Predictors of Survival in U.S. Dialysis Patients after Acute Myocardial Infarction

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Dedications

I would like to dedicate this work to all dialysis patients, hoping that one day their outcomes after acute myocardial infarction will be similar to outcomes for the general population.

I would also like to dedicate this work to my parents who helped me to become the person I am today. Also, to my wife and my son for all their love and support they provide me.

Abstract

Background: Acute myocardial infarction (AMI) in dialysis patients continues to be associated with poor survival. This study aimed to identify predictors of survival in dialysis patients prior to AMI and to examine the association between survival and different revascularization techniques.

Methods and Results: 3,049 US prevalent dialysis patients hospitalized for AMI between April 1, 1998, and June 30, 2000, were identified by cross-matching the United States Renal Data System (USRDS) database and the Third National Registry of Myocardial Infarction (NRMI 3). Of the 3011 data abstraction forms, 1,696 were suitable for analysis. Mean age was 67.0 ±11.9 years and average dialysis duration was 2.8 ± 3.2 years. Of the cohort, 69% were white and 47% were women. Diabetes and dysrhythmia were present in 72.5% and 65.5%, respectively. These two conditions were used for patient stratification. At 1 year post-AMI, 62% of the cohort died. The impact of independent predictors on survival was examined in a Cox proportional hazards model. Beta blockers use was associated with improved 1-year all-cause mortality (hazard ratio [HR] 0.8, $P = 0.003$). Compared with dialysis via catheter, fistula use was associated with favorable outcome (HR = 0.75, $P = 0.0047$), as was graft use (HR = 0.8 , $P = 0.0054$). Compared with predialysis systolic blood pressure 120-179 mmHg, values < 120 mmHg were more hazardous (HR =1.46, $P \leq 0.0001$) and ≥ 180 mmHg less hazardous (HR = 0.7, $P = 0.004$). Coronary artery bypass graft surgery (CABG) and percutaneous coronary

intervention (PCI) within 30 days of AMI were examined in time-dependent Cox models. CABG was not significantly associated with improved survival (HR = 0.87, *P* = 0.35), while PCI showed a strong protective association (HR = 0.67, *P* = 0.0005).

Conclusion:

Beta Blocker use prior to AMI, vascular access with fistula or graft and PCI within 30 days of AMI are associated with improved one year survival in dialysis patients. Optimal target blood pressure in dialysis patients remains controversial. Validation of these observational data by randomized clinical trials is needed as the impact of selection bias and unknown confounders may not be accounted for in our study.

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List of Abbreviations

ACE-I, angiotensin converting enzyme inhibitor

AMI, acute myocardial infarction

ASA, aspirin

BMI, body mass index

CABG, coronary artery bypass graft

CAD, coronary artery disease

CHF, congestive heart failure

CMS, Centers for Medicare & Medicaid Services

CVA, cerebrovascular accident

CVD, cardiovascular disease

DMMS, Dialysis Morbidity and Mortality Study

ESA, erythropoiesis stimulating agent

ESRD, end-stage renal disease

HR, hazard ratio

ICD-9-CM, *International Classification of Diseases, Ninth Edition, Clinical Modification*

NRMI, National Registry of Myocardial Infarction

PCI, percutaneous coronary intervention

PVD, peripheral vascular disease

SD, standard deviation

USRDS, United States Renal Data Syste

Introduction

As of 2007, 368,544 patients were on dialysis in the United States (1). Mortality due to cardiovascular disease (CVD) in dialysis patients is 20-40 times higher than in the general population. CVD is the most frequent cause of death in the end-stage renal disease (ESRD) population (2), accounting for nearly 45% of overall mortality. Acute myocardial infarction (AMI) accounts for nearly 15% of CVD-related mortality (3). Outcomes of AMI in the ESRD population are poor: the 1-year death rate is approximately 60% (4). Over the last 2 decades, a number of evidence-based strategies have been introduced and employed in the care of coronary artery disease (CAD) in the general population. These strategies have shown survival benefit in the general population. Unfortunately, dialysis patients have been excluded from major clinical trials that tested the efficacy of these strategies (5), leaving their role in the ESRD population largely unknown (5). Moreover, despite the huge mortality burden in dialysis patients after AMI, no randomized controlled trials have studied the role of coronary revascularization interventions such as percutaneous coronary intervention (PCI; that is, angioplasty with or without stent placement) or coronary artery bypass graft (CABG) surgery in dialysis patients. Furthermore, to date there are no evidence-based, established goals targeting traditional risk factors for CAD, such as blood pressure parameters, lipid levels, or specific medications, for dialysis patients. Paradoxically, a number of observations revealed that some

traditional risk factors, such as lipids and blood pressure parameters, have a reversed relationship with outcomes in the dialysis population (6,7).

In addition, there has been no randomized controlled trials of cardioprotective medications, such as aspirin (ASA), beta blockers, or angiotensin converting enzyme inhibitors (ACE-I), to determine their benefit in the dialysis population with AMI. Several retrospective analyses examined the role of cardioprotective medications in dialysis patients, with mixed results. However, beta blockers have been observed by many to have cardio-protective effect in dialysis patients (8-12).

Aims and Hypotheses

AMI in dialysis patients is a catastrophic event with dismal long-term survival (4). Despite advances in cardiovascular medicine that have improved AMI outcomes in the general population, outcomes in the dialysis population remain poor. The overall goals of this project are, in dialysis patients, to 1) compare recorded characteristics 1 month before AMI by survival; 2) identify modifiable predictors of mortality; and 3) study the impact of revascularization techniques on survival after AMI.

Specific Aim 1

Compare the characteristics of dialysis patients who survived an AMI event by at least 1 year and their peers who did not survive.

Hypothesis:

Dialysis subjects who survived to 1 year after AMI differ from their peers who did not survive.

Specific Aim 2

Determine the impact of comorbid conditions, medications, cholesterol levels, and blood pressure measurements on dialysis patient survival after AMI.

Hypotheses:

1) The odds of surviving AMI for dialysis patients using beta blockers, ACE-I, statins, or ASA are higher than for those not using these agents.

2) The odds of surviving AMI differ for dialysis patients with different blood pressure measurements.

3) The odds of surviving AMI for dialysis patients with comorbid conditions differ from the odds of surviving for those without such conditions.

Specific Aim 3

Determine the impact of the coronary revascularization techniques PCI or CABG on 1-year survival after AMI in dialysis patients.

Hypothesis:

The odds of surviving AMI are higher for dialysis patients who undergo a revascularization procedure than for those who do not.

Specific Aim 3.1

Compare the performance of different coronary revascularization techniques (PCI and CABG) in dialysis patients after AMI.

Hypothesis:

The odds of surviving AMI differ for dialysis patients who undergo PCI and who undergo CABG.

Methods

Data Sources

All data were derived from the United States Renal Data System (USRDS), which included data for 1.2 million patients at the time this project was started. Most data sets used by the USRDS are provided by the Centers for Medicare & Medicaid Services (CMS). Administrative data are from Medicare claims, Parts A (hospitalization) and B (physician/provider) (4).

