (48.5)	431 (46.1)	218 (39.9)†
End-stage renal disease or chronic kidney disease	131 (4.2)	234 (6.8)‡	19 (2.0)†	34 (6.2)*
Chronic lung disease	489 (15.9)	666 (19.2)‡	180 (19.3)*	102 (18.7)
Chronic liver disease	45 (1.5)	47 (1.4)	19 (2.0)	20 (3.7)‡
Atrial fibrillation or flutter	741 (24.0)	891 (25.7)	183 (19.6)†	152 (27.8)
Systemic cancer	318 (10.3)	339 (9.8)	76 (8.1)*	48 (8.8)
Diagnosed dementia or psychiatric disorder	147 (4.8)	147 (4.2)	23 (2.5)†	20 (3.7)
Diagnosed depression	370 (12.0)	391 (11.3)	97 (10.4)	67 (12.3)
Medications at baseline, N (%)				
Angiotensin-converting enzyme (ACE) inhibitor	2,237 (72.5)	2,530 (73.1)	724 (77.4)†	369 (67.6)*
Angiotensin II receptor blocker	644 (20.9)	757 (21.9)	246 (26.3)‡	116 (21.2)
Digoxin	1,038 (33.6)	1,529 (44.2)‡	611 (65.3)‡	207 (37.9)
Diuretic	2,938 (95.2)	3,264 (94.3)	910 (97.3)	520 (95.2)
Nitrate	1,809 (58.6)	2,107 (60.8)	533 (57.0)	291 (53.3)†
Hydralazine	664 (21.5)	820 (23.7)	250 (26.7)‡	117 (21.4)
Aldosterone receptor antagonist	564 (18.3)	823 (23.8)‡	435 (46.5)‡	106 (19.4)
Calcium channel blocker	1,418 (46.0)	1,424 (41.1)‡	236 (25.2)‡	269 (49.3)
α-adrenergic receptor antagonist	674 (21.8)	701 (20.2)	125 (13.4)‡	143 (26.2)*
Statin	1,927 (62.5)	2,231 (64.4)	599 (64.1)	290 (53.1)‡
Other lipid-lowering therapy	123 (4.0)	122 (3.5)	48 (5.1)	14 (2.6)
Duration of prior β-blockers usage, Median (IQR), days				
Atenolol	339 (180-485)	0 (0-0)	0 (0-0)	0 (0-0)
Metoprolol Tartrate	0 (0-0)	272 (119-360)	0 (0-0)	0 (0-0)
Carvedilol	0 (0-0)	0 (0-0)	273 (120-355)	0 (0-0)
Other β-blockers	0 (0-0)	0 (0-0)	0 (0-0)	309 (146-433)

Compared with atenolol: *P<0.05; †P<0.01; ‡P<0.001

Table 6. Multivariable association between receipt of selected β-blockers on the 12-month rate of rehospitalization for heart failure among patients discharged alive from a hospitalization for heart failure between January 1, 2001 and December 31, 2002. Results are given for the overall cohort and the subgroup of patients concurrently receiving digoxin which was used as a proxy for reduced left ventricular systolic function and/or more severe heart failure. The referent group in all analyses is receipt of atenolol.

	Rehospitalization for Heart Failure	
	Adjusted Hazard Ratio (95% Confidence Interval)*	
	Overall Cohort	Receiving Concurrent Digoxin Therapy
Type of β-blocker	(N=7883)	(N=1673)
Atenolol	Reference	Reference
Metoprolol tartrate	0.97 (0.87-1.08)	0.88 (0.71-1.10)
Carvedilol	0.96 (0.78-1.18)	1.04 (0.73-1.47)
Other β-blocker	1.29 (1.09-1.53)	1.03 (0.70-1.51)
No β-blocker	1.28 (1.18-1.39)	1.09 (0.84-1.43)

*Models adjusted for time-varying individual β-blocker use, total duration of exposure to each β-blocker between 12 months before index hospitalization throughout followup, health plan, age, sex, calendar year of entry, time-varying Medicare insurance coverage, index hospitalization length of stay, prior hospitalization for heart failure, cardiovascular history, other coexisting illnesses, time-varying use of other cardiovascular medications, and baseline propensity score for receiving carvedilol.

Appendix I

Methods for Assembly of Cohort of Hospitalized Heart Failure

1. Purpose: To assemble a cohort of adult members within Kaiser Permanente of Northern California and Harvard Pilgrim Health Care who were hospitalized for heart failure between 2001 and 2003.

2. Cohort inclusion dates: Admit date for eligible heart failure hospitalization between January 1, 2001 through December 31, 2003 (inclusive).

3. Identification method: Search hospital discharge/inpatient claims database (For Kaiser this corresponds to the ADT database) for hospital admissions with a *primary/principal ICD-9-CM discharge diagnosis code* corresponding to "heart failure" as defined in the table below:

ICD-9-CM Code*	DESCRIPTOR
39891	RHEUMATIC HEART FAILURE
428	HEART FAILURE
4280	CHF NOS
4281	LEFT HEART FAILURE
4282	SYSTOLIC HEART FAILURE
4283	DIASTOLIC HEART FAILURE
4284	SYSTOLIC & DIASTOLIC HF
4289	HEART FAILURE NOS
40201	MAL HTN HEART DIS W HF
40211	BEN HTN HEART DIS W HF
40291	HTN HEART DIS NOS W HF
40401	MAL HRT&KIDN HTN W HF
40403	MAL HRT&KID HTN W HF/CKD
40411	BEN HRT&KIDN HTN W HF
40413	BEN HRT&KID HTN W HF/CKD
40491	HRT&KIDN HTN NOS W HF
40493	HRT&KID HTN NOS W HF/CKD
42820	SYSTOLIC HF NOS
42821	ACUTE SYSTOLIC HF
42822	CHRONIC SYSTOLIC HF
42823	AC & CHR SYSTOLIC HF
42830	DIASTOLIC HF NOS
42831	ACUTE DIASTOLIC HF
42832	CHRONIC DIASTOLIC HF
42833	AC & CHR DIASTOLIC HF
42840	SYS & DIASTOLIC HF NOS
42841	AC SYS & DIASTOLIC HF
42842	CHR SYS & DIASTOLIC HF
42843	ACCHR SYS & DIASTOLIC HF

*Note that codes are listed without typical periods (e.g., ICD-9 code 428.0 is listed as 4280)

4. Cohort inclusion criteria: The goal is to include a cohort of adult health plan members hospitalized for heart failure who had continuous membership and pharmacy benefit during the 12 months prior to and 12 months after the index hospitalization.

4.1. Index Hospitalization. The first hospitalization where the subject is ≥ 18 year old between the period of January 1, 2001 and December 31, 2003. Delete any records without admit or discharge dates. If the admit date and the discharge date of two hospitalizations are within 3 days of each other then they are counted as one "continuous" hospitalization/clinical episode of heart failure.

4.2. Membership/Drug benefits. Continuous membership and drug benefit was defined as having no membership gaps of 60 day or more in addition to an active pharmacy drug benefit (i.e., no missing monthly indicators during periods of monthly membership) for at least 12 months (30 days per month) before the index admission date **and for at least 12 months (30 days per month) after the discharge date** of the index hospitalization or until the date of death if it occurred before the end of followup. Patients whose membership started after the 12 months prior to index admit date were not included. Because of the absence of mortality data in 2004 for the HPHC population, the requirement for continuous membership and pharmacy drug benefit was only applied for HPHC subjects identified between 2001-2002.

4.3. Qualifying age. Age ≥ 18 years on index date (i.e., admission date of qualifying hospitalization).

4.4. Length of hospitalization. Defined as Date/Time of discharge day minus Date/Time of admission day. Any patient who dies during the index hospitalization was excluded.

Appendix II

Methods for Ascertaining Coexisting Illnesses

1. Data Sources to Identify Comorbid Conditions

Various automated health plan databases were used to identify relevant comorbid conditions at each participating health plan:

Kaiser Permanente of Northern California**.** The following data sources and methods were used:

Inpatient: ADT (Kaiser hospitals), AOMS (Contracted non-Kaiser hospitals), CATS (Non-contracted, non-Kaiser hospitals providing emergent care) (ICD-9-CM Diagnoses, ICD-9-CM Procedure, and CPT codes)

Outpatient: OSCR (ambulatory visit database for Kaiser facilities) (ICD-9-CM Diagnoses and ICD-9-CM Procedure codes) Laboratory results: LURS (regional Kaiser laboratory testing and results tracking database) (specific plan-specific test codes)

Drugs: PIMS (Kaiser outpatient pharmacy database) (NDC Codes and AHFS Classifications)

Harvard Pilgrim Health Care**.** The following data sources and methods were used:

Inpatient: Billing claims for inpatient ICD-9-CM Diagnoses, ICD-9-CM Procedure, and CPT codes

Outpatient: Billing claims for non-inpatient ICD-9-CM Diagnoses, ICD-9-CM Procedure, and CPT codes

Drugs: Pharmacy claims for filled prescriptions (NDC Codes and AHFS Classifications)

2. Comorbid Conditions

The following outlines the list of specific comorbid conditions with hyperlinks to tables with the corresponding codes and/or additional detailed methods used to define each condition:

Atrial fibrillation

Atrial flutter

Coronary heart disease

Peripheral arterial disease

Stroke Only use ICD-9 codes with a .x1 fifth digit qualifier for higher specificity.

Transient cerebral ischemia/Transient Ischemic Attack

Ventricular Fibrillation/ Tachycardia

Chronic lung disease

Chronic liver disease

Coronary heart Disease

Acute coronary syndrome. Only based on information from inpatient data sources.
Defined as either: (I) Myocardial infarction:1 primary dx of 410.x (not 412) or
(II) Unstable Angina:
(a) 1 primary dx of 411.1, 411.8, 411.9 or
(b) 1 primary dx of 414.x (CAD) and 2 secondary dx of 411.x

Angina (Pectoris, Unstable, Unspecified)

Myocardial infarction

Other coronary artery disease

Coronary revascularization (CABG, PCI with stent, or PCI without stent)

Dementia or psychotic disorders

Depression

Diabetes mellitus

Kaiser Permanente of Northern California**.** Identified from the validated longitudinal Kaiser Diabetes Registry(1)

Harvard Pilgrim Health Care**.** The following methods were used to identify the presence of diabetes:

Inclusion Criteria:

1. Pharmacy data: One or more filled prescription for any of the following AHFS Classes for anti-diabetic medications: 682002, 682004, 682008, 682016,682020,682028
2. Outpatient: ≥2 visits for diabetes or diabetic complications (ICD-9 code 250.x)
3. Inpatient: One or more hospitalizations with a primary discharge diagnosis of diabetes (ICD-9 code 250.x)

Exclusion Criteria: Patients who were identified as having diabetes from the inclusion criteria above and who were diagnosed with an ICD-9 code of 648.8 (gestational diabetes) within 8 months from either outpatient or inpatient sources were excluded.

Dyslipidemia. Defined as having (1) any filled prescription for lipid lowering medication (using AFHS theurapeutic class) in pharmacy database and/or (2) one or more outpatient diagnoses of dyslipidemia (ICD-9 codes 272.x)

End stage renal disease or chronic kidney disease

Kaiser Permanente of Northern California. Identified from Kaiser End-Stage Renal Disease Treatment Registry which includes patients receiving maintenance dialysis and/or a kidney transplant.

Harvard Pilgrim Health Care. Identified from inpatient or outpatient claims for chronic renal failure (ICD-9 code 585.x)

Hypertension

Kaiser Permanente of Northern California. Defined as meeting the following criteria:

1) ≥ 2 outpatient diagnoses of hypertension (see associated table for list of Kaiser-specific codes) or

2) ≥ 1 outpatient diagnosis of hypertension plus an anti-hypertensive drug prescription fill within one year of outpatient diagnosis (based on AFHS Therapeutic Classes for antihypertensive agents)

Harvard Pilgrim Health Care. Defined as having ≥ 2 outpatient diagnoses of hypertension (see associated table for listed of ICD-9 codes)

Pericarditis

*Thyroid Disease***.** Defined as any outpatient diagnosis/claim of thyroid disease or relevant medication for either hypo- or hyperthyroidism found in pharmacy databases

Hyperthyroidism

Hypothyroidism

Systemic Cancer

Kaiser Permanente of Northern California. Identified from Regional Kaiser/SEER Cancer Registry.(2)

Harvard Pilgrim Health Care. Based on outpatient or inpatient claim for cancer or cancer-related care using the following ICD-9 codes:

ICD-9-CM Codes	Diagnosis (in preferred ICD-O-3 terminology)
140.0 - 208.9	Malignant neoplasms
203.1	Plasma cell leukemia (9733/3)
205.1	Chronic neutrophilic leukemia (9963/3)
230.0 - 234.9	Carcinoma in situ
235.0 - 238.9	Neoplasms of uncertain behavior
238.6	Solitary plasmacytoma (9731/3)
238.6	Extramedullary plasmacytoma (9734/3)
239.0 - 239.9	Neoplasms of unspecified behavior
V58.0	Admission for radiotherapy
V58.1	Admission for chemotherapy
V66.1	Convalescence following radiotherapy
V66.2	Convalescence following chemotherapy
V67.1	Radiation therapy followup
V67.2	Chemotherapy followup