Dialysis patients were initially identified using the USRDS database (n =1,285,177 at the time the study began) as having been hospitalized for AMI between April 1, 1998, and June 30, 2000. AMI hospitalizations were identified by *International Classification of Diseases*, *Ninth Edition, Clinical Modification* (ICD-9-CM), codes: 410, 410.x, 410.x0, and 410.x1. Eligible patients had received renal replacement therapy for at least 90 days and dialysis for at least 60 days before AMI. The third National Registry of Myocardial Infarction (NRMI 3; n = 537,444 patients, 1553 hospitals) data collection study was used for cross matching. The cross-match was performed by the Ovation Research Group (San Francisco, California) using variables including age; gender; birth date; first, middle, and last initials; claim admit and through dates; and provider hospital. A final cohort of 3,049 matching patients was established. A questionnaire (see appendix A) modeled after the Dialysis Morbidity and Mortality Study (DMMS) survey was developed to determine AMI patient characteristics at least 30 days before AMI using AMI admission date. The

questionnaire included information on demographics, activity level, laboratory values, dialysis prescription, pre- and postdialysis blood pressure measures, and medication use before the AMI admission date.

Inclusion and exclusion criteria

Inclusion criteria:

1) Patient record found in USRDS and NRMI 3 with admission date for AMI between April 1, 1998, and June 30, 2000.
2) Dialysis dependency for at least 90 days and for 60 days before AMI.
3) Complete data abstraction form.

Exclusion Criteria:

1) AMI admission dates different from the inclusion criteria.
2) Incomplete data abstraction forms.

Participants

Figure 1 shows a schematic representation of study participants. Questionnaires were sent to the 18 Renal Networks for data abstraction by Network representatives. Detailed instruction forms were sent along with the questionnaires to aid representatives in abstracting the data in a uniform way. Of the 1720 questionnaires mailed back, 1696 were complete. USRDS Coordinating Center staff tabulated the data and created a database ready for research use. The established cohort was linked to Medicare claims data to determine the interventions received within 30 days of the AMI admission. Death dates for all individuals in the cohort were indentified using the Medicare data.

Comorbid conditions were verified using the Medical Evidence Report (form CMS-2728) and ICD-9-CM codes as follows:

Condition	ICD-9-CM Diagnoses Code	ICD-9-CM V code
Atherosclerosis (CAD)	410-414	V45.81; V45.82
Congestive heart failure	398.91;422; 425; 428; 402.X1;404.x1; 404.x3	V42.1
Cerebral vascular accident	430-438	
Peripheral vascular disease	440-444; 447; 451-453; 557	
Dysrhythmia	426-427	V45.0; V53.3
Diabetes	250; 357.2; 362.0x; 366.41	

Using the Medicare data for injectable erythropoiesis stimulating agents (ESAs), data were collected on total monthly dose before the AMI admission date. Vitamin D analog data were also collected in the same fashion. All vitamin D analog doses were converted to Zemplar® equivalent doses using the following conversion scheme: Calcijex® dose was multiplied by 4 and Hectoral® dose was multiplied by 2 (13).

Patients with incomplete data forms were excluded from the final analysis due to lack of medication information. These patients were younger with significantly less comorbidities (Table 1). In addition, their intervention rate was significantly higher and their survival rate was also higher. The death rate in the incomplete-data group was lower than any reported value in the literature (4,14), although the effects of various comorbid conditions on survival were similar between the complete- and incomplete-data groups.

Our cohort was 53% men and 69% white, with mean age 67 (± 11.9) years and median age 69 years. Mean dialysis duration was 2.83 (± 3.2) years. Other baseline characteristics are listed in Table 2.

To compare post-AMI intervention rates with rates in the dialysis population, 2 parallel comparator groups were identified: the transplant population and the general Medicare population. Using the United Network of Organ Sharing file in the USRDS database, we identified patients with AMI between April 1, 1998, and June 30, 2000, who underwent kidney transplant at least 90 days before the AMI date (n = 976), and we identified intervention rates within 30 days from the AMI admission date. Using the Medicare 5% sample, we identified patients with AMI between these dates who were covered by Medicare Parts A and B (n = 23,823, nondialysis and without transplants), and we identified intervention rates within 30 days from the AMI admission date.

Statistical Analysis

All statistical analyses were performed using SAS for Windows, version 9.1 (SAS Institute, Inc., Cary, North Carolina). Additionally, R statistical program (ISBN 3-900051-12-7) was used to generate hazard ratio (HR) plots.

All continuous variables are expressed in means ± standard deviation (SD) unless otherwise specified. Categorical variables are expressed as percentages. Differences in patient characteristics between groups were tested using Student's t-test and the chi-square test for continuous and categorical variables, respectively. These tests were performed to compare patient characteristics by completeness of survey data, by medication use, and by

survival status. A time-dependent Cox proportional hazards model was employed to determine unadjusted and adjusted HRs for covariates. Covariates that reached statistical significance in the unadjusted model ($P < 0.05$), except cholesterol and body mass index (BMI), due to missing data, were included in the final model. Because of its clinical relevance, dialysis duration in years was retained in the final model, where it reached statistical significance. A check of the proportional hazards assumption showed that the hazards of 2 comorbid conditions, diabetes mellitus and dysrhythmia, were not proportional over time. To control for this, these covariates were entered as strata in all models. This is a standard technique to compensate for non-proportionality (15).

Because intervention status changed over time in our data set, we formulated the intervention variable as a time-dependent variable (16). Forward and backward selection led to the same final model. The final model included age, race, access type, years on dialysis, beta blockers use, average predialysis systolic blood pressure, albumin level, injectables (ESAs and 1,25 [OH] vitamin D), and intervention type.

In an effort to better understand the differential benefit of intervention type, a sensitivity analysis was conducted by left-censoring follow-up at 30, 60 and 90 days after the AMI admission date. Left-censoring allowed for exclusion of early deaths more likely to be associated with complications of the intervention procedure.

Finally, the Kaplan-Meier procedure was used to generate different survival curves.

Results

At 1-year follow-up, 62% of the cohort had died. Unadjusted and adjusted mortality HRs are listed in Table 3. Beta blocker use, statin use, intervention type, access type, albumin level, BMI, and total cholesterol were significantly associated with lower mortality hazards in the unadjusted model. Figures 2-5 depict the Kaplan-Meier survival estimates by medication use, ACE-I, ASA, beta blockers, and statins. Congestive heart failure (CHF), cerebrovascular accident (CVA), and peripheral vascular disease (PVD) were associated with higher mortality hazards before adjustment. HRs for ASA, ACE-I, calcium channel blocker, and vasodilator use were insignificant, favoring survival. Clopidogrel use was insignificantly associated with higher mortality hazards. Beta blocker use was strongly associated with lower mortality, and this association remained strong after adjustment. Conversely, statin use was significantly associated with an unadjusted lower mortality HR, but this association was no longer significant after adjustment and was therefore excluded from the final model (table 3).

Dialysis access type was significantly associated with mortality. Compared with catheter use, fistula and AV graft use were associated with a 25% and 20%reduction in mortality respectively; these associations remained significant after adjustment and were included in the final model (table3). Kaplan-Meier survival by access is shown in Figure 6.

Intervention type was among the strongest associations examined. We studied the impact of CABG and PCI including percutaneous translumenal

coronary angioplasty or stent placement within 30 days of the event (Figure 7). Time to intervention varied by patient, and each patient underwent one procedure. A total of 120 CABG procedures were done, with mean time to intervention 9.2 days; a total of 219 PCI procedures were done, with mean time to intervention 4.85 days. Table 4 compares the characteristics of patients who received any intervention and patients who received no intervention. Patients who received interventions were overall younger with fewer comorbid conditions.

In the time-dependent model, which allowed a status change from “no intervention” to “intervention” during follow-up, with follow up starting at the time of AMI admission, PCI reached statistical significance as a predictor of survival but CABG did not.

Sensitivity Analysis Results:

The sensitivity analysis showed the following, with follow-up starting at 30 days post-AMI, PCI was significantly associated with a lower hazard of mortality, while CABG was not significant. The results of 60 and 90 day left-censoring suggested an increasingly similar performance of PCI and CABG, with hazard ratios of 0.770 and 0.768 at 60 days, and 0.781 and 0.719 at 90 days, respectively. However, none of these 4 hazard ratios reached statistical significance of $P < 0.05$. (table 7)

The combined intervention rate of CABG and PCI in dialysis patients was 20%, the lowest rate compared with transplant patients (39.3%) and the general Medicare population (45.9%; Table 5).

Predialysis systolic blood pressure values before AMI strongly predicted outcome after AMI. The association of postdialysis systolic blood pressure was relatively similar, but the significance was not as robust (Figure 8). Pre- and postdialysis diastolic blood pressure values showed similar associations (Figure 9).

The mortality HRs for ESA use increased in a graded manner with dose. Higher doses were associated with increased mortality hazards compared with lower doses or no ESA use (Figure 10).

Only 50% of the cohort received a vitamin D analog. Compared with patients not using a vitamin D analog, there was no significant association with improved mortality for patients using lower doses of vitamin D analog. However, the highest dose was associated with lower hazards of mortality. Figure 11 depicts HRs by doses of vitamin D analog.

Discussion

In this retrospective cohort study, we examined various groups of independent predictors of survival after AMI in dialysis patients. Fortunately, some of these predictors may be modifiable, such as beta blocker use, blood pressure values, and revascularization intervention. Reverse epidemiology continues to manifest as favorable survival association with higher BMI (7,17) and total cholesterol level see Figure 12. In keeping with the CHOICE trial results (18), access type showed a strong association favoring survival for fistula and graft patients compared with catheter patients. Predialysis systolic blood pressure before AMI showed a strong graded association; the higher the blood pressure, the lower the mortality hazards. This finding echoes findings of Kalantar-Zadeh et.al. (7).

Beta blocker was the only medicine category showing significantly lower mortality hazards at 1 year after AMI. The association was robust, echoing findings of McCullough, Foley, Berger, and others (6,8-12). However, these investigators looked at the beta blocker benefit from a perspective different from ours. McCullough delineated the favorable association of ASA and beta blockers after S-T segment elevation myocardial infarction and in-hospital mortality in CKD and dialysis patients. Foley found a favorable association of beta blockers as blood pressure medication and all-cause mortality in dialysis patients in DMMS waves 3 and 4. Berger delineated the benefit of early use of beta blockers after AMI hospitalization and 30-day mortality. In our study, beta blocker use before AMI and survival association at 1 year was specifically

examined in dialysis patients and showed beneficial association. To overcome biases related to medication associations in a retrospective cohort, such as confounding by indication, we further compared characteristics of patients using and not using beta blockers before AMI (Table 6). The 2 groups were similar in all aspects except that predialysis systolic blood pressure was 4 mmHg higher in the beta blocker group. The beta blocker association remained robust in the fully adjusted model.

Two revascularization techniques were examined, CABG and PCI. The impact on survival was different from what Herzog et al reported (19); PCI was associated with significantly favorable outcome. However, in the Herzog et al study, CABG and PCI were not examined in relation to AMI hospitalization, but were examined in all patients. In this study, subsequent sensitivity analysis indicated that PCI and CABG mortality hazards changed depending on when follow-up began. Hazards are listed by interval in Table 7.

The finding of lower coronary revascularization use rates in dialysis patients may, in part, explain their poor outcomes after AMI. However, low intervention rates cannot fully explain the poor outcomes.

ESA use also showed a graded association with AMI; the higher the monthly dose, the higher the hazards of mortality at 1 year. These results may be confounded by indication, but higher ESA requirements usually indicate poor general condition. Lower doses were not associated with any benefit.

Monthly vitamin D analog, only at higher doses, was significantly associated with lower hazards of mortality in keeping with (20). Lower doses

showed no significant association. The association of high dose vitamin D analog with lower mortality hazards is contrary to finding of Cantor et al (21). A trial is most needed in this area to further clarify the impact of vitamin D analog on the survival in the dialysis patient population.

Limitations

There are several limitations to our findings. We used a retrospective cohort of dialysis patients with AMI to define associations between modifiable risk factors such as medication use and intervention use, and cardiovascular outcomes. We restricted our analysis to patients enrolled in the Medicare program with matching NRMI records, which may have introduced bias into our results. Of our mailed data collection forms, 43.6% were not returned, and we had to exclude these patients from the final analysis. We attempted to define major differences between included and excluded patients. Compared with included patients, baseline characteristics were similar for excluded patients except for diabetes status, CHF, dysrhythmia, and history of CVA, which were significantly lower in the excluded group. Furthermore, the excluded group was significantly younger. Given these differences, we looked at the hazards related to variables such as CHF, CVA, and age, and they were similar. We could not examine the association of medication use and outcomes for excluded patients due to lack of data. ICD-9-CM codes were used to define comorbid conditions and procedures. This is the main tool used by the USRDS; however, some conditions or procedure may have been missed.

Some returned forms were missing laboratory values, such as low-density lipoprotein and high-density lipoprotein cholesterol and hemoglobin A1c, preventing us from examining their associations.

Results of the time-dependent analysis lead us to believe that, despite adjustment, a CABG intervention appears to be ineffective for dialysis patients who experience AMI. However, time to intervention for CABG patients was nearly twice as long as for PCI patients (9.2 versus 4.85 days). This additional time without treatment may make CABG patients similar to patients with no intervention; the window for effective intervention may have closed by the time CABG was performed. In that case, a systematic bias is associated with CABG, and a true estimation of its effectiveness is impossible in this study. Furthermore, patients who underwent CABG may have had more blockages and more severe conditions and needed more time to stabilize before the intervention.

Confounding by indication may have contaminated the associative results of medication use and outcome, which is a major limitation of examining associations of medications and outcomes in a retrospective cohort.

Due to the retrospective nature of the cohort and the inherent biases of this design, any association between modifiable risk factors and mortality after AMI should be considered hypotheses generating. Interesting findings such as the favorable association of beta blocker use, intervention, and survival after AMI must be examined in randomized controlled clinical trials before conclusions can be drawn or generalizations made.

Implications and Conclusion

We conclude that mortality after AMI in dialysis patient remains high compared with the general population. Our data suggest that revascularization techniques are underused in the dialysis population despite association with lower mortality HR. PCI was superior to CABG in the time-dependent covariate model. However, one should interpret this with extreme caution.

Beta blocker use was associated with lower HR of mortality and improved survival. This observation was robust and withstood all adjustments. There were no major differences between patients using and not using beta blockers except outcome. Based on our findings, coupled with findings from Foley (6) and McCullough (10), dialysis providers should thoroughly review their patients' antihypertensive medication lists, and identify beta blocker candidates, especially those with history of CAD or CHF. Randomized clinical trials are still needed to assess the unbiased role of beta blockers in dialysis patients.

In our study population, statins, ACE-Is, and ASA had no significant association with mortality. The roles of these medications in AMI in dialysis patients should be examined in randomized clinical trials. The apparent anomalous lack of efficacy in dialysis patients compared with the general population raises the question of whether AMI is the same disease in dialysis and nondialysis patients.

State-of-the-art injectables, ESAs and vitamin D analogs, heavily used by dialysis providers, did not associate with improved mortality, except for high

dose vitamin D analog. On the contrary, higher ESA doses were associated with worse mortality.