Valvular Heart Disease

Aortic
Aortic/Mitral
Rheumatic heart disease
Mitral

3. Disease-Specific ICD-9-CM, CPT, or Health Plan Codes

For Code Type: OSCR = Kaiser outpatient diagnosis or procedure code; KHFS = Kaiser Health Plan Formulary System; AHFS = American Hospital Formulary Service;

Disease	Code_Type	CODE	Description
Atrial Fibrillation/Flutter ***(Disease Index)***			
AFIB	ICD9D	427.31	Atrial fibrillation
AFIB	OSCR	42731	Rhythm disturbance atrial fibrillation
AFIB	OSCR	42731.000	Rhythm disturbance - atrial fibrillation
AFIB	OSCR	42731.001	Rhythm disturbance PAF
AFIB	OSCR	42731.002	Fibrillation atrial (afib)
AFIB	OSCR	42731.003	Fibrillation atrial
AFIB	OSCR	42731.004	Fibrillation, atrial (afib), paroxysmal
AFIB	OSCR	42731.005	Fibrillation, atrial (afib), persistent
AFIB	OSCR	42731.006	Atrial fibrillation, chronic
AFIB	OSCR	42731.900	Atrial fibrillation: (afib)
AFIB	OSCR	42731.901	Atrial fibrillation: paroxysmal
AFLUTTER	ICD9D	427.32	Atrial flutter
AFLUTTER	OSCR	42732	Rhythm disturbance atrial flutter
AFLUTTER	OSCR	42732.000	Rhythm disturbance - atrial flutter
AFLUTTER	OSCR	42732.001	Atrial flutter
AFLUTTER	OSCR	42732.002	Flutter, paroxysmal atrial
Stroke ***(Disease Index)***			
ACUTE_STROKE	ICD9D	433.01	Basil Art OCCL w/ Infarction
ACUTE_STROKE	ICD9D	433.11	CAROTID ART OCC W INFARC
ACUTE_STROKE	ICD9D	433.21	VERTEB ART OCC W INFARCT
ACUTE_STROKE	ICD9D	433.31	MULT PRECER OCC W INFARC
ACUTE_STROKE	ICD9D	433.81	OTH PERCER OCCL W INFARC
ACUTE_STROKE	ICD9D	433.91	PRECEREB OCCL W INFARCT
ACUTE_STROKE	ICD9D	434.01	Cerebral thrombosis with cerebral infarction
ACUTE_STROKE	ICD9D	434.11	Cerebral embolism with cerebral infarction
ACUTE_STROKE	ICD9D	434.91	Cerebral artery occlusion unspecified with cerebral infarction
PRIOR_STROKE	ICD9D	436	CVA
PRIOR_STROKE	ICD9D	438	Late Effect- CEREBROVASCULAR DISEASE
PRIOR_STROKE	ICD9D	438.0	Late Effect-COGNITIVE
PRIOR_STROKE	ICD9D	438.1	Late Effect-SPEECH/LANG
PRIOR_STROKE	ICD9D	438.10	Late Effect-SPEECH NOS
PRIOR_STROKE	ICD9D	438.11	Late Effect-APHASIA
PRIOR_STROKE	ICD9D	438.12	Late Effect CVD-DYSPHSIA
PRIOR_STROKE	ICD9D	438.19	Late Effect CVD-SPEECH NEC
PRIOR_STROKE	ICD9D	438.2	Late Effect-HEMIPLEGIA
PRIOR_STROKE	ICD9D	438.20	Late Effect-HEMI NOS
PRIOR_STROKE	ICD9D	438.21	Late Effect-DOM HEMI

Disease	Code_Type	CODE	Description
PRIOR_STROKE	ICD9D	438.22	Late Effect-NONDOM HEMI
PRIOR_STROKE	ICD9D	438.3	Late Effect -UL MONOPLEG
PRIOR_STROKE	ICD9D	438.30	Late Effect- UL NOS
PRIOR_STROKE	ICD9D	438.31	Late Effect- DOM UL
PRIOR_STROKE	ICD9D	438.32	Late Effect-NONDOM UL
PRIOR_STROKE	ICD9D	438.4	Late Effect-LE MONOPLEG
PRIOR_STROKE	ICD9D	438.40	Late Effect-LE NOS
PRIOR_STROKE	ICD9D	438.41	Late Effect-DOM LE
PRIOR_STROKE	ICD9D	438.42	Late Effect-NONDOM LE
PRIOR_STROKE	ICD9D	438.5	Late Effect-PARAL NEC
PRIOR_STROKE	ICD9D	438.50	Late Effect- SIDE NOS
PRIOR_STROKE	ICD9D	438.51	Late Effect-DOM SIDE
PRIOR_STROKE	ICD9D	438.52	Late Effect-NONDOM SIDE
PRIOR_STROKE	ICD9D	438.53	Late Effect CVD-BILAT
PRIOR_STROKE	ICD9D	438.8	Late Effect CVD NEC
PRIOR_STROKE	ICD9D	438.81	Late eff cvd-apraxia
PRIOR_STROKE	ICD9D	438.82	Late effect CVD-Dysphagia
PRIOR_STROKE	ICD9D	438.89	Other late effect CVD
PRIOR_STROKE	ICD9D	438.9	Late effect CVD NOS

Disease	Code_Type	CODE	Description
ACUTE_STROKE	ICD9D	997.02	IATROGEN CV INFARCT / HEM
PRIOR_STROKE	OSCR	342.001	CVA/ stroke
PRIOR_STROKE	OSCR	4341.001	Cardio-embolic stroke
PRIOR_STROKE	OSCR	43410.001	(FORM NO 1510, 0900) Cardio-embolic stroke
PRIOR_STROKE	OSCR	436.000	(FROM NO 2200) Peripheral vascular disease- CVA/ stroke
PRIOR_STROKE	OSCR	436.001	(FROM NO 1500, 6400) Stroke
PRIOR_STROKE	OSCR	436.002	(FROM NO 2000, 2001) CVA acute
PRIOR_STROKE	OSCR	436.003	Trace CVA
PRIOR_STROKE	OSCR	436.004	(FROM NO 2200) CVA/stroke
PRIOR_ACUTE_STROKE	OSCR	436.006	(FROM NO 2000, 0500)CVA
PRIOR_STROKE	OSCR	436.007	(FROM NO 0900)Ischemic stroke
PRIOR_STROKE	OSCR	436.008	(FROM NO 0900, 1510)Lacunar stroke
PRIOR_ACUTE_STROKE	OSCR	436.009	(FROM NO 0510) CVA NOS
PRIOR_STROKE	OSCR	436.010	(FROM NO 0900, 1510,)Stroke lacunar
PRIOR_STROKE	OSCR	436.900	CVA: NOS
PRIOR_STROKE	OSCR	436.901	STROKE: LACUNAR
PRIOR_STROKE	OSCR	436.999	CVA/stroke
PRIOR_STROKE	OSCR	4371.001	Ischemic stroke
PRIOR_STROKE	OSCR	438.001	Post CVA/stroke
PRIOR_STROKE	OSCR	438.002	CVA/ stroke
PRIOR_STROKE	OSCR	4380.001	Lacunic stroke
PRIOR_STROKE	OSCR	4380.002	CVA late effects cognitive deficits
PRIOR_STROKE	OSCR	4380.003	CVA late effects behavioral/cognitive disorder
PRIOR_STROKE	OSCR	43811.001	Late effects CVA aphasia
PRIOR_STROKE	OSCR	43811.002	Aphasia status post stroke
PRIOR_STROKE	OSCR	43812.001	Late effects CVA dysphasia
PRIOR_STROKE	OSCR	43820.001	N/M S/P CVA C hemiplegia
PRIOR_STROKE	OSCR	43820.002	CVA late effects hemiplegia
PRIOR_STROKE	OSCR	43820.003	Hemiplegia/hemiparesis due to CVA
PRIOR_STROKE	OSCR	43820.004	Late effects CVA hemiparesis
PRIOR_STROKE	OSCR	43820.900	HEMIPARESIS/HEMIPLEGIA: DUE TO CVA
PRIOR_STROKE	OSCR	43821.001	Late effects CVA Hemiparesis/Hemiplegia of dominant side
PRIOR_STROKE	OSCR	43822.001	Late effects CVA Hemiparesis/Hemiplegia of non-dominant side
PRIOR_STROKE	OSCR	43851.001	Late effects CVA parparesis/paraplegia of dominant side
PRIOR_STROKE	OSCR	43852.001	Late effects CVA parparesis/paraplegia of non-dominant side
PRIOR_STROKE	OSCR	43881.001	CVA late effects apraxia
PRIOR_STROKE	OSCR	43881.002	Apraxia due to CVA
PRIOR_STROKE	OSCR	43882.001	CVA late effects dysphagia
PRIOR_STROKE	OSCR	43882.002	Dysphagia status post stroke
PRIOR_STROKE	OSCR	43889.001	Thalamic post stroke plegia
PRIOR_STROKE	OSCR	43889.002	Visual field defect status post stroke
PRIOR_STROKE	OSCR	43889.003	Late effects CVA quadriparesis/quadriplegia
PRIOR_STROKE	OSCR	43889.009	S/P CARDIOEMBOLIC STROKE, RECENT
PRIOR_STROKE	OSCR	43889.010	S/P LACUNAR STROKE, RECENT

Disease	Code_Type	CODE	Description
PRIOR_STROKE	OSCR	4389.001	Late effects of CVA
PRIOR_STROKE	OSCR	4389.002	Post CVA
PRIOR_STROKE	OSCR	4389.003	LATE EFFECTS CVA, UNSPECIFIED
PRIOR_STROKE	OSCR	4389.004	LATE EFFECTS CARDIOEMBOLIC STROKE
PRIOR_STROKE	OSCR	4389.005	LATE EFFECTS CVA, UNSPECIFIED
PRIOR_STROKE	OSCR	4389.006	LATE EFFECTS CARDIOEMBOLIC STROKE
PRIOR_STROKE	OSCR	4389.007	LATE EFFECTS ISCHEMIC STROKE
PRIOR_STROKE	OSCR	4389.008	LATE EFFECTS LACUNIC STROKE
PRIOR_STROKE	OSCR	4389.009	LATE EFFECTS CORONARY ARTERY STENOSIS W CEREBRAL INFARCTION
PRIOR_STROKE	OSCR	V1250.003	History of stroke non-residual
PRIOR_STROKE	OSCR	V1259.003	History of cerebrovascular accident; stroke/CVA
PRIOR_STROKE	OSCR	V1259.021	History of stroke
PRIOR_STROKE	OSCR	V6549.044	Stroke class/group
PRIOR_STROKE	OSCR	V6549.190	Stroke individual counseling
PRIOR_STROKE	OSCR	V6549.191	Stroke group counseling
PRIOR_STROKE	OSCR	V6549.309	Stroke indiv/group education and counseling
Transient Cerebral Ischemia (Disease Index)			
TCI	ICD9D	435	Transient cerebral ischemia (code incomplete)
TCI	ICD9D	435.0	Basilar artery syndrome
TCI	ICD9D	435.1	Vertebral artery syndrome
TCI	ICD9D	435.2	Subclavian steal syndrome
TCI	ICD9D	435.3	Vertebrobasilar artery syndrome
TCI	ICD9D	435.8	Other specified transient cerebral ischemia
TCI	ICD9D	435.9	Unspecified transient cerebral ischemia
TCI	OSCR	4359.000	PVD – transient cerebral ischemia
TCI	OSCR	4359.001	Trans. Ischemic attack
TCI	OSCR	4359.002	Trans. Ischemic attack
TCI	OSCR	4359.003	Transient cerebral ischemia
Angina (Disease Index)			
ANGINA_PECTORIS	OSCR	080.008	Diabetes 2, w/diabetic angina pectoris
ANGINA_PECTORIS	OSCR	081.004	Diabetes 1, w/diabetic angina pectoris
ANGINA_PECTORIS	OSCR	39.000	Angina
ANGINA_PECTORIS	OSCR	39.001	Stable chronic angina
ANGINA_PECTORIS	OSCR	39.002	Angina, NOS
ANGINA_PECTORIS	OSCR	39.003	Angina, stable
ANGINA_PECTORIS	OSCR	39.900	Angina, stable
ANGINA_PECTORIS	ICD9D	413	Angina pectoris
ANGINA_PECTORIS	ICD9D	413.0	Angina decubitus
ANGINA_PECTORIS	ICD9D	413.1	Prinzmetal angina
ANGINA_PECTORIS	ICD9D	413.9	Angina pectoris nec/nos
ANGINA_PECTORIS	OSCR	4139.000	Angina NOS
ANGINA_PECTORIS	OSCR	4139.001	Stable chronic angina
ANGINA_PECTORIS	OSCR	4139.002	Angina, NOS