The reversed association of blood pressure values and outcome remains in our population, similar to finding of Kalantar-Zadeh (7). A large-scale clinical trial aimed at identifying blood pressure goals for the dialysis population should be conducted.

In summary, beta blocker use prior to AMI, vascular access with fistula or graft and PCI within 30 days of AMI are underutilized and associated with improved one year survival in dialysis patients. Optimal target blood pressure in dialysis patients remains controversial. Validation of these observational data by randomized clinical trials is needed to establish evidence-based practices for AMI patients on dialysis as the impact of selection bias and unknown confounders may not be accounted for in our study.

Table 1. Patient Characteristics by Data Form Completion

Covariate	Complete Forms	Incomplete Forms	*P* value
n (%)	1696 (56.3)	1315 (43.7)	
Age, yr, mean ± SD	67.0 ± 11.9	66.1 ± 12.2	0.04
Dialysis duration, yr, mean ± SD	2.83 ± 3.2	2.78 ± 3.2	0.69
Monthly EPO dose, units, mean ± SD	45,986 ± 56,989	40,023 ± 49,932	0.0023
Monthly vitamin D dose, mcg, mean ± SD	11.75 ± 22.6	10.5 ± 19.8	0.115
Race, %			0.0001
Black	23	30	
White	69	64	
Other	8	6	
Hemodialysis, %	96.2	94.5	0.0016
Intervention, %			0.0126
CABG	5.6	6.09	
PCI	11.6	14.5	
None	83	78.6	
Men, %	53	53	0.86
Dysrhythmia, %	65.5	59.2	0.0004
CHF, %	84.1	81.3	0.044
CVA, %	37.1	33.5	0.0435
PVD, %	63.3	60.6	0.127
Diabetes, %	72.5	68.1	0.009
Death at 1 yr, %	61.97	48.7	0.0001

Table 2. Patient Characteristics by Survival

Covariate	Survived to 1 year	Died by 1 year	*P* value
n (%)	645 (38.03)	1051 (61.97)	
Age, yr, mean ± SD	64.7 ± 12.2	68.4 ± 11.5	0.0001
Men, %	55.2	52.0	0.19
BMI, kg/m^2, mean ± SD	26.7 ± 5.78	25.2 ± 5.56	0.0001
Race, %			0.087
Black	25	22	
White	66	71	
Other	9	7	
Social demographics, %			
Education			
< 12 years	33.3	37	
HS grad or GED	37.6	38.3	
Some college	14.5	12.3	
College graduate	14.7	12.4	0.3876
Employment status			
Full time	2.9	1.1	
Part time	1.9	0.8	
Homemaker	6.6	8.8	
Retired	52.6	58.2	
Unemployed	6	5.1	
Disabled	29.1	24.1	
Never employed	1	1.9	0.0033
Marital status			
Never married	7.4	4.6	
Married or DP	55.4	55.1	
Widowed	21.3	27.5	
Divorced	13.7	10.5	
Separated	2.3	2.3	0.0058
Able to transfer independently, %	85.5	76.5	0.0001
Living status, %			
House/apartment	90.0	86.2	
Homeless	1.0	0.5	
Assisted living	3.4	3.9	
Nursing home/institution	5.7	9.4	0.03
Dialysis-related demographics			
Dialysis duration, yr, mean ± SD	2.7 ± 3	2.9 ± 3.3	0.115
Access, %			
Fistula	23.3	18.3	0.0002
Graft	45.9	42.7	
Catheter	15.8	24.3	
Unknown	15	14.8	
Dialyzer reuse, %	78	81	0.184

Delivered minutes, mean ± SD	212.3 ± 12.2	205.6 ± 12.2	0.002
Delivered weekly treatments, mean ± SD	2.9 ± 12.2	2.84 ± 12.2	0.043
Delivered blood flow rate, ml/min, mean ± SD	390.1 ± 12.2	377.4 ± 12.2	0.0042
Predialysis weight, kg, mean ± SD	76.6 ± 12.2	72.6 ± 12.2	0.0003
Postdialysis weight, kg, mean ± SD	73.1 ± 12.2	69.8 ± 12.2	0.0001
Difference, kg, mean ± SD	3.5 ± 12.2	2.8 ± 12.2	0.65
Average blood pressure, mmHg, mean ± SD			
Average Pre-dialysis BP (Systolic):			<0.0001
<120	7.7%	16%	
120-179	77.5%	76.2%	
180+	14.8%	7.8%	
Average Pre-dialysis BP (Diastolic):			<0.0001
<60	9.7%	14.5%	
60-90	73.7%	76.2%	
>90	16.5%	9.3%	
Average Post-dialysis BP (Systolic):			<0.0001
<120	14.8%	26.6%	
120-179	79.%	70.4%	
180+	5.7%	3.0%	
Average Post-dialysis BP (Diastolic):			0.0007
<60	14.9%	22.7%	
60-90	79.0%	73.2%	
>90	6.1%	4.1%	
Predialysis BUN, mean ± SD	60.0 ± 12.2	58.4 ± 12.2	0.09
Postdialysis BUN, mean ± SD	18.5 ± 12.2	18.2 ± 12.2	0.56
Laboratory values, mean ± SD			
Total cholesterol, mg/dL,	177.2 ± 47.3	167.2 ± 43.5	0.0003
Albumin, g/dL	3.67 ± 0.45	3.56 ± 0.49	0.0001
Serum calcium, mg/dL	9.2 ± 0.87	9.26 ± 0.87	0.36
Serum phosphorus, mg/dL	5.7 ± 1.8	5.8 ± 2.0	0.26
Serum PTH, pg/dL	263.2 ± 296	278.1 ± 341	0.42
Hemoglobin, g/dL	11.13 ± 1.4	11.14 ± 1.4	0.81
Medication use 1 month before AMI			
Monthly EPO dose *1000, mean ± SD	38.6 ± 41.5	50.5 ± 64.3	0.0001
Monthly vitamin D analog dose, mean ± SD	12.7 ± 12.2	11.2 ± 12.2	0.174
Using, %			
ASA	34.6	34.57	0.98
Plavix	3.1	3.6	0.58
Beta blocker	36.3	27.7	0.0003
ACEI	33.5	32.4	0.65
A-blocker	22.7	16.3	0.003
Vasodilator	7.8	6	0.14
Calcium channel blocker	45.8	42	0.14
Statin	24.2	18.5	0.0047
Comorbid conditions, %			
PVD	57.1	67.2	0.0001
CHF	79.1	87.2	0.0001
CVA	32.3	40.1	0.0012

Diabetes	72.0	73.0	0.59
Dysrhythmia	56.1	71.3	0.0001
Interventions within 30 days of AMI, %			
PCI	18.6	10.2	0.0001
CABG	9.8	5.5	0.001

Table 3. Unadjusted and Adjusted Time-Dependent Hazard Ratios of Mortality Stratified by Dysrhythmia and Diabetes Status

Covariate	Unadjusted HR (95% Confidence Interval)	*p*-value	Adjusted HR (95% Confidence Interval)	*p*-value
Age (per year)	1.014 (1.01, 1.02)	<0.0001	1.016(1.01, 1.022)	<0.0001
Years on dialysis	1.01 (0.99, 1.029)	0.28	1.031(1.01, 1.05)	0.0063
Race				
White	Reference		Reference	
Black	0.90 (0.78, 1.05)	0.16	1.01(.86,1.18)	0.91
Other	0.79(0.62,0.996)	0.046	0.819 (0.63, 1.06)	0.13
BMI	0.97(0.96 , 0.98)	<0.0001		
Access				
Catheter	Reference		Reference	
Fistula	0.69 (0.57,0.84)	0.0001	0.73(0.60 , 0.88)	0.0014
Graft	0.76 (0.65,0.88)	0.0004	0.77(0.66 , 0.91)	0.0016
Other	0.77 (0.63,0.94)	0.011	0.878(0.66,1.11)	0.27
Laboratory Values				
Average Predialysis BP (Systolic)				
<120	1.652 (1.39,1.96)	<0.0001	1.56 (1.31,1.86)	<0.0001
120-179	Reference		Reference	
180+	0.631(0.5, 0.8)	0.0001	0.700(0.55,0.89)	0.0039
Total Cholesterol	0.996(0.995, 0.998)	0.0001		
Calcium	1.033(0.96,1.11)	0.38		
Serum Phosphorus	1.026(0.99,1.06)	0.12		
PTH (serum PTH)	1.00(1.00,1.00)	0.55		
HCO3	0.999(0.98,1.015)	0.88		
Albumin	0.727(0.64, 0.83)	<0.0001	0.994(0.90, 1.09)	0.856
Hematocrit	1.016(1.00, 1.03)	0.042		
Comorbidities				
CHF	1.309 (1.1, 1.57)	0.004		
PVD	1.25(1.098 , 1.42)	0.0008		
CVA	1.17(1.036 , 1.33)	0.0117		
Medication				
B-Blockers	0.774(0.68, 0.89)	0.0003	0.813 (0.71, 0.94)	0.0042
ACE-Inhibitors	0.964(0.846,1.1)	0.587		
A-Blocker	0.797(0.675, 0.94)	0.0075		
Vasodialators	0.948(0.73,1.23)	0.687		
CCB	0.925(0.82,1.048)	0.220		
Statin	0.819(0.70, 0.95)	0.0129		
ASA	0.969(0.852,1.10)	0.633		
Plavix	1.074(0.773,1.49)	0.670		

Total Epoetin				
< 40,000 IU	Reference			
40-79,999 IU	0.999(0.86,1.16)	0.987	1.029 (0.88,1.21)	0.73
80,000+ IU	1.427(1.224,1.66)	<0.0001	1.60 (1.35,1.88)	<0.0001
Total Vitamin D				
0 IU	1.00 (reference)		1.00 (reference)	
1-7 IU	1.4 (0.92,2.07)	0.12	1.198(0.78,1.84)	0.41
8-24 IU	1.16(0.97,1.403)	0.109	1.1 (0.91,1.33)	0.335
25-43 IU	0.89(0.72,1.104)	0.29	0.87 (0.7, 1.08)	0.20
44-216 IU	0.83(0.67,1.02)	0.08	0.72(0.57,0.9)	0.0038
Intervention				
PCI / no PCI	0.622(0.50, 0.77)	<0.0001	0.74 (0.60, 0.92)	0.0067
CABG / no CABG	0.767(0.577,1.02)	0.0686	0.92(0.69 , 1.22)	0.56

Table 4. Patient Characteristics by Intervention (PCI or CABG) Status

	N	Intervention(n=339)	No(n=1357)	*P* value
Age	1696	63.7 (11.67)	67.8 (11.85)	0.0001
BMI	1251	27.4 (5.8)	25.4 (5.6)	0.0001
Race				0.89
White (%)		19.7	80.3	
Black (%)		20.6	79.4	
Other (%)		20.9	79.1	
Gender				0.056
Male (%)		58	52	
Co morbidities				
CHF (%)		74.6	86.4	0.0001
Dysrhythmia(%)		59.6	67	0.01
PVD (%)		54.2	65.6	0.0001
CVA (%)		27.4	39.5	0.0001
DM (%)		72	72.6	0.8
Access				0.0048
Catheter (%)		14.5	22.7	
Fistula (%)		21.8	19.75	
Graft (%)		45.4	43.55	
Other (%)		18.3	14	
Average Pre-dialysis BP (Systolic): <120	1561	7.3%	14.4%	0.002
120-179		80.1%	75.8%	
180+		12.7%	9.8%	
Average Pre-dialysis BP (Diastolic): <60	1564	6.3%	14.3%	< 0.0001
60-90		76.0%	75.2%	
>90		17.7%	10.5%	
Average Post-dialysis BP (Systolic): <120	1445	20.4%	22.6%	0.6977
120-179		75.8%	73.4%	
180+		3.9%	4.0%	
Average Post-dialysis BP (Diastolic): <60	1449	18.3%	20.2%	0.633
60-90		76.1%	75.2%	
>90		5.6%	4.6%	
Laboratory parameters in the 30 days prior to AMI				
Total Cholesterol	1226	180.2 (47.3)	168.7 (44.4)	0.0004
Calcium	1591	9.3 (0.85)	9.2 (0.88)	0.63
Serum Phosphorus	1582	6.2 (1.95)	5.8 (1.90)	0.001
PTH (serum PTH)	1235	277.1 (314.5)	271.5 (327.9)	0.8

Albumin	1598	3.7 (0.45)	0 (0.48)	0.0003
Hematocrit	1507	34.9 (4.35)	34.3 (4.32)	0.053
Hemoglobin	1519	11.3 (1.34)	11.1 (1.33)	0.008
Epo dose (in 10,000s)	1696	40.9 (49.1)	47.3 (58.7)	0.0397
1,25 OH Vitamin D	1696	14.5 (27.9)	11.1 (21.0)	0.038
Mean survival days		254 (142)	182 (156.5)	0.0001

Table 5. Coronary Revascularization Intervention Rates by Group

		Intervention			
Patient Group	N	PCI, %	CABG, %	None, %	*P*-value
Dialysis	1696	12.9	7.1	78.1	
Transplant	976	26.4	12.9	60.7	
Non-dialysis Medicare	23,823	29.8	16.1	54.1	< 0.0001

Table 6. Patient Characteristics by Beta Blocker Status

	B-Blocker (N=505)	No (n=1128)	*P* value
Age	66.5(12.8)	67.1(11.6)	0.351
Race			0.40
White (%)	30.8	69.2	
Black (%)	32.7	67.3	
Other (%)	26.4	73.6	
Gender			
Male (%)	50.3	54.0	0.167
Co morbidities			
CHF (%)	82	85	0.11
Dysrhythmia (%)	62.6	66.8	0.09
PVD (%)	64.75	62.9	0.48
CVA (%)	38.8	36	0.29
DM (%)	70	74	0.084
Access			0.54
Catheter (%)	20	22.4	
Fistula (%)	20.8	20	
Graft (%)	45.0	45.3	
Other (%)	14.3	12.2	
Average Pre-dialysis BP (Systolic): <120	14.4%	9.5%	0.0072
120-179	76.4%	77.6%	
180+	9.2%	12.7%	
Average Pre-dialysis BP (Diastolic): <60	13.2%	11.8%	0.77
60-90	74.9%	76.2%	
>90	11.9%	12.0%	
Average Post-dialysis BP (Systolic): <120	24.7%	16.3%	0.002
120-179	71.3%	79.7%	
180+	4.0%	4.0%	
Average Post-dialysis BP (Diastolic): <60	21.4%	16.5%	0.094
60-90	73.8%	78.9%	
>90	4.8%	4.6%	
Laboratory parameters in the 30 days prior to AMI			
Total Cholesterol	174.6(49.5)	169.6(43.0)	0.085
Calcium	9.23(0.88)	9.25(0.87)	0.62
Serum Phosphorus	5.9(1.8)	5.9(1.9)	0.97
PTH (serum PTH)	260.1(319.8)	276.7(326.5)	0.4
Albumin	3.62(0.50)	3.60(0.46)	0.6
Hematocrit	34.4(4.2)	34.5(4.4)	0.87