Disease	Code_Type	CODE	Description
ANGINA_PECTORIS	OSCR	4139.003	Angina, stable
ANGINA_PECTORIS	OSCR	4139.900	Angina, stable
ANGINA_PECTORIS	OSCR	V6549.250	ANGINA
ANGINA_UNSTABLE	ICD9D	411	OTH AC ISCHEMIC HRT DIS
ANGINA_UNSTABLE	ICD9D	411.0	POST MI SYNDROME
ANGINA_UNSTABLE	ICD9D	411.1	INTERMED CORONARY SYND
ANGINA_UNSTABLE	ICD9D	411.8	AC ISCHEMIC HRT DIS NEC
ANGINA_UNSTABLE	ICD9D	411.81	AC ISCHEMIC HEART-NO AMI
ANGINA_UNSTABLE	ICD9D	411.89	AC ISCHEMIC HRT DIS NEC
		411.9	
ANGINA_UNSTABLE	OSCR	4111.001	UNSTABLE ANGINA
Coronary Artery Bypass ***(Disease Index)***			Deleted Codes: 37, 37 (0,10,11,12,2), 93508
CABG	CPT4	33510	Coronary artery bypass vein only; single coronary venous graft
CABG	CPT4	33511	Coronary artery bypass vein only; two coronary venous grafts
CABG	CPT4	33512	Coronary artery bypass vein only; three coronary venous grafts
CABG	CPT4	33513	Coronary artery bypass vein only; four coronary venous grafts
CABG	CPT4	33514	Coronary artery bypass vein only; five coronary venous grafts
CABG	CPT4	33516	Coronary artery bypass vein only; six or more coronary venous grafts
CABG	CPT4	33517	Coronary artery bypass using venous graft(s) and arterial graft(s); single vein graft
CABG	CPT4	33518	Coronary artery bypass using venous graft(s) and arterial graft(s); two venous grafts
CABG	CPT4	33519	Coronary artery bypass using venous graft(s) and arterial graft(s); three venous grafts
CABG	CPT4	33521	Coronary artery bypass using venous graft(s) and arterial graft(s); four venous grafts
CABG	CPT4	33522	Coronary artery bypass using venous graft(s) and arterial graft(s); five venous grafts
CABG	CPT4	33523	Coronary artery bypass using venous graft(s) and arterial graft(s); six or more venous grafts
CABG	CPT4	33533	Coronary artery bypass using arterial graft(s); single arterial graft
CABG	CPT4	33534	Coronary artery bypass using arterial graft(s); two coronary arterial grafts
CABG	CPT4	33535	Coronary artery bypass using arterial graft(s); three coronary arterial grafts
CABG	CPT4	33536	Coronary artery bypass using arterial graft(s); four or more arterial grafts
CABG	ICD9P	36	Operations on vessels of heart – incomplete
CABG	ICD9P	36.1	Aortocornary bypass for heart revascularization not otherwise specified
CABG	ICD9P	36.10	Bypass anastomosis for heart revascularization – incomplete
CABG	ICD9P	36.11	Aortocoronary bypass of one coronary artery
CABG	ICD9P	36.12	Aortocoronary bypass of two coronary arteries
CABG	ICD9P	36.13	Aortocoronary bypass of three coronary arteries
CABG	ICD9P	36.14	Aortocoronary bypasss of four or more coronary arteries
CABG	ICD9P	36.15	Single internal mammary-coronary artery bypass
CABG	ICD9P	36.16	Double internal mammary-coronary artery bypass
CABG	ICD9P	36.17	Abdominal-coronary artery bypass
CABG	ICD9P	36.19	Other bypass anastomosis for heart revasculari-zation
CABG	OSCR	7469.003	Surgically treated CHD
PRIOR_CABG	ICD9D	414.02	CORNRY ATHER-AUT BYP GFT
PRIOR_CABG	ICD9D	414.03	COR ATHER-NONAUT BYP GFT
PRIOR_CABG	ICD9D	414.04	COR AS-ART BYPASS GRFT

Disease	Code_Type	CODE	Description
PRIOR_CABG	ICD9D	414.05	COR AS-BYPASS GRAFT NOS
PRIOR_CABG	ICD9D	414.06	COR AS-TRANSPL HEART
PRIOR_CABG	ICD9D	414.07	COR AS-BYP GRAFT TRANSPL
PRIOR_CABG	CPT4	93539	INJ PROC DURING CARDIAC CATH; ART CONDUITS
PRIOR_CABG	CPT4	93540	INJ PROC DURING CARDIAC CATH; AORTOCORON VEN GFT
PRIOR_CABG	OSCR	V4581.001	POST CABG
PRIOR_CABG	OSCR	V4581.002	S/P CABG
Other Coronary Disease ***(Disease Index)***			Deleted Codes: 414 (1,10,11,12,19), 4140.003, 4140.001, 41411.000,v717.000, v717.001,v717.002
OTHER_CAD	ICD9D	414	OTH CHR ISCHEMIC HRT DIS
OTHER_CAD	ICD9D	414.0	CORONARY ATHEROSCLEROSIS
OTHER_CAD	ICD9D	414.00	CORNARY ATHERO-VESL NOS
OTHER_CAD	ICD9D	414.01	CORNARY ATHERO-NATV VESL
OTHER_CAD	ICD9D	414.8	CHR ISCHEMIC HRT DIS NEC
OTHER_CAD	ICD9D	414.9	CHR ISCHEMIC HRT DIS NOS
OTHER_CAD	OSCR	4140.001	ASHD
OTHER_CAD	OSCR	4140.002	CAD
OTHER_CAD	OSCR	4140.004	CONDUIT OBSTRUCTION
OTHER_CAD	OSCR	41400.001	CAD
OTHER_CAD	OSCR	41400.002	CONDUIT OBSTRUCTION
OTHER_CAD	OSCR	41401.001	CORONARY ARTERY DISEASE
OTHER_CAD	OSCR	4149.001	STABLE CORONARY DISEASE
OTHER_CAD	OSCR	4292.002	ASCVD
Myocardial Infarction ***(Disease Index)***			
ACUTE_MI	ICD9D	410	Acute myocardial infarction (code incomplete)
ACUTE_MI	ICD9D	410.0	Acute myocardial infarction of anterolateral wall - Incomplete
ACUTE_MI	ICD9D	410.00	Acute myocardial infarction of anterolateral wall episode of care unspecified
ACUTE_MI	ICD9D	410.01	Acute myocardial infarction of anterolateral wall initial episode of care
ACUTE_MI	ICD9D	410.02	Acute myocardial infarction of anterolateral wall subsequent episode of care
ACUTE_MI	ICD9D	410.1	Acute myocardial infarction of other anterior wall - incomplete
ACUTE_MI	ICD9D	410.10	Acute myocardial infarction of other anterior wall episode of care unspecified
ACUTE_MI	ICD9D	410.11	Acute myocardial infarction of other anterior wall initial episode of care
ACUTE_MI	ICD9D	410.12	Acute myocardial infarction of other anterior wall subsequent episode of care
ACUTE_MI	ICD9D	410.2	Acute myocardial infarction of inferolateral wall - Incomplete
ACUTE_MI	ICD9D	410.20	Acute myocardial infarction of inferolateral wall episode of care unspecified
ACUTE_MI	ICD9D	410.21	Acute myocardial infarction of inferolateral wall initial episode of care
ACUTE_MI	ICD9D	410.22	Acute myocardial infarction of inferolateral wall subsequent episode of care
ACUTE_MI	ICD9D	410.3	Acute myocardial infarction of inferoposterior wall - Incomplete
ACUTE_MI	ICD9D	410.30	Acute myocardial infarction of inferoposterior wall episode of care unspecified
ACUTE_MI	ICD9D	410.31	Acute myocardial infarction of inferoposterior wall initial episode of care
ACUTE_MI	ICD9D	410.32	Acute myocardial infarction of inferoposterior wall subsequent episode of care
ACUTE_MI	ICD9D	410.4	Acute myocardial infarction of other inferior wall - Incomplete
ACUTE_MI	ICD9D	410.40	Acute myocardial infarction of other inferior wall episode of care unspecified

Disease	Code_Type	CODE	Description
ACUTE_MI	ICD9D	410.41	Acute myocardial infarction of other inferior wall initial episode of care
ACUTE_MI	ICD9D	410.42	Acute myocardial infarction of other inferior wall subsequent episode of care
ACUTE_MI	ICD9D	410.5	Acute myocardial infarction of other lateral wall - Incomplete
ACUTE_MI	ICD9D	410.50	Acute myocardial infarction of other lateral wall episode of care unspecified
ACUTE_MI	ICD9D	410.51	Acute myocardial infarction of other lateral wall initial episode of care
ACUTE_MI	ICD9D	410.52	Acute myocardial infarction of other lateral wall subsequent episode of care
ACUTE_MI	ICD9D	410.6	Acute myocardial infarction true posterior wall infarction - Incomplete
ACUTE_MI	ICD9D	410.60	Acute myocardial infarction true posterior wall infarction episode of care unspecified
ACUTE_MI	ICD9D	410.61	Acute myocardial infarction true posterior wall infarction initial episode of care
ACUTE_MI	ICD9D	410.62	Acute myocardial infarction true posterior wall infarction subsequent episode of care
ACUTE_MI	ICD9D	410.7	Acute myocardial infarction subendocardial infarction - Incomplete
ACUTE_MI	ICD9D	410.70	Acute myocardial infarction subendocardial infarction episode of care unspecified
ACUTE_MI	ICD9D	410.71	Acute myocardial infarction subendocardial infarction initial episode of care
ACUTE_MI	ICD9D	410.72	Acute myocardial infarction subendocardial infarction subsequent episode of care
ACUTE_MI	ICD9D	410.8	Acute myocardial infarction of other specified sites - Incomplete
ACUTE_MI	ICD9D	410.80	Acute myocardial infarction of other specified sites episode of care unspecified
ACUTE_MI	ICD9D	410.81	Acute myocardial infarction of other specified sites initial episode of care
ACUTE_MI	ICD9D	410.82	Acute myocardial infarction of other specified sites subsequent episode of care
ACUTE_MI	ICD9D	410.9	Acute myocardial infarction unspecified site - Incomplete
ACUTE_MI	ICD9D	410.90	Acute myocardial infarction unspecified site episode of care unspecified
ACUTE_MI	ICD9D	410.91	Acute myocardial infarction unspecified site initial episode of care
ACUTE_MI	ICD9D	410.92	Acute myocardial infarction unspecified site subsequent episode of care
PRIOR_MI	OSCR	4109.002	Myocardial infarc
PRIOR_MI	OSCR	41090.001	History of myocardial infarction <8 weeks
PRIOR_MI	OSCR	41090.002	Myocardial infarction
PRIOR_MI	OSCR	41090.999	Cardiac MI
PRIOR_MI	OSCR	41091.001	Myocardial infarction
PRIOR_MI	OSCR	4109.001	History of MI < 8 weeks
PRIOR_MI	OSCR	41092.001	Recent MI < 8 weeks
PRIOR_MI	OSCR	411.001	MI (S/P)
PRIOR_MI	ICD9D	412	Old MI - complete
PRIOR_MI	OSCR	412.001	Post MI
PRIOR_MI	OSCR	412.002	History of Myocardial infarction (MI)
PRIOR_MI	OSCR	412.003	Old MI
PRIOR_MI	OSCR	412.004	History of MI > 8 weeks
PRIOR_MI	OSCR	412.005	Myocardial infarct (MI), OLD (>8 Weeks)
PRIOR_MI	OSCR	412.900	History of MI > 8 weeks
PRIOR_MI	OSCR	78650.003	MI (R/O)
PRIOR_MI	OSCR	V653.067	Nutrition Therapy TX for MI
Percutaneous Coronary Intervention ***(Disease Index)***			
PCI_NOSTENT	ICD9P	36.01	PTCA-NO THROMBOLYSIS
PCI_NOSTENT	ICD9P	36.02	PTCA-WITH THROMBOLYSIS

Disease	Code_Type	CODE	Description
PCI_NOSTENT	ICD9P	36.05	PTCA-MULTIPLE VESSELS
PCI_NOSTENT	ICD9P	36.09	REMOV COR ART OBSTR NEC
PCI_NOSTENT	CPT	92982	PERCUT.TRANSLUMINAL CORONARY ANGIOPLASTY;1 VES'L
PCI_NOSTENT	CPT	92984	PERCUT.TRANSLUM.CORONARY ANGIOPLASTY;EA ADD V
PCI_NOSTENT	CPT	92995	PERCUTANEOUS TRANSLUMINAL CORONARY ATHERECTOM
PCI_NOSTENT	CPT	92996	PERCUTANEOUS TRANSLUMINAL CORONARY ATHERECTOM
PRIOR_PCI_NOTSPEC	OSCR	V4582.001	Post PTCA
PRIOR_PCI_NOTSPEC	OSCR	V4582.002	POST PCI
PCI_STENT	ICD9P	36.06	INSERT CORONARY STENT
PCI_STENT	ICD9P	36.07	DRUG-ELUTING COR STENT
PCI_STENT	CPT	92980	TRNSCATH PLCMT INTRACORONRY STENT-PERC; SNGL
PCI_STENT	CPT	92981	TRNSCATH PLCMT INCORONARY STENT-PERC; EA ADD
Peripheral Arterial disease (Disease Index)			
PAD	CPT4	33335	Insertion of graft aorta or great vessels; with shunt bypass
PAD	CPT4	33860	Thoracic Aortic Aneurysm ascending aorta graft with cardiopulmonary bypass with or without valve suspension
PAD	CPT4	33870	Thoracic Aortic Aneurysm transverse arch graft with cardiopulmonary bypass
PAD	CPT4	35450	Transluminal balloon angioplasty open; renal or other visceral artery
PAD	CPT4	35452	Transluminal balloon angioplasty open; aortic
PAD	CPT4	35454	Transluminal balloon angioplasty open; iliac
PAD	CPT4	35456	Transluminal balloon angioplasty open; femoral-popliteal
PAD	CPT4	35458	Transluminal balloon angioplasty open; brachiocephalic trunk or branches each vessel
PAD	CPT4	35459	Transluminal balloon angioplasty open; tibioperoneal trunk and branches
PAD	CPT4	35470	Transluminal balloon angioplasty percutaneous; tibioperoneal trunk or branches each vessel
PAD	CPT4	35471	Transluminal balloon angioplasty percutaneous; renal or visceral artery
PAD	CPT4	35472	Transluminal balloon angioplasty percutaneous; aortic
PAD	CPT4	35473	Transluminal balloon angioplasty percutaneous; iliac
PAD	CPT4	35474	Transluminal balloon angioplasty percutaneous; femoral-popliteal
PAD	CPT4	35475	Transluminal balloon angioplasty percutaneous; brachiocephalic trunk or branches each vessel
PAD	CPT4	35476	Transluminal balloon angioplasty percutaneous; venous
PAD	CPT4	35511	Bypass graft w/ vein subclavian-subclavian
PAD	CPT4	35516	Bypass graft w/ vein subclavian-axillary
PAD	CPT4	35518	Bypass graft w/ vein axillary-axillary
PAD	CPT4	35521	Bypass graft w/ vein axillary-femoral
PAD	CPT4	35531	Bypass graft w/ vein aortoceliac or aortomesenteric
PAD	CPT4	35533	Bypass graft w/ vein axillary-femoral-femoral
PAD	CPT4	35536	Bypass graft w/ vein splenorenal
PAD	CPT4	35541	Bypass graft w/ vein aortoiliac or bi-iliac
PAD	CPT4	35546	Bypass graft w/ vein aortofemoral or bifemoral
PAD	CPT4	35548	Bypass graft w/ vein aortoiliofemoral unilateral
PAD	CPT4	35549	Bypass graft w/ vein aortoiliofemoral bilateral
PAD	CPT4	35551	Bypass graft w/ vein aortofemoral-popliteal
PAD	CPT4	35556	Bypass graft w/ vein femoral-popliteal