Epo dose (in 10,000)	44.3(51.6)	47.3(59.6)	0.32
1,25 OH Vitamin D	11.0(22.4)	12.4(22.9)	0.23

Table 7. Adjusted Intervention Hazards at Different Left-Censored Follow-up Times

No intervention being the reference group

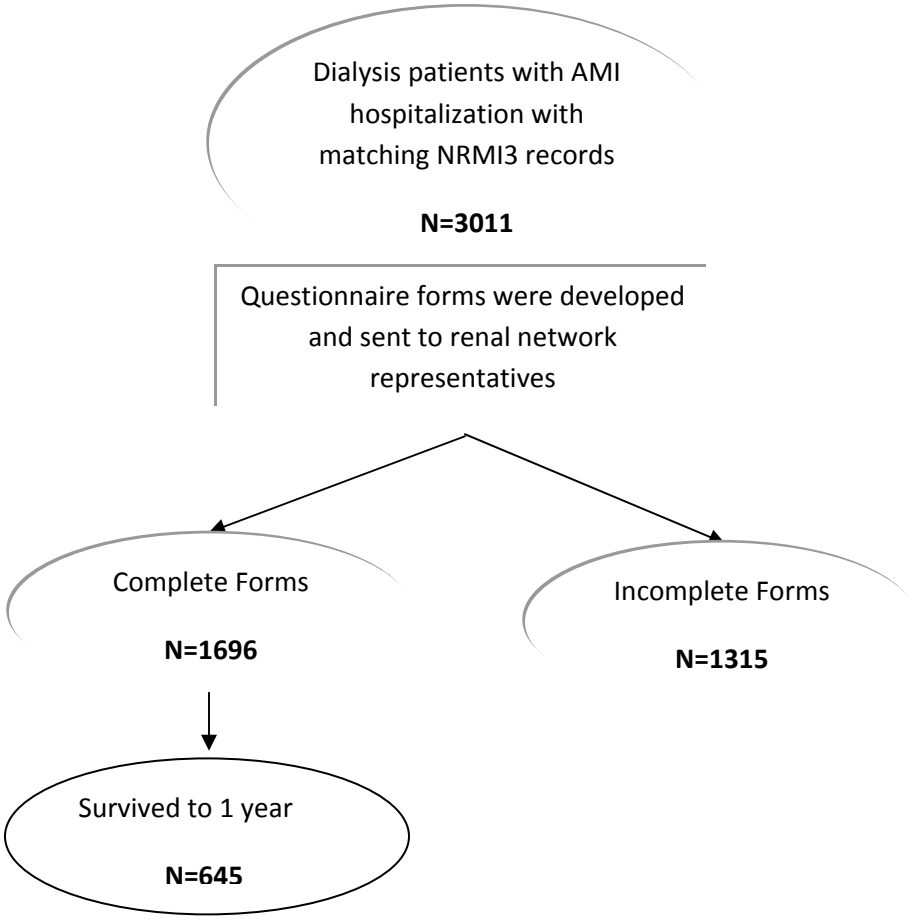
Days after AMI date	Patients Alive in Cohort	Valid N†	PCI HR	*P*-value	CABG HR	*P*-value
0 *	1696	1575	0.692	0.0014	0.869	0.35
30 **	1216	1062	0.703	0.0102	0.873	0.44
60 **	**1103**	**957**	**0.773**	**0.08**	**0.773**	**0.21**
90 **	1036	901	0.784	0.12	0.721	0.155

* Time-dependent model, adjusted for all covariates used in Final Model (Table 3)

** Time-independent model, because by 30, 60, and 90 days, all interventions have occurred and patient status is fixed. Adjusted for all covariates used in Final Model (Table 3)

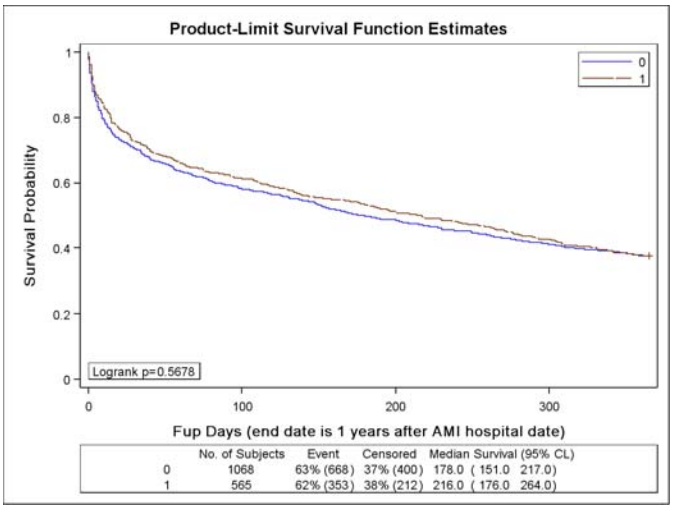
† Actual N used in the model (total patients with all nonmissing values)

Figure 1



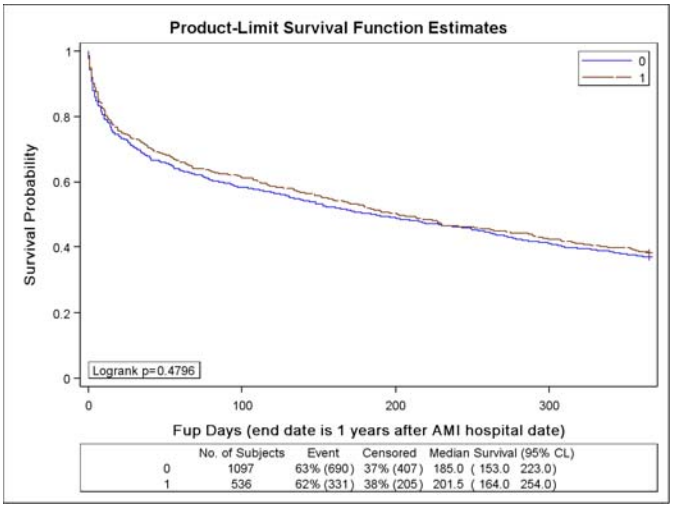
- The analysis excluded subjects with incomplete forms.

Figure 2: Survival by ACE-I use



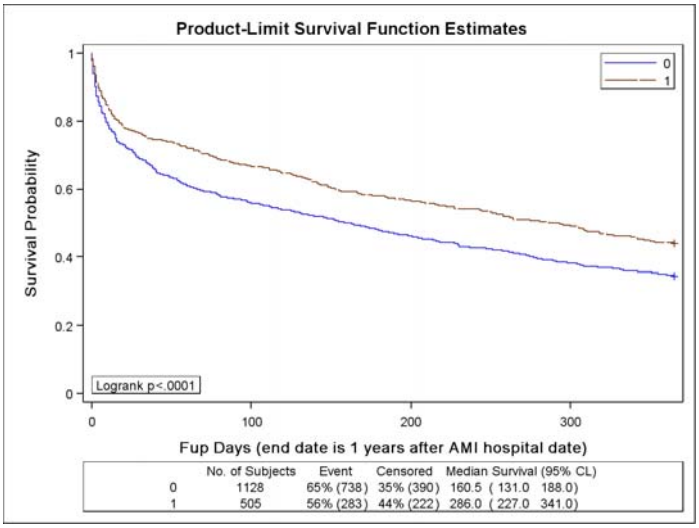
0: indicates no ACE-I use 1: Indicates ACE-I use

Figure 3: Survival by ASA Use



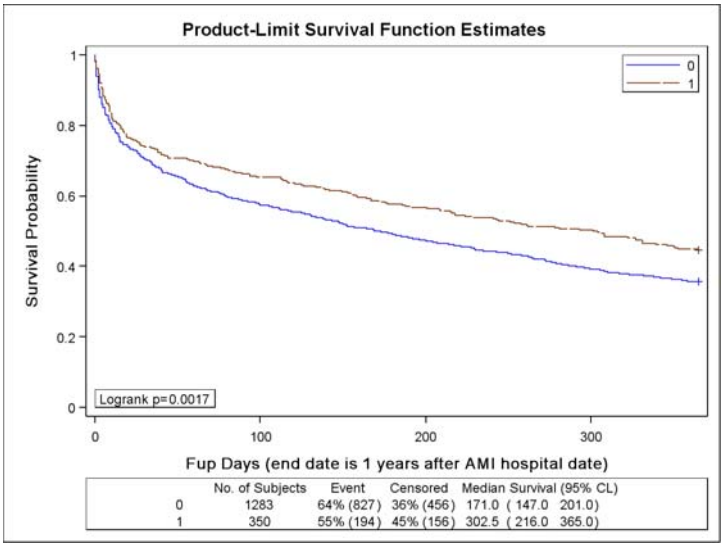
0: indicates no ASA use 1: Indicates ASA use

Figure 4: Survival by B-Blockers Use



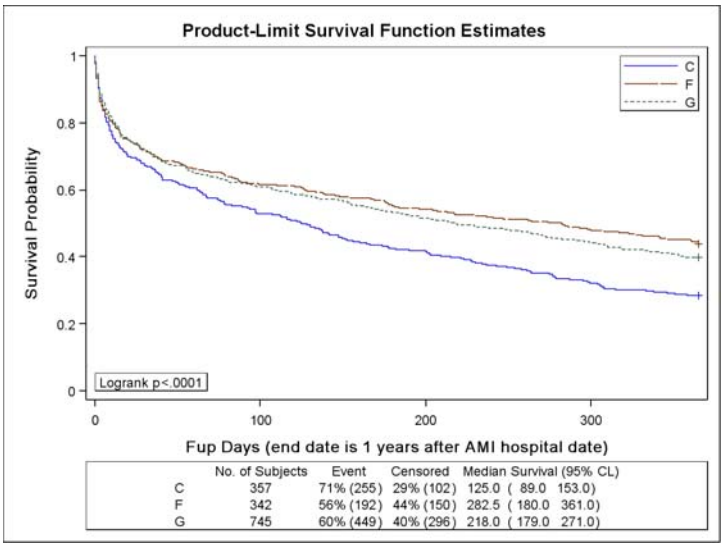
0: indicates no B-Blockers use 1: Indicates B-Blockers use

Figure 5: Survival by Statin Use



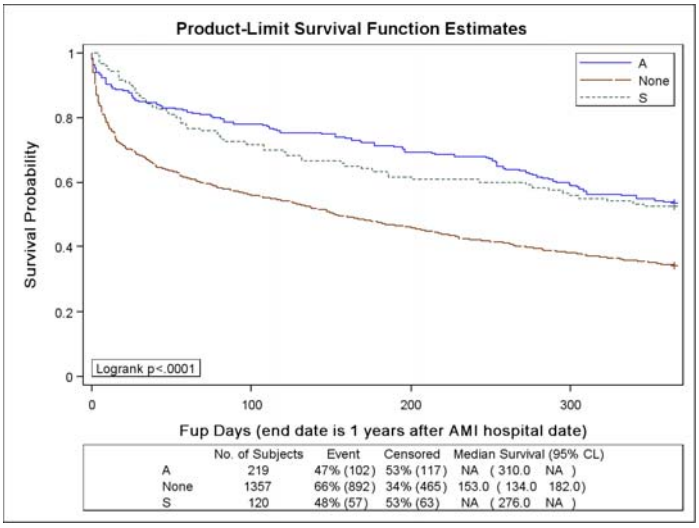
0: indicates no Statin use 1: Indicates Statin use