Disease	Code_Type	CODE	Description
PAD	CPT4	35558	Bypass graft w/ vein femoral-femoral
PAD	CPT4	35560	Bypass graft w/ vein aortorenal
PAD	CPT4	35563	Bypass graft w/ vein ilioiliac
PAD	CPT4	35565	Bypass graft w/ vein iliofemoral
PAD	CPT4	35566	Bypass graft w/ vein femoral-anterior tibial posterior tibial peroneal artery or other distal vessels
PAD	CPT4	35571	Bypass graft w/ vein popliteal-tibial -peroneal artery or other distal vessels
PAD	CPT4	35582	In-situ vein bypass; aortofemoral-popliteal (only femoral-popliteal portion in-situ)
PAD	CPT4	35583	In-situ vein bypass; femoral-popliteal
PAD	CPT4	35585	In-situ vein bypass; femoral-anterior tibial posterior tibial or peroneal artery
PAD	CPT4	35587	In-situ vein bypass; popliteal-tibial peroneal
PAD	CPT4	35612	Other than vein bypass graft subclavian-subclavian
PAD	CPT4	35616	Other than vein bypass graft subclavian-axillary
PAD	CPT4	35621	Other than vein bypass graft axillary-femoral
PAD	CPT4	35623	Other than vein bypass graft axillary-popliteal or -tibial
PAD	CPT4	35631	Other than vein bypass aortoceliac aortomesenteric aortorenal
PAD	CPT4	35636	Other than vein bypass graft splenorenal (splenic to renal arterial anastomosis)
PAD	CPT4	35641	Other than vein bypass graft aortoiliac or bi-iliac
PAD	CPT4	35646	Other than vein bypass graft aortofemoral or bifemoral
PAD	CPT4	35650	Other than vein bypass graft axillary-axillary
PAD	CPT4	35651	Other than vein bypass graft aortofemoral-popliteal
PAD	CPT4	35654	Other than vein bypass graft axillary-femoral-femoral
PAD	CPT4	35656	Other than vein bypass graft femoral-popliteal
PAD	CPT4	35661	Other than vein bypass graft femoral-femoral
PAD	CPT4	35663	Other than vein bypass graft ilioiliac
PAD	CPT4	35665	Other than vein bypass graft iliofemoral
PAD	CPT4	35666	Other than vein bypass graft femoral-anterior tibial posterior tibial or peroneal artery
PAD	CPT4	35671	Other than vein bypass graft popliteal-tibial or -peroneal artery
PAD	CPT4	35879	Revision of lower extrenity arterial bypass: w/o thrombectomy open; w/vein patch angioplasty
PAD	ICD9P	38	Incision excision and occlusion of vessels (code incomplete)
PAD	ICD9P	38.13	Endarterectomy (upper limb vessels)
PAD	ICD9P	38.14	Endarterectomy (aorta)
PAD	ICD9P	38.15	Endarterectomy (other thoracic vessels)
PAD	ICD9P	38.16	Endarterectomy (abdominal arteries)
PAD	ICD9P	38.18	Endarterectomy (lower limb arteries)
PAD	ICD9P	39	Other operations on vessels (code incomplete)
PAD	ICD9P	39.2	Other shunt or vascular bypass - incomplete
PAD	ICD9P	39.22	Aorta-subclavian-carotid bypass
PAD	ICD9P	39.24	Aorta-renal bypass
PAD	ICD9P	39.25	Aorta-iliac-femoral bypass
PAD	ICD9P	39.26	Other intra-abdominal vascular shunt or bypass
PAD	ICD9P	39.50	Angioplasty or atherectomy of non-coronary vessel: complete
PAD	ICD9D	440	Atherosclerosis (code incomplete)
PAD	ICD9D	440.0	Atherosclerosis of aorta
PAD	ICD9D	440.1	Atherosclerosis of renal artery

Disease	Code_Type	CODE	Description
PAD	ICD9D	440.2	Atherosclerosis of native arteries of the extremities - incomplete
PAD	ICD9D	440.3	Atherosclerosis of bypass graft extremities - incomplete
PAD	ICD9D	440.30	Atheroslerosis of unspecified bypass graft of extrmities
PAD	ICD9D	440.31	Atheroslerosis of autologous vein bypass graft of extremities
PAD	ICD9D	440.32	Artheroslerosis of nonautologous biological bypass graft of extremities
PAD	ICD9D	440.7	Non-coronary atherosclerosis (aorta renal extremities)
PAD	ICD9D	440.8	Atherosclerosis of other specified arteries
PAD	ICD9D	440.9	Atherosclerosis generalized and unspecified atherosclerosis
PAD	OSCR	4414.000	Aneurysm- Aorto/Iliac
PAD	OSCR	4414.001	Aneurysm Aortic Abdominal (AAA)
PAD	OSCR	4414.002	ANEURYSM, AORTIC, ABDOMINAL (AAA), CURRENT w/o RUPTURE
PAD	OSCR	4414.003	ANEURYSM, AORTIC, ABDMONIAL (AAA), STABLE
PAD	OSCR	4414.004	ANEURYSM, AORTIC, Abdominal (AAA), ENLARGING
PAD	OSCR	4414.005	ANEURYSM,Suprarenal AORTIC
PAD	OSCR	4414.006	ANEURYSM, Supraceliac AORTIC
PAD	OSCR	4419.000	Aneurysm Aortic
PAD	OSCR	4419.001	Aortic aneurysm stable
PAD	OSCR	4419.002	Aneurysm, aortic, enlarging
PAD	OSCR	4419.003	Dilated Aortic Root
PAD	OSCR	4439.000	Peripheral vascular disease- claudication intermittent
PAD	OSCR	4439.001	PVD/Peripheral Vascular Disease (1994, 1995 listed as cervico-throacic dysfunction)
PAD	OSCR	4439.002	Peripheral vascular disease
PAD	OSCR	4439.005	Peripheral vascular disease- claudication
PAD	OSCR	4439.006	PVD; Chest Pain
PAD	OSCR	4439.900	PVD
PAD	CPT4	75962	Transluminal balloon angioplasty each addit. peripheral artery radiological supervision and interpretation
PAD	CPT4	75964	Transluminal balloon angioplasty each additional peripheral artery radiological supervision and interpretation; add-on code
PAD	CPT4	75966	Transluminal balloon angioplasty renal or other visceral artery radiological supervision and interpretation
PAD	CPT4	75968	Transluminal balloon angioplasty each additional visceral artery radiological supervision and interpretation; add-on code
PAD	ICD9D	747.1	Coarctation of Aorta
PAD	ICD9D	747.10	Coarctation – Aorta
PAD	ICD9D	747.2	Congenital anomaly of aorta NOS
PAD	ICD9D	747.21	Congenital anomalies of aortic arch
PAD	ICD9D	747.22	Congenital aortic Atresia/Stenosis
PAD	ICD9D	747.29	Congenital anomaly of aorta NEC
PAD	OSCR	V433.003	Aneurysm- post aortic surgery
PAD	OSCR	V4589.007	Post aortic surgery
Chronic lung disease ***(Disease Index)***			Deleted Codes: 496.003
LUNG	ICD9D	490	Bronchitis not specified as acute or chronic - complete

Disease	Code_Type	CODE	Description
LUNG	ICD9D	491	Chronic bronchitis - incomplete
LUNG	ICD9D	491.0	Simple chronic bronchitis
LUNG	ICD9D	491.1	Mucopurulent chronic bronchitis
LUNG	ICD9D	491.2	Obstructive chronic bronchitis - incomplete
LUNG	ICD9D	491.20	Obstructive chronic bronchitis without exacerbation
LUNG	ICD9D	491.21	Obstructive chronic bronchitis without (acute) exacerbation
LUNG	ICD9D	491.8	Other chronic bronchitis
LUNG	ICD9D	491.9	Unspecified chronic bronchitis
LUNG	ICD9D	492	Emphysema (code incomplete)
LUNG	ICD9D	492.0	Emphysematous bleb
LUNG	ICD9D	492.8	Other emphysema
LUNG	ICD9D	493	Asthma (code incomplete)
LUNG	ICD9D	493.0	Extrinsic asthma - incomplete
LUNG	ICD9D	493.00	Extrinsic asthma without mention of status asthmaticus
LUNG	ICD9D	493.01	Extrinsic asthma with status asthmaticus
LUNG	ICD9D	493.02	Extrinsic asthma with acute exacerbation
LUNG	ICD9D	493.1	Intrinsic asthma - incomplete
LUNG	ICD9D	493.10	Intrinsic asthma without mention of status asthmaticus
LUNG	ICD9D	493.11	Intrinsic asthma with status asthmaticus
LUNG	ICD9D	493.12	Intrinsic asthma with acute exacerbation
LUNG	ICD9D	493.2	Chronic obstructive asthma - incomplete
LUNG	ICD9D	493.20	Chronic obstructive asthma without mention of status asthmaticus
LUNG	ICD9D	493.21	Chronic obstructive asthma with status asthmaticus
LUNG	ICD9D	493.22	Chronic obstructive asthma with acute exacerbation
LUNG	ICD9D	493.9	Asthma unspecified - incomplete
LUNG	ICD9D	493.90	Asthma unspecified without mention of status asthmaticus
LUNG	ICD9D	493.91	Asthma unspecified with status asthmaticus
LUNG	ICD9D	493.92	Asthma unspecified with acute exacerbation
LUNG	ICD9D	494	Bronchiectasis - incomplete
LUNG	ICD9D	494.0	Bronchiectasis without acute exacerbation
LUNG	ICD9D	494.1	Bronchiectasis with acute exacerbation
LUNG	ICD9D	495	Extrinisc allergic alveolitis (code incomplete)
LUNG	ICD9D	495.0	Farmers' lung
LUNG	ICD9D	495.1	Bagassosis
LUNG	ICD9D	495.2	Bird-fanciers' lung
LUNG	ICD9D	495.3	Suberosis
LUNG	ICD9D	495.4	Malt workers' lung
LUNG	ICD9D	495.5	Mushroom workers' lung
LUNG	ICD9D	495.6	Maple bark-strippers' lung
LUNG	ICD9D	495.7	Ventilation pneumonitis
LUNG	ICD9D	495.8	Other specified allergic alveolitis and pneumonitis
LUNG	ICD9D	495.9	Unspecified allergic alveolitis and pneumonitis
LUNG	ICD9D	496	Chronic airway obstruction not elsewhere classified - complete
LUNG	ICD9D	518.1	Interstitial emphysema

Disease	Code_Type	CODE	Description
LUNG	ICD9D	518.2	Compensatory emphysema
LUNG	OSCR	491.000	Chronic bronchitis
LUNG	OSCR	4912.000	Bronchitis chronic
LUNG	OSCR	49120.001	Chronic bronchitis with COPD
LUNG	OSCR	493.000	Asthma
LUNG	OSCR	49300.001	Allergic asthma intermittent
LUNG	OSCR	49300.002	Allergic asthma mild persistent
LUNG	OSCR	49300.003	Allergic asthma moderate persistent
LUNG	OSCR	49301.000	Asthma- acute
LUNG	OSCR	49301.001	Allergic asthma severe persistent
LUNG	OSCR	49301.002	Allergic asthma acute exacerbation
LUNG	OSCR	49310.001	Asthma intermittent
LUNG	OSCR	49310.002	Asthma mild persistent
LUNG	OSCR	49310.003	Asthma moderate persistent
LUNG	OSCR	49311.001	Asthma severe persistent
LUNG	OSCR	49311.002	Asthma acute exacerbation
LUNG	OSCR	49320.001	Asthma w/chronic obstructive pulmonary disease (COPD)
LUNG	OSCR	49320.002	Asthma chronic obstructive
LUNG	OSCR	4939.000	Asthma/bronchospas.
LUNG	OSCR	4939.001	Asthma
LUNG	OSCR	4939.002	Asthma/RAWD
LUNG	OSCR	4939.003	Asthma/RAWD- moderate
LUNG	OSCR	4939.004	Asthma/RAWD- severe
LUNG	OSCR	49390.000	Asthma
LUNG	OSCR	49390.001	Asthma/COPD/bronchospasm
LUNG	OSCR	49390.002	Asthma/RAD
LUNG	OSCR	49390.003	Asthma/RAD moderate
LUNG	OSCR	49390.004	Bronchial asthma acute
LUNG	OSCR	49390.008	Bronchial asthma mild persistent
LUNG	OSCR	49390.010	Bronchial asthma moderate persistent
LUNG	OSCR	49390.012	Bronchial asthma steroid dependent (oral)
LUNG	OSCR	49390.014	Bronchial asthma intermittent
LUNG	OSCR	49390.016	Asthma/RAD intermittent
LUNG	OSCR	49390.017	Asthma/RAD mild persistent
LUNG	OSCR	49390.018	Asthma/RAD moderate persistent
LUNG	OSCR	49390.019	Asthma- Intermittent
LUNG	OSCR	49390.020	Asthma- mild persistent
LUNG	OSCR	49390.021	Asthma- moderate persistent
LUNG	OSCR	49390.022	Asthma cough variant
LUNG	OSCR	49390.023	Asthma exercise induced
LUNG	OSCR	49390.024	Asthma/RAD severe persistent
LUNG	OSCR	49390.700	Reactive Airway disease
LUNG	OSCR	49390.701	Asthma Persistent Controlled
LUNG	OSCR	49390.702	Asthma persistent uncontrolled

Disease	Code_Type	CODE	Description
LUNG	OSCR	49391.001	Asthma/RAD severe
LUNG	OSCR	49391.002	Bronchial asthma severe persistent
LUNG	OSCR	49391.004	Bronchial asthma acute exacerbation
LUNG	OSCR	49391.005	Asthma/RAD severe persistent
LUNG	OSCR	49391.006	Asthma- severe persistent
LUNG	OSCR	49391.007	Asthma- acute exacerbation
LUNG	OSCR	49392.001	Asthma acute exacerbation
LUNG	OSCR	496.000	Chronic Obstructive Pulmonary Disease (COPD)
LUNG	OSCR	496.001	Chronic Obstructive Pulmonary Disease (COPD)
LUNG	OSCR	496.002	Chronic Lung Disease NOS
LUNG	OSCR	496.900	COPD
Chronic liver disease ***(Disease Index)***			
LIVER	ICD9D	070	Viral hepatitis- incomplete
LIVER	ICD9D	070.0	Viral hep A with hepatic coma- complete
LIVER	ICD9D	070.2	Viral hepatitis B with hepatic coma - incomplete
LIVER	ICD9D	070.20	Viral hepatitis B with hepatic coma acute or unspecified without mention of hepatitis delta
LIVER	ICD9D	070.21	Viral hepatitis B with hepatic coma acute or unspecified with hepatitis delta
LIVER	ICD9D	070.22	Viral hepatitis B with hepatic coma chronic without mention of hepatitis delta
LIVER	ICD9D	070.23	Viral hepatitis B with hepatic coma chronic with hepatitis delta
LIVER	ICD9D	070.3	Viral hepatitis B without mention of hepatic coma - incomplete
LIVER	ICD9D	070.30	Viral hepatitis B without mention of hepatic coma acute or unspecified without mention of hepatitis delta
LIVER	ICD9D	070.31	Viral hepatitis B without mention of hepatic coma acute or unspecified with hepatitis delta
LIVER	ICD9D	070.32	Viral hepatitis B without mention of hepatic coma chronic without mention of hepatitis delta
LIVER	ICD9D	070.33	Viral hepatitis B without mention of hepatic coma chronic with hepatitis delta
LIVER	ICD9D	070.4	Other specified viral hepatitis with hepatic coma - incomplete
LIVER	ICD9D	070.41	Acute or unspecified hepatitis C with hepatic coma
LIVER	ICD9D	070.42	Hepatitis delta without mention of active hep B disease with hepatic coma- complete
LIVER	ICD9D	070.43	Hep E with hepatic coma- complete
LIVER	ICD9D	070.44	Chronic hepatitis C with hepatic coma
LIVER	ICD9D	070.49	Other specified viral hepatitis with hepatic coma- complete
LIVER	ICD9D	070.5	Other specified viral hepatitis without mention of hepatic coma- incomplete
LIVER	ICD9D	070.51	Acute or unspecified hep C without mention of hepatic coma- complete
LIVER	ICD9D	070.52	Hepatitis delta without mention of active hep B disease or hepatic coma-complete
LIVER	ICD9D	070.53	Hep E without mention of hepatic coma- complete
LIVER	ICD9D	070.54	Chronic hepatitis C without mention of hepatic coma
LIVER	ICD9D	070.59	Other specified viral hepatitis without mention of hepatic coma
LIVER	ICD9D	070.6	Unspecified viral hepatitis with hepatic coma- complete
LIVER	ICD9D	070.9	Unspecified viral hepatitis without mention of hepatic coma- complete
LIVER	ICD9D	570	Acute and subacute necrosis of the liver- complete
LIVER	ICD9D	571	Chronic liver disease and cirrhosis- incomplete
LIVER	ICD9D	571.0	Alcoholic fatty liver- complete
LIVER	ICD9D	571.1	Acute alcoholic hepatitis- complete

Disease	Code_Type	CODE	Description
LIVER	ICD9D	571.2	Alcoholic cirrhosis of liver- complete
LIVER	ICD9D	571.3	Alcoholic liver damage unspecified- complete
LIVER	ICD9D	571.4	Chronic hepatitis- incomplete
LIVER	ICD9D	571.40	Chronic hepatitis unspecified- complete
LIVER	ICD9D	571.41	Chronic persistent hepatitis- complete
LIVER	ICD9D	571.49	Other chronic hepatitis- complete
LIVER	ICD9D	571.5	Cirrhosis of liver without mention of alcohol- complete
LIVER	ICD9D	571.6	Biliary cirrhosis- complete
LIVER	ICD9D	571.8	Other chronic nonalcoholic liver disease- complete
LIVER	ICD9D	571.9	Unspecified chronic liver disease without mention of alcohol- complete
LIVER	OSCR	5712.001	Alcoholic liver disease
LIVER	OSCR	5712.002	Cirrhosis, Alcoholic
LIVER	OSCR	5713.000	Alcoholic liver disease
LIVER	OSCR	5713.001	Alcoholic liver disease
LIVER	OSCR	5714.000	Hepatitis- chronic
LIVER	OSCR	57140.000	Chronic hepatitis
LIVER	OSCR	57140.001	Hepatitis other chronic
LIVER	OSCR	57149.001	Chronic hepatitis- autoimmune
LIVER	OSCR	57149.002	Chronic hepatitis- non-autoimmune
LIVER	OSCR	57149.003	Metabolic liver disease alpha/antitrypsin def. disease
LIVER	OSCR	57149.004	Chronic active hepatitis
LIVER	OSCR	57149.005	Hepatitis autoimmune
LIVER	OSCR	5715.000	Liver- cirrhosis
LIVER	OSCR	5715.001	Cirrhosis liver non-alcoholic
LIVER	OSCR	5715.002	Cirrhosis liver unspecified
LIVER	OSCR	5716.000	Primary biliary cirrhosis
LIVER	ICD9D	572	Liver abscess and sequelae of chronic liver disease- incomplete
LIVER	ICD9D	572.0	Abscess of liver- complete
LIVER	ICD9D	572.1	Portal pyemia- complete
LIVER	ICD9D	572.2	Hepatic coma- complete
LIVER	ICD9D	572.3	Portal hypertension- complete
LIVER	ICD9D	572.4	Hepatorenal syndrome- complete
LIVER	ICD9D	572.8	Other sequelae of chronic liver disease- complete
LIVER	ICD9D	573	Other disorders of liver- incomplete
LIVER	ICD9D	573.0	Chronic passive congestion of liver- complete
LIVER	ICD9D	573.1	Hepatitis in viral diseases classified elsewhere- complete
LIVER	ICD9D	573.2	Hepatitis in other infectious diseases classified elsewhere- complete
LIVER	ICD9D	573.3	Hepatitis unspecified- complete
LIVER	ICD9D	573.4	Hepatic infarction- complete
LIVER	ICD9D	573.8	Other specified liver disorders- complete
LIVER	ICD9D	573.9	Unspecified disorder of liver- complete
LIVER	OSCR	5730.001	Congestive liver
LIVER	OSCR	5733.000	Hepatitis
LIVER	OSCR	5733.004	Drug-induced liver disease

Disease	Code_Type	CODE	Description
LIVER	OSCR	5738.002	Metabolic liver disease
LIVER	OSCR	5739.000	Liver disease NOS
LIVER	OSCR	5739.003	Metabolic liver disease- storage
LIVER	OSCR	5739.005	Metabolic liver disease- other
LIVER	ICD9D	70.30	Viral hepatitis B without mention of hepatic coma acute or unspecified without mention of hepatitis delta
Dementia/Psychotic disorders ***(Disease Index)***			Deleted Codes: 290(11,12)
DEMENT	ICD9D	290	Senile and presenile organic psychotic conditions (code incomplete)
DEMENT	ICD9D	290.0	SENILE DEMENTIA UNCOMP
DEMENT	ICD9D	290.1	PRESENILE DEMENTIA
DEMENT	ICD9D	290.10	PRESD UNCOMPLICATED
DEMENT	ICD9D	290.13	Presenile dementia with depressive features
DEMENT	ICD9D	290.2	Senile dementia with delusional or depressive features - incomplete
DEMENT	ICD9D	290.20	Senile Delusion
DEMENT	ICD9D	290.21	Senile dementia with depressive features
DEMENT	ICD9D	290.4	Vascular dementia
DEMENT	ICD9D	290.40	AS Dementia UNCOMP
DEMENT	ICD9D	290.41	VASC Dementia w delirium
DEMENT	ICD9D	290.42	VASC dementia w delusion
DEMENT	ICD9D	290.43	Arteriosclerotic dementia with depressive freatures.
DEMENT	ICD9D	290.8	Senile psychosis NEC
DEMENT	ICD9D	290.9	Senie Psychot Cond NOS
DEMENT	OSCR	2900.000	Dementia- others
DEMENT	OSCR	2900.001	Dementia- etiology undetermined
DEMENT	OSCR	29040.001	Dementia multi-infarct
DEMENT	OSCR	29040.002	Dementia vascular
DEMENT	ICD9D	294	Other organic psychotic conditions (chronic) (code incomplete)
DEMENT	ICD9D	294.0	AMNESTIC SYNDROME - Complete
DEMENT	ICD9D	294.1	Dementia in conditions classified elsewhere - Incomplete
DEMENT	ICD9D	294.10	Dementia in conditions classified elsewhere without behavioral disturbance
DEMENT	ICD9D	294.11	Dementia in conditions classified elsewhere with behavioral disturbance
DEMENT	ICD9D	294.8	Other specified organic brain syndromes (chronic)
DEMENT	ICD9D	294.9	Unspecified organic brain syndrome (chronic)
DEMENT	OSCR	2941.000	Dementia
DEMENT	OSCR	2941.001	Dementia AIDS related
DEMENT	OSCR	2941.002	Dementia due to Parkinson's disease
DEMENT	OSCR	2941.003	Dementia due to Huntington’s disease
DEMENT	OSCR	2941.004	Dementia due to Pick's disease
DEMENT	OSCR	2941.005	DEMENTIA DUE TO CREUTZFELDT J. DIS
DEMENT	OSCR	2941.006	AIDS DEMENTIA COMPLEX
DEMENT	OSCR	2941.042	Dementia AIDS related
DEMENT	OSCR	29410.001	Dementia AIDS related

Disease	Code_Type	CODE	Description
DEMENT	OSCR	29410.002	Dementia due to Parkinson's disease
DEMENT	OSCR	29410.003	Dementia due to Huntington's disease
DEMENT	OSCR	29410.004	Dementia due to Pick's disease
DEMENT	OSCR	29410.005	Dementia due to Creutzfeldt Jakob disease
DEMENT	OSCR	29410.006	Dementia. AIDS comples related
DEMENT	OSCR	2948.001	Dementia etiology undetermined
DEMENT	OSCR	2948.002	Dementia
DEMENT	OSCR	2948.003	Dementia due to head trauma
DEMENT	OSCR	2948.004	Dementia Complex. AIDS
DEMENT	OSCR	2948.006	Dementia in remission
DEMENT	OSCR	2948.008	DEMENTIA, MILD
DEMENT	OSCR	2948.009	DEMENTIA, MODERATE
DEMENT	OSCR	2948.010	DEMENTIA, SEVERE
DEMENT	OSCR	2948.011	DEMENTIA, UNSPECIFIED
DEMENT	OSCR	2949.003	Dementia unspecified
DEMENT	ICD9D	331	Other cerebral degenerations (code incomplete)
DEMENT	ICD9D	331.0	Alzheimer's disease
DEMENT	ICD9D	331.1	Front to temporal dementia
DEMENT	ICD9D	331.11	PICK's Disease
DEMENT	ICD9D	331.19	Front to Temporal Dem Nec
DEMENT	ICD9D	331.2	Senile degenration of brain
DEMENT	ICD9D	331.7	Cerebral Degn in DCE
DEMENT	ICD9D	331.8	Cereb degeneration nec
DEMENT	ICD9D	331.81	Reye's syndrome
DEMENT	ICD9D	331.82	Dementia with Lewy Bodies
DEMENT	ICD9D	331.89	Bereb Degeneration Nec
DEMENT	ICD9D	331.9	Cereb degeneration NOS
DEMENT	OSCR	3310.000	Alzheimer's disease
DEMENT	OSCR	3310.001	Dementia Alzheimer's type early onset
DEMENT	OSCR	3310.002	Dementia Alzheimer's type late onset
DEMENT	OSCR	7809.003	Memory disorder
Depression ***(Disease Index)***			Deleted Codes: 296 (" ",0, 00, 01, 02, 1, 10, 11, 12, 13, 14, 15, 16, 9, 90, 99, 81) , 311 (003, 006), 3004 (001,002,003), 305 (80, 81,82,83, 8)
DEPRESS	ICD9D	296.2	Major depressive disorder single episode (code incomplete)
DEPRESS	ICD9D	296.20	Major depressive disorder single episode (unspecified)
DEPRESS	ICD9D	296.21	Major depressive disorder single episode (mild)
DEPRESS	ICD9D	296.22	Major depressive disorder single episode (moderate)
DEPRESS	ICD9D	296.23	Major depressive disorder single episode (severe without mention of psychotic behavior)
DEPRESS	ICD9D	296.24	Major depressive disorder single episode (severe specified as with psychotic behavior)
DEPRESS	ICD9D	296.25	Major depressive disorder single episode (in partial or unspecified remission)
DEPRESS	ICD9D	296.26	Major depressive disorder single episode (in full remission)
DEPRESS	ICD9D	296.3	Major depressive disorder recurrent episode - incomplete
DEPRESS	ICD9D	296.30	Major depressive disorderrecurrent episode (unspecified)
DEPRESS	ICD9D	296.31	Major depressive disorder recurrent episode (mild)

Disease	Code_Type	CODE	Description
DEPRESS	ICD9D	296.32	Major depressive disorder recurrent episode (moderate)
DEPRESS	ICD9D	296.33	Major depressive disorder recurrent episode (severe without mention of psychotic behavior)
DEPRESS	ICD9D	296.34	Major depressive disorder recurrent episode (severe specified as with psychotic behavior)
DEPRESS	ICD9D	296.35	Major depressive disorder recurrent episode (in partial or unspecified remission)
DEPRESS	ICD9D	296.36	Major depressive disorder recurrent episode (in full remission)
DEPRESS	ICD9D	296.4	BPI – RECENT MANIC EPISODE
DEPRESS	ICD9D	296.40	BIPOL AFF Manic-Mild
DEPRESS	ICD9D	296.41	BPI-RECENT MANIC MILD
DEPRESS	ICD9D	296.42	BAD MANIC-MODERATE
DEPRESS	ICD9D	296.43	BAD MANIC-Severe
DEPRESS	ICD9D	296.44	BIPOL MANIC-SSEV W PSYCHO
DEPRESS	ICD9D	296.45	BAD-PART REMISSION
DEPRESS	ICD9D	296.46	BAD-FULL REMISSION
DEPRESS	ICD9D	296.5	Bipolar affective disorder depressed - incomplete
DEPRESS	ICD9D	296.50	Bipolar affective disorder depressed (unspecified)
DEPRESS	ICD9D	296.51	Bipolar affective disorder depressed (mild)
DEPRESS	ICD9D	296.52	Bipolar affective disorder depressed (moderate)
DEPRESS	ICD9D	296.53	Bipolar affective disorder depressed (severe without mention of psychotic behavior)
DEPRESS	ICD9D	296.54	Bipolar affective disorder depressed (severe specified as with psychotic behavior)
DEPRESS	ICD9D	296.55	Bipolar affective disorder depressed (in partial or unspecified remission)
DEPRESS	ICD9D	296.56	Bipolar affective disorder depressed (in full remission)
DEPRESS	ICD9D	296.6	BPI-RECENT MIXED EPISODE
DEPRESS	ICD9D	296.60	BPI-RECENT MIXED NOS
DEPRESS	ICD9D	296.61	Bipolar Affective-RECENT MIXED MILD
DEPRESS	ICD9D	296.62	BIPOLAR AFFEC, MIXED-MOD
DEPRESS	ICD9D	296.63	BPI-RECENT MIXED SEVERE
DEPRESS	ICD9D	296.64	BPI-RECENT MIXED PSYCH
DEPRESS	ICD9D	296.65	BPI-RECENT MIX PART REM
DEPRESS	ICD9D	296.66	BPI-RECENT MIX FULL REM
DEPRESS	ICD9D	296.7	Bipolar Affective NOS
DEPRESS	ICD9D	296.8	Manic-depressive psychosis other and unspecified - incomplete
DEPRESS	ICD9D	296.80	Manic-depressive psychosis unspecified
DEPRESS	ICD9D	296.82	Atypical depressive disorder
DEPRESS	ICD9D	296.89	Other manic-depressive psychosis
DEPRESS	ICD9D	300.4	Neurotic depression
DEPRESS	ICD9D	301.12	Chronic depressive personality disorder
DEPRESS	ICD9D	309.1	Prolonged depressive reaction as ajustment reaction

Disease	Code_Type	CODE	Description
DEPRESS	ICD9D	311	Depressive disorder NEC
DEPRESS	OSCR	2962.000	Major depression single psychotic
DEPRESS	OSCR	2962.001	Major depression single
DEPRESS	OSCR	2962.002	Major Depressive Disease Single episode
DEPRESS	OSCR	29620.001	Major depression single episode
DEPRESS	OSCR	29620.002	Major depression single psychotic
DEPRESS	OSCR	29620.003	Major depression
DEPRESS	OSCR	29620.005	Major depression with psychosis
DEPRESS	OSCR	29625.001	Major depression in remission
DEPRESS	OSCR	29625.002	Major depression single psychotic in remission
DEPRESS	OSCR	29625.003	Major depression single in remission
DEPRESS	OSCR	29625.700	Depression Major in remission
DEPRESS	OSCR	2963.000	Major depression recurrent psychotic
DEPRESS	OSCR	2963.001	Major depression recurrent
DEPRESS	OSCR	2963.002	Major depressive disorder recurrent episode
DEPRESS	OSCR	29630.001	Major depression recurrent episode
DEPRESS	OSCR	29630.002	Major depression recurrent psychotic
DEPRESS	OSCR	29635.001	Major depression recurrent psychotic in remission
DEPRESS	OSCR	29635.002	Major depression recurrent in remission
DEPRESS	OSCR	2965.000	Bipolar disorder depressed
DEPRESS	OSCR	29650.000	Bipolar disorder depressed
DEPRESS	OSCR	29650.001	Bipolar disorder depressed
DEPRESS	OSCR	2980.001	Major depression with psychosis
DEPRESS	OSCR	2980.002	Major depression with psychosis in remission
DEPRESS	OSCR	3004.000	Depressive disorder
DEPRESS	OSCR	3004.004	Depression psychogenic
DEPRESS	OSCR	3004.005	Depressive features
DEPRESS	OSCR	3090.001	Adjustment disorder with depressed mood
DEPRESS	OSCR	3090.002	Adjustment disorder with depressed mood
DEPRESS	OSCR	3090.003	Adjustment disorder with depressed mood
DEPRESS	OSCR	3090.004	Adjustment disorder with depressed mood in remission
DEPRESS	OSCR	30928.003	Adjustment disorder with mixed anxiety/depression
DEPRESS	OSCR	30928.004	Adjustment dis w/mixed anxiety/depression in remission
DEPRESS	OSCR	30928.005	Adjustment disorder with depressed mood in remission
DEPRESS	OSCR	311.000	Depressive disorder NOS
DEPRESS	OSCR	311.001	Depression
DEPRESS	OSCR	311.002	Depression/suicidal
DEPRESS	OSCR	311.004	Depression NOS
DEPRESS	OSCR	311.005	Depression NOS in remission
DEPRESS	OSCR	311.008	Depressive disorder
DEPRESS	OSCR	311.009	Depressive disorder in remission
DEPRESS	OSCR	311.010	Depressive disorder

Disease	Code_Type	CODE	Description
DEPRESS	OSCR	311.011	Depressive disorder in remission
DEPRESS	OSCR	311.012	Depressive features
DEPRESS	OSCR	V6549.128	Depression individual counseling
DEPRESS	OSCR	V6549.129	Depression group counseling
DEPRESS	OSCR	V6549.267	DEPRESSION, INDIV/GRP EDUC & COUNSELING
Pericarditis ***(Disease Index)***			
PERICARD	ICD9D	115.03	Infection by Histoplasma capsulatum pericarditis
PERICARD	ICD9D	115.13	Infection by Histoplasma duboisii pericarditis
PERICARD	ICD9D	115.93	Histoplasmosis unspecified pericarditis
PERICARD	ICD9D	036.41	Meningococcal pericarditis
PERICARD	ICD9D	074.21	Coxsackie Pericarditis
PERICARD	ICD9D	093.81	Syphilitic percarditis
PERICARD	ICD9D	098.83	Gonococcal Pericarditis
PERICARD	ICD9D	39.10	Acute rheumatic pericarditis
PERICARD	ICD9D	393	CHR Rheumatic Pericarditis
PERICARD	ICD9D	420	Acute pericarditis (code incomplete)
PERICARD	ICD9D	420.0	Acute pericarditis in diseases classified elsewhere
PERICARD	ICD9D	420.9	Other and unspecified acute pericarditis (code incomplete)
PERICARD	ICD9D	420.90	Acute pericarditis unspecified
PERICARD	ICD9D	420.91	Acute idiopathic pericarditis
PERICARD	ICD9D	420.99	Other and unspecified acute pericarditis other
PERICARD	ICD9D	423	Other diseases of pericardium (code incomplete)
PERICARD	ICD9D	423.0	Hemopericardium
PERICARD	ICD9D	423.1	Adhesive pericarditis
PERICARD	ICD9D	423.2	Constrictive pericarditis
PERICARD	ICD9D	423.8	Other specified diseases of pericardium
PERICARD	ICD9D	423.9	Unspecified disease of pericardium
PERICARD	OSCR	42090.000	Pericarditis acute
PERICARD	OSCR	4232.000	Pericarditis constrictive
PERICARD	OSCR	4238.000	Pericarditis- chronic
PERICARD	OSCR	4238.001	Pericarditis chronic
PERICARD	OSCR	4239.000	Pericardial disease
PERICARD	OSCR	4239.001	Pericarditis
PERICARD	OSCR	4239.002	Chronic pericarditis
PERICARD	OSCR	4239.003	Pericarditis pain
PERICARD	OSCR	4239.004	Effusion pericardial
PERICARD	OSCR	4294.001	Post pericardiotomy syndrome
PERICARD	OSCR	585.002	Uremic pericarditis
Hyperthyroidism ***(Disease Index)***			
HYPER	ICD9D	242	Thyrotoxicosis with or without goiter incomplete
HYPER	ICD9D	242.0	Toxic diffuse goiter without mention of thyrotoxic crisis or storm
HYPER	ICD9D	242.00	Tox dif goiter no crisis
HYPER	ICD9D	242.01	Toxic diffuse goiter with mention of thyrotoxic crisis or storm

Disease	Code_Type	CODE	Description
HYPER	ICD9D	242.1	Toxic uninodular goiter - Incomplete
HYPER	ICD9D	242.10	Toxic uninodular goiter without mention of thyrotoxic crisis or storm
HYPER	ICD9D	242.11	Toxic uninodular goiter with mention of thyrotoxic crisis or storm
HYPER	ICD9D	242.2	Toxic multinodular goiter - Incomplete
HYPER	ICD9D	242.20	Toxic multinodular goiter without mention of thyrotoxic crisis or storm- complete
HYPER	ICD9D	242.21	Toxic multinodular goiter with mention of thyrotoxic crisis or storm- complete
HYPER	ICD9D	242.3	Toxic nodular goiter unspecified type - Incomplete
HYPER	ICD9D	242.30	Toxic nodular goiter unspecified type without mention of thyrotoxic crisis or storm- complete
HYPER	ICD9D	242.31	Toxic nodular goiter unspecified type with mention of thyrotoxic crisis or storm- complete
HYPER	ICD9D	242.4	Thyrotoxicosis from ectopic thyroid nodule - Incomplete
HYPER	ICD9D	242.40	Thyrotoxicosis from ectopic thyroid nodule without mention of thyrotoxic crisis or storm- complete
HYPER	ICD9D	242.41	Thyrotoxicosis from ectopic thyroid nodule with mention of thyrotoxic crisis or storm- complete
HYPER	ICD9D	242.8	Thyrotoxicosis of other specified origin - Incomplete
HYPER	ICD9D	242.80	Thyrotoxicosis of other specified origin without mention of thyrotoxic crisis or storm- complete
HYPER	ICD9D	242.81	Thyrotoxicosis of other specified origin with mention of thyrotoxic crisis or storm- complete
HYPER	ICD9D	242.9	Thyrotoxicosis without mention of goiter or other cause - Incomplete
HYPER	ICD9D	242.90	Thyrotoxicosis without mention of goiter or other cause without mention of thyrtoxic crisis or storm-complete
HYPER	ICD9D	242.91	Thyrotoxicosis without mention of goiter or other cause with mention of thyrtoxic crisis or storm-complete
HYPER	OSCR	2429.001	Hyperthyroidism
HYPER	OSCR	24290.001	Hyperthyroidism
HYPER	AHFS	683608	
HYPER	KHFS	502515	
HYPER	LURS	1001740	RESULTS <0.1
Hypothyroidism ***(Disease Index)***			Delete Codes: 2449.001
HYPO	OSCR	243.000	Congenital hypothyroidism
HYPO	OSCR	2440.000	Post surgical hypothyroidism
HYPO	OSCR	2440.001	Hypothyroidism – Acqired/ Other
HYPO	OSCR	2441.001	Post radiation hypothyroidism
HYPO	OSCR	2441.002	Hypothyroidism Post Radioactive Iodine
HYPO	OSCR	2442.001	Post radiation iodine hypothyroidism
HYPO	OSCR	2448.000	Hypothyroidism. Acquired/Other
HYPO	OSCR	2448.001	Hypothyroidism. Secondary
HYPO	OSCR	2449.000	Hypothyroidism
HYPO	OSCR	2449.002	Hypothyroidism - autoimmune
HYPO	OSCR	2449.005	Hypothyroidism Acuqired/Other
HYPO	OSCR	2449.006	Hypothyroidism. NOS
SUBC_HYPO	OSCR	7945.002	Subclinical hypothyroidism
SUBC_HYPO	OSCR	7945.003	Subclinical hypothyroidism
HYPO	ICD9D	243	Congenital hypothyroidism - complete
HYPO	ICD9D	244	Acquired hypothyroidism (code incomplete)
HYPO	ICD9D	244.0	Postsurgical hypothyroidism

Disease	Code_Type	CODE	Description
HYPO	ICD9D	244.1	Other postablative hypothyroidism
HYPO	ICD9D	244.2	Iodine hypothyroidism
HYPO	ICD9D	244.3	Other iatrogenic hypothyroidism
HYPO	ICD9D	244.8	Other specified acquired hypothyroidism
HYPO	ICD9D	244.9	Unspecified hypothyroidism
HYPO	OSCR	243.000	Congenital hypothyroidism
HYPO	OSCR	2440.000	Post-surgical hypothyroidism
HYPO	OSCR	2440.001	Hypothyroidism- acquired/other
HYPO	OSCR	2441.001	Post-radiation hypothyroidism
HYPO	OSCR	2441.002	Post-radioactive iodine hypothyroidism
HYPO	OSCR	2442.001	Post radioactive iodine hypothryoidism
HYPO	OSCR	2448.000	Hypothyroidism, Acquired/Other
HYPO	OSCR	2448.001	Secondary hypothyroidism
HYPO	OSCR	2449.000	Hypothyroidism
HYPO	OSCR	2449.001	Euthyroid
HYPO	OSCR	2449.002	Hypothyroidism- autoimmune
HYPO	OSCR	2449.003	TGB deficiency
HYPO	OSCR	2449.004	Euthyroid on RX
HYPO	OSCR	2449.005	Hypothyroidism- acquired/other
HYPO	OSCR	2449.006	Hypothyroidism not specified
HYPO	OSCR	2469.002	Thyroid hormaone resistance
HYPO	AHFS	683604	
HYPO	KHFS	502505	
HYPO	KHFS	502510	
HYPO	LURS	1001740	THYROID STIMULATING HORMONE (TSH) RESULTS ≥ 10
Rheumatic heart disease *(Disease Index)*			
RHD	ICD9D	391	Rheumatic fever with heart involvement (code incomplete)
RHD	ICD9D	391.0	Acute rheumatic pericarditis
RHD	ICD9D	391.1	Acute rheumatic endocarditis
RHD	ICD9D	391.2	Acute rheumatic myocarditis
RHD	ICD9D	391.8	Other acute rheumatic heart disease
RHD	ICD9D	391.9	Acute rheumatic heart disease unspecified
RHD	ICD9D	392	Rheumatic chorea (code incomplete)
RHD	ICD9D	392.0	Rheumatic chorea with heart involvement
RHD	ICD9D	392.9	Rheumatic chorea without mention of heart involvement
RHD	ICD9D	393	Chronic rheumatic pericarditis - complete
RHD	ICD9D	397.1	Rheumatic diseases of pulmonary valve
RHD	ICD9D	397.9	Rheumatic diseases of endocardium valve unspecified
RHD	ICD9D	398	Other rheumatic heart disease (code incomplete)
RHD	ICD9D	398.0	Rheumatic myocarditis
RHD	ICD9D	398.9	Other and unspecified rheumatic heart diseases (code incomplete)
RHD	ICD9D	398.90	Rheumatic heart disease unspecified
RHD	ICD9D	398.91	Rheumatic heart failure (congestive)

Disease	Code_Type	CODE	Description
RHD	ICD9D	398.99	Other and unspecified rheumatic heart diseases
RHD	OSCR	39890.001	Rheumatic carditis
RHD	OSCR	7142.000	Rheumatic carditis
Mitra/Aortic Valvular Disease ***(Disease Index)***			Deleted Codes: 35.93, 424
AORTIC	CPT4	33400	Valvuloplasty aortic valve; open with cardiopulmonary bypass
AORTIC	CPT4	33401	Valvuloplasty aortic valve; open with inflow occlusion
AORTIC	CPT4	33403	Valvuloplasty aortic valve; using transventricular dilation with cardiopulmonary bypass
AORTIC	CPT4	33405	Replacement aortic valve; with cardiopulmonary bypass with prosthetic valve other than homograft or stentless valve
AORTIC	CPT4	33406	Replacement aortic valve; with homograft valve (freehand)
AORTIC	CPT4	33410	Replacement aortic valve with stentless tissue valve
AORTIC	CPT4	33411	Replacement aortic valve; with aortic annulus enlargement noncoronary cusp
AORTIC	CPT4	33412	Replacement aortic valve; with transventricular aortic annulus enlargement (Konno procedure)
AORTIC	CPT4	33413	Replacement aortic valve; by translocation of autologous pulmonary valve with homograft replacement of pulmonary valve (Ross procedure)
AORTIC	CPT4	33417	Aortoplasty (gusset) for supravalvular stenosis
AORTIC	ICD9P	35.01	Closed heart valvotomy aortic valve
AORTIC	ICD9P	35.11	Open heart valvuloplasty of aortic valve without replacement
AORTIC	ICD9P	35.21	Replacement of aortic valve with tissue graft
AORTIC	ICD9P	35.22	Other replacement of aortic valve
AORTIC	ICD9D	395	Diseases Of Aortic Valve (code incomplete)
AORTIC	ICD9D	395.0	Rheumatic Aortic Stenosis
AORTIC	ICD9D	395.1	Rheumatic Aortic Insufficiency
AORTIC	ICD9D	395.2	Rheumatic Aortic Stenosis with insufficiency
AORTIC	ICD9D	395.9	Other and unspecified rheumatic aortic diseases
AORTIC	OSCR	3960.000	Aortic stenosis- valvular
AORTIC	ICD9D	424.1	Aortic Valve Disorders
AORTIC	OSCR	4241.000	Aortic valve-aortic stenosis/regurgitation
AORTIC	OSCR	4241.001	Aortic stenosis subvalvular
AORTIC	OSCR	4241.002	Aortic stenosis supravalvular
AORTIC	OSCR	4241.003	Insufficiency aortic
AORTIC	OSCR	4241.004	stenosis- aortic valve
AORTIC	OSCR	4241.005	Regurgitation- aortic valve
AORTIC	OSCR	4241.006	Aortic valve disease
AORTIC	ICD9D	746.3	Congenital Aortic Valvular Stenosis
AORTIC	ICD9D	746.4	Congenital Aortic Valvular Insufficiency
AORTIC	ICD9D	746.81	Congenital Subaortic Stenosis
AORTIC	OSCR	7464.000	Congenital anomalies- bicuspid aortic valve
AORTIC	OSCR	7464.001	Congenital anomaly- bicuspid aortic valve
AORTIC	OSCR	7464.002	Insufficiency- aortic valve
AORTIC	OSCR	74681.001	Aortic stenosis subvalvular
AORTIC	OSCR	7469.002	bicuspid aortic valve

Disease	Code_Type	CODE	Description
AORTIC	OSCR	74722.000	Aortic valve- supravalvular aortic stenosis
AORTIC	OSCR	74722.001	Aortic stenosis supravalvular
AORTIC	CPT4	92986	Percutaneous balloon angioplasty; aortic valve
AORTIC	OSCR	V433.005	Prosthetic valve- aortic status
AORTIC	OSCR	V433.008	S/P mechanical aortic valve
MITRAL	CPT4	33420	Valvotomy mitral valve; closed heart
MITRAL	CPT4	33422	Valvotomy mitral valve; open heart with cardiopulmonary bypass
MITRAL	CPT4	33425	Valvuloplasty mitral valve with cardiopulmonary bypass
MITRAL	CPT4	33426	Valvuloplasty mitral valve with prosthetic ring
MITRAL	CPT4	33427	Valvuloplasty mitral valve radical reconstruction with or without prosthetic ring
MITRAL	CPT4	33430	Replacement mitral valve with cardiopulmonary bypass
MITRAL	ICD9P	35.02	Closed heart valvotomy mitral valve
MITRAL	ICD9P	35.12	Open heart valvuloplasty of mitral valve without replacement
MITRAL	ICD9P	35.23	Replacement of mitral valve with tissue graft
MITRAL	ICD9P	35.24	Other replacement of mitral valve
MITRAL	ICD9D	394	Diseases of Mitral valve (code incomplete)
MITRAL	ICD9D	394.0	Mitral stenosis
MITRAL	ICD9D	394.1	Rheumatic mitral insufficiency
MITRAL	ICD9D	394.2	Mitral stenosis w/ insufficiency
MITRAL	ICD9D	394.9	Other and unspecified mitral valve diseases
MITRAL	OSCR	3940.000	Mitral valve stenosis
MITRAL	OSCR	3949.000	Mitral stenosis- supravalvular ring
MITRAL	OSCR	3949.001	Mitral valve disease
MITRAL	OSCR	3969.001	Mitral valve disease
MITRAL	ICD9D	424.0	Mitral valve disorders
MITRAL	OSCR	4240.001	Mitral regurgitation
MITRAL	OSCR	4240.002	Insufficiency- mitral
MITRAL	OSCR	4240.003	Mitral valve disease
MITRAL	OSCR	4240.004	Mitral valve regurgitation
MITRAL	ICD9D	746.5	Congenital mitral stenosis
MITRAL	ICD9D	746.6	Congenital mitral insufficiency
MITRAL	OSCR	7465.001	Stenosis mitral valve congenital
MITRAL	OSCR	7465.002	Stenosis mitral valve supravalvular
MITRAL	OSCR	7466.001	Mitral valve insufficiency
MITRAL	CPT4	92987	Percutaneous balloon angioplasty; mitral valve
MITRAL	OSCR	V422.003	S/P Tissue Mitral Valve
MITRAL	OSCR	V433.002	Mitral valve- post valvular surgery
MITRAL	OSCR	V433.006	Prosthetic Valve Mitral - Status
MITRAL	OSCR	V433.009	S/P Mechanical Mitral Valve
MITRAL	OSCR	V4589.011	S/P mitral valve repair
MITRAL_AORTIC	ICD9D	396	Disease of mitral and aortic valves incomplete
MITRAL_AORTIC	ICD9D	396.0	Mitral valve stenosis and aortic valve stenosis
MITRAL_AORTIC	ICD9D	396.1	Mitral valve stenosis and aortic valve insufficiency
MITRAL_AORTIC	ICD9D	396.2	Mitral valve insuff and aortic valve stenosis

Disease	Code_Type	CODE	Description
MITRAL_AORTIC	ICD9D	396.3	Mitral and Aortic Val Insuff
MITRAL_AORTIC	ICD9D	396.8	Multiple involvement of mitral and aortic valves
MITRAL_AORTIC	ICD9D	396.9	Mitral and aortic valve diseases unspecified
Ventricular Tachycardia/ Fibrillation (Disease Index)			Codes reviewed and deleted: 427, 427.8, 427.81, 427.89, 427.9,4271 (002,004)
VTACH/FIB	ICD9D	427.1	Paroxysmal ventricular tachycardia
VTACH/FIB	ICD9D	427.2	Paroxysmal tachycardia unspecified
VTACH/FIB	ICD9D	427.4	Ventricular fibrillation and flutter (code incomplete)
VTACH/FIB	ICD9D	427.41	Ventricular fibrillation
VTACH/FIB	ICD9D	427.42	Ventricular flutter
VTACH/FIB	OSCR	4271.001	Rhythm disturbance- ventricular tachycardia
VTACH/FIB	OSCR	4271.003	Ventricular- V-tach
VTACH/FIB	OSCR	4271.005	Ventricular fibrillation
VTACH/FIB	OSCR	4271.007	History VT/VF
VTACH/FIB	OSCR	4271.008	Ventricular tachycardia
VTACH/FIB	OSCR	4271.010	HX sustained ventricular tachy/ventricular fib
VTACH/FIB	OSCR	4271.011	HX of sustained ventricular tachycardia (VT)
VTACH/FIB	OSCR	42741.000	Ventricular fibrillation
Hypertension (Disease Index)			NOTE: ICD9 codes begins with the first strings.
HT	ICD9	401	Essential Hypertension
HT	ICD9	401.0	Essential Hypertension Malignant
HT	ICD9	401.1	Essential Hypertension Benign
HT	ICD9	401.9	Essential Hypertension Unspecified
HT	ICD9	402	Hyperntensive heart disease
HT	ICD9	402.0	Hypertensive heart disease Malignant
HT	ICD9	402.00	Hypertensive heart disease Malignant w/o CHF
HT	ICD9	402.01	Hypertensive heart disease Malignant w/ CHF
HT	ICD9	402.1	Hypertensive heart disease Benign
HT	ICD9	402.10	Hypertensive heart disease Benign w/o CHF
HT	ICD9	402.11	Hypertensive heart disease Benign w/ CHF
HT	ICD9	402.9	Hypertensive heart disease Unspecified
HT	ICD9	402.90	Hypertensive heart disease Unspecified w/o CHF
HT	ICD9	402.91	Hypertensive heart disease Unspecified w/ CHF
HT	ICD9	403	Hypertensive renal disease
HT	ICD9	403.0	Hypertensive renal disease Malignant
HT	ICD9	403.00	Hypertensive renal disease Malignant w/o mention of renal failure
HT	ICD9	403.01	Hypertensive renal disease Malignant w/ renal failure
HT	ICD9	403.1	Hypertensive renal disease Benign
HT	ICD9	403.10	Hypertensive renal disease Benign w/o mention of renal failure
HT	ICD9	403.11	Hypertensive renal disease Benign w/ renal failure
HT	ICD9	403.9	Hypertensive renal disease Unspecified
HT	ICD9	403.90	Hypertensive renal disease Unspecified w/o mention of renal failure
HT	ICD9	403.91	Hypertensive renal disease Unspecified w/ renal failure

Disease	Code_Type	CODE	Description
HT	ICD9	404	Hypertensive heart and renal disease
HT	ICD9	404.0	Hypertensive heart and renal disease Malignant
HT	ICD9	404.00	Hypertensive heart and renal disease Malignant w/o mention of chf or renal failure
HT	ICD9	404.01	Hypertensive heart and renal disease Malignant w/ chf
HT	ICD9	404.02	Hypertensive heart and renal disease Malignant w/ renal failure
HT	ICD9	404.03	Hypertensive heart and renal disease Malignant w/chf and renal failure
HT	ICD9	404.1	Hypertensive heart and renal disease Benign
HT	ICD9	404.10	Hypertensive heart and renal disease Benign w/o mention of chf or renal failure
HT	ICD9	404.11	Hypertensive heart and renal disease Benign w/ chf
HT	ICD9	404.12	Hypertensive heart and renal disease Benign w/ renal failure
HT	ICD9	404.13	Hypertensive heart and renal disease Benign w/chf and renal failure
HT	ICD9	404.9	Hypertensive heart and renal disease Unspecified
HT	ICD9	404.90	Hypertensive heart and renal disease Unspecified w/o mention of chf or renal failure
HT	ICD9	404.91	Hypertensive heart and renal disease Unspecified w/ chf
HT	ICD9	404.92	Hypertensive heart and renal disease Unspecified w/ renal failure
HT	ICD9	404.93	Hypertensive heart and renal disease Unspecified w/chf and renal failure
HT	ICD9	405	Secondary hypertension
HT	ICD9	405.0	Secondary hypertension Malignant
HT	ICD9	405.01	Secondary hypertension Malignant Renovascular
HT	ICD9	405.09	Secondary hypertension Malignant other
HT	ICD9	405.1	Secondary hypertension Benign
HT	ICD9	405.11	Secondary hypertension Benign Renovascular
HT	ICD9	405.19	Secondary hypertension Benign other
HT	ICD9	405.9	Secondary hypertension Unspecified
HT	ICD9	405.91	Secondary hypertension Unspecified Renovascular
HT	ICD9	405.99	Secondary hypertension Unspecified Other
HT	ICD9	416.0	Primary pulmonary hypertension
HT	ICD9	348.2	Hypertension Intracranial, benign
HT	ICD9	365.04	Hypertension ocular Unspecified
HT	ICD9	572.3	Hypertension due to liver disease
HT	ICD9	362.11	Hypertensive retinopathy
HT	ICD9	437.2	Hypertensive encephalopathy
HT	ICD9	459.3	Chronic venous hypertension (idiopathic)
HT	ICD9	459.30	Chronic venous hypertension w/o complications
HT	ICD9	459.31	Chronic venous hypertension with ulcer
HT	ICD9	459.32	Chronic venous hypertension with inflammation
HT	ICD9	459.33	Chronic venous hypertension with ulcer and inflammation
HT	ICD9	459.39	Chronic venous hypertension with other complication
HT	KHFS	252510	DIURETIC (402800)
HT	KHFS	252520	DIURETIC (402810, 243220
HT	KHFS	252525	DIURETIC
HT	KHFS	252530	DIURETIC
HT	KHFS	251005	BB
HT	KHFS	250505	CABLKR

Disease	Code_Type	CODE	Description
HT	KHFS	251020	ACE
HT	KHFS	251030	ARB
HT	KHFS	251010	OTHER
HT	KHFS	251015	OTHER
HT	KHFS	251025	OTHER
HT	AHFS	121600	
HT	AHFS	240608	
HT	AHFS	240816	
HT	AHFS	240820	
HT	AHFS	240832	
HT	AHFS	240892	
HT	AHFS	241208	
HT	AHFS	241292	
HT	AHFS	242000	
HT	AHFS	242400	
HT	AHFS	242808	
HT	AHFS	242892	
HT	AHFS	243204	
HT	AHFS	243208	
HT	AHFS	243220	
HT	AHFS	281604	
HT	AHFS	402800	
HT	AHFS	402810	
HT	AHFS	920000	
HT	OSCR	V5869.005	MEDICATION SURVEILLANCE, ANTIHYPERTENSIVE
HT	OSCR	V653.058	NUTR.TX FOR HYPERTENSION
HT	OSCR	V6549.025	HYPERTENSION EDUCATION CLASS/GROUP
HT	OSCR	V6549.042	SDM VIDEO - HYPERTENSION CLASS/GROUP
HT	OSCR	V6549.154	HYPERTENSION IND. COUNSELING
HT	OSCR	V6549.155	HYPERTENSION GRP. COUNSELING
HT	OSCR	V6549.244	CARE/CASE MNGT PROGRAM, HYPERTENSION (HTN), LEVEL 2
HT	OSCR	V6549.284	COUNSELING/EDUC, HYPERTENSION (HTN), INDIV/GRP
HT	OSCR	V811.005	HYPERTENSION, R/O
HT	OSCR	36211.000	HYPERTENSION - W/RETINOPATHY
HT	OSCR	36211.001	RETINOPATHY, HYPERTENSIVE
HT	OSCR	4010.000	HYPERTENSION (HTN), MALIGNANT/ACCELERATED
HT	OSCR	4010.001	MALIGNANT/ACCELERATED- HYPERTENSION
HT	OSCR	4019.000	HYPERTENSION (HTN)
HT	OSCR	4019.001	HYPERTENSION (HTN), ESSENTIAL
HT	OSCR	4019.002	HYPERTENSION - CHRONIC
HT	OSCR	4019.003	SYSTEMIC HYPERTENSION
HT	OSCR	4019.004	HYPERTENSION - WO/RETINOPATH
HT	OSCR	4019.005	PRIMARY HYPERTENSION
HT	OSCR	4019.006	LABILE HTN

Disease	Code_Type	CODE	Description
HT	OSCR	4019.007	HYPERTENSION R/O
HT	OSCR	4019.008	HYPERTENSION IN REMISSION
HT	OSCR	4019.009	DIABETIC COMPLICATION - HYPERTENSION
HT	OSCR	4019.010	HYPERTENSION (HTN), SYSTOLIC
HT	OSCR	4019.011	HYPERTENSION (HTN), SYSTEMIC ARTERIAL
HT	OSCR	4029.000	HYPERTENSIVE HEART DISEASE
HT	OSCR	40290.001	HYPERTENSIVE HEART DISEASE
HT	OSCR	40290.002	HYPERTENSIVE HEART DISEASE W/O CHF
HT	OSCR	40291.001	HYPERTENSIVE HEART DISEASE W/CHF
HT	OSCR	40300.001	HTN ACCEL. (>209/119)
HT	OSCR	40390.000	RENAL VASC. HYPERTENSION
HT	OSCR	40390.001	NEPHROSCLEROSIS - HYPERTENSION
HT	OSCR	40390.002	VASCULITIS (NON ANCA)
HT	OSCR	40390.003	SECONDARY GLOMERULONEPHRITIS, VASCULITIC
HT	OSCR	40390.004	HYPERTENSION (HTN), PRIMARY
HT	OSCR	40390.005	HYPERTESION, ESSENTIAL
HT	OSCR	40390.006	HYPERTENSION, SYSTOLIC
HT	OSCR	40390.007	HYPERTENSION, RENOVASCULAR
HT	OSCR	40390.008	HYPERTENSION, SECONDARY
HT	OSCR	40390.009	HTN MILD (140-159/90-99)
HT	OSCR	40390.010	HTN MOD (160-179/100-109)
HT	OSCR	40390.011	HTN SEVERE (180-209/110-119)
HT	OSCR	40390.015	HYPERTENSION (HTN), TRANSPLANT RELATED
HT	OSCR	40390.016	RENAL DISEASE D/T HYPERTENSION (HTN)
HT	OSCR	40391.001	VASCULITIS (NON ANCA)
HT	OSCR	40591.000	HYPERTENSION (HTN), RENOVASCULAR
HT	OSCR	40591.001	SECONDARY HYPERTENSION
HT	OSCR	40591.002	HYPERTENSION (HTN), D/T RENAL DISEASE
HT	OSCR	40591.003	HYPERTENSION (HTN), SECONDARY
HT	OSCR	40599.000	HYPERTENSION - SECONDARY
HT	OSCR	40599.001	ENDOCRINE - HYPERTENSION
HT	OSCR	40599.002	HYPERTENSION, SECONDARY
HT	OSCR	9726.001	ANTIHYPERTENSIVE
Dyslipidemia			
DYSLIPID	OSCR	V181.006	HYPERCHOLESTEROLEMIA, FAMILIAL
DYSLIPID	OSCR	V653.001	CHOLESTEROL CLASS/GROUP
DYSLIPID	OSCR	V653.057	NUTR.TX FOR HYPERLIPIDEMIA
DYSLIPID	OSCR	V653.107	LIPIDS COUNSELING
DYSLIPID	OSCR	V653.109	CHOLESTEROL/LIPIDS IND. COUNSELING
DYSLIPID	OSCR	V653.110	CHOLESTEROL/LIPIDS GRP. COUNSELING
DYSLIPID	OSCR	V653.136	CHOLESTEROL MANAGEMENT, CARE/CASE MNGT PROGRAM, LEVEL 2
DYSLIPID	OSCR	V653.137	COUNSELING/EDUC, CHOLESTEROL/LIPIDS, INDIV/GRP
DYSLIPID	OSCR	2720.001	CHOLESTEROL EMBOLIC DISEASE
DYSLIPID	OSCR	2720.002	HYPERCHOLESTEROLEMIA

Disease	Code_Type	CODE	Description
DYSLIPID	OSCR	2720.003	FAM. HYPERCHOLESTEROLEMIA
DYSLIPID	OSCR	2720.004	HYPERLIPIDEMIA, FAMILIAL, COMBINED
DYSLIPID	OSCR	2720.005	SEC. HYPERCHOLESTEROLEMIA
DYSLIPID	OSCR	2724.000	HYPERLIPIDEMIA
DYSLIPID	OSCR	2724.001	TYPE V HYPERLIPIDEMIA
DYSLIPID	OSCR	2729.001	ELEV. CHOL./TRIG
DYSLIPID	KHFS	251500	LIPID LOWERING DRUG
DYSLIPID	AHFS	240604	LIPID LOWERING DRUG
DYSLIPID	AHFS	240605	LIPID LOWERING DRUG
DYSLIPID	AHFS	240606	LIPID LOWERING DRUG
DYSLIPID	AHFS	240608	LIPID LOWERING DRUG
DYSLIPID	AHFS	240692	LIPID LOWERING DRUG
DYSLIPID	AHFS	562400	LIPID LOWERING DRUG
DYSLIPID	AHFS	800000	LIPID LOWERING DRUG
DYSLIPID	AHFS	880800	LIPID LOWERING DRUG
DYSLIPID	ICD9D	272.0	Pure hypercholesterolemia
DYSLIPID	ICD9D	272.1	Pure hyperglyceridemia
DYSLIPID	ICD9D	272.2	Mixed hyperlipidemia
DYSLIPID	ICD9D	272.3	Hyperchylomicroneima
DYSLIPID	ICD9D	272.4	Other and unspecified hyperlipidemia

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