Figure 6: Survival by Access type



C: indicates Catheter F: Indicates Fistula G: Indicates Graft

Figure 7: Survival By management type within 30 days



A: indicates PCI S: Indicates CABG None: Indicates neither

Figure 8

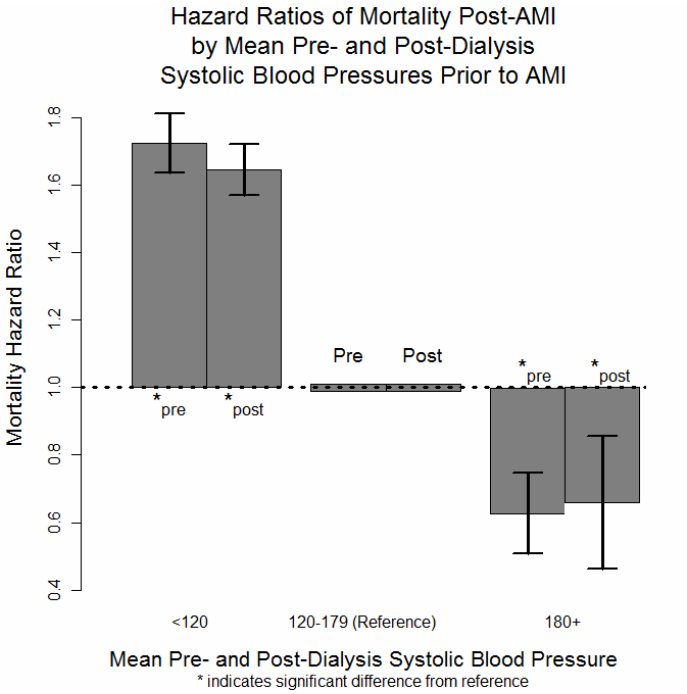


Figure 9

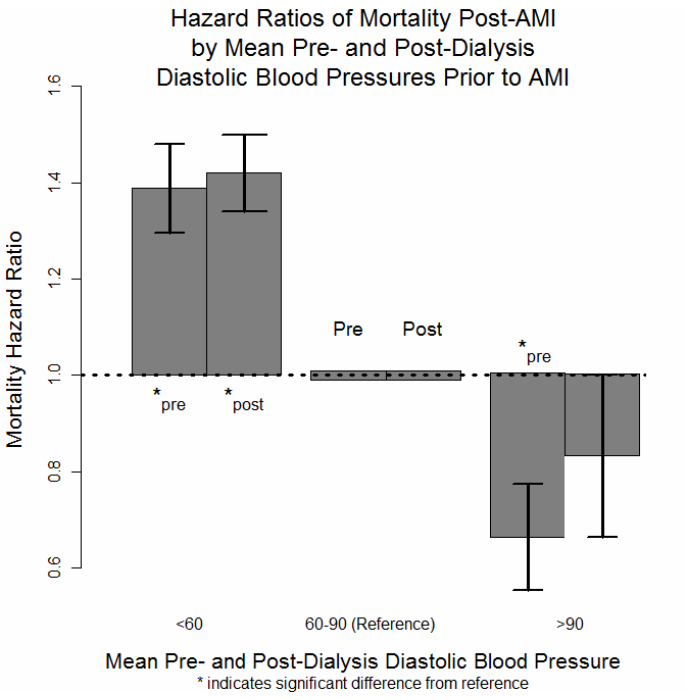


Figure 10

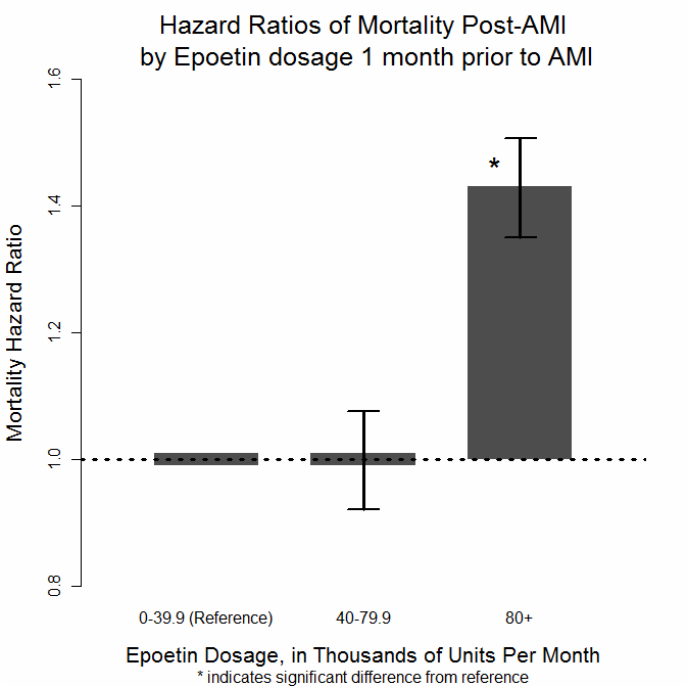


Figure 11

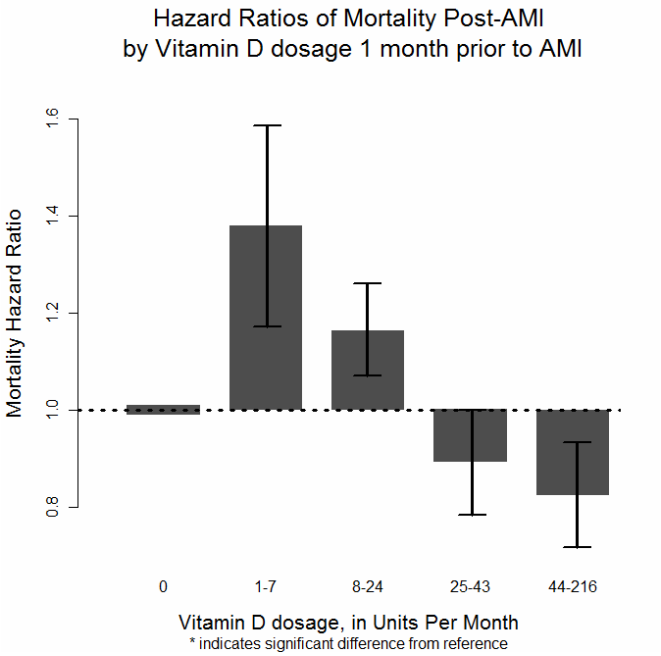
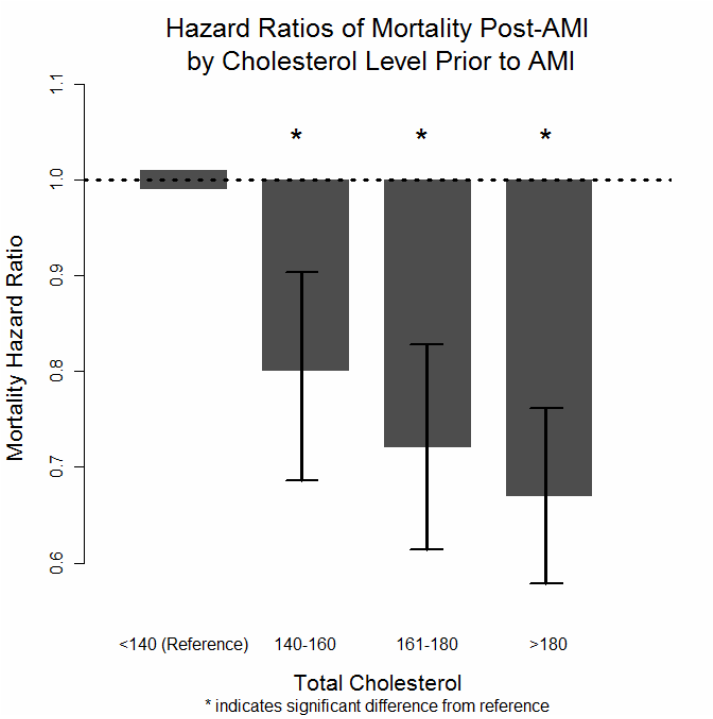


Figure 12


Hazard Ratios of Mortality Post-AMI
by Cholesterol Level Prior to AMI
Mortality Hazard Ratio
1.1
1.0
0.9
0.8
0.7
0.6
*
*
*
<140 (Reference)
140-160
161-180
>180
Total Cholesterol
* indicates significant difference from reference

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Appendix A

USRDS Cardiovascular Special Study - Medical Questionnaire

1. Name: 2. DOB:
3. SSN: 4. HIC:
5. Sex: 6. Race:
7. Facility 8. Network:
9. Diagnosis: 10. Dial Date:
11. Hosp AMI Admit Date:

WRITE CORRECTIONS TO THE PATIENT'S LABEL INFORMATION IN THIS SPACE

- **Review information printed on above label. If information is incorrect, write corrections in space to the right of label.**
- **Refer to the key below for a description of numbered label items.**

1. LAST and first name.
2. DATE of birth (DOB) as MM/DD/YYYY
3. SOCIAL Security Number (SSN)
4. MEDICARE HEALTH Insurance Claim Number (HIC)
5. SEX (1=Male; 2= Female; 3=Unknown)
6. RACE (*1=American Indian/Alaska Native; 2=Asian; 3=Black; 4=White; 5=Unknown; 6=Pacific Islander; 7=Mid East Arabian; 8=Indian Subcontinent; 9=Multiracial; 10=Other)*
7. FACILITY'S Medicare provider number
8. ESRD Network Number
9. Primary ESRD diagnosis (from HCFA-2728 form)
10. DATE (MM/DD/YYYY) patient began a regular course of dialysis (from HCFA-2728 form)
11. **Hospital Acute Myocardial Infarction (AMI) Admit Date - Do NOT change this date.**

Date Form was completed and Name of Person who Completed Form (Please Print LEGIBLY)

Date Form completed: _____

First Name: _____ Last Name: _____ Title: _____

Phone # (___) _____ Fax # (___) _____ Email _____

a) Write Hospital AMI Admit Date (#11 on label above) AND Patient Initials in space provided at the top of every page.
b) Read the enclosed directions for completing the Cardiovascular Special Study – Medical Questionnaire.
c) Answer questions on pages 1 – 6 using one of the methods described on page 2 of the instructions:

Select numbered choice that BEST answers each question & write number in box to the right of statement.
OR **** If you don't know the answer to a "multiple choice" question – write number for" Unable to determine" in the box.***
Fill in requested information in the blank spaces provided.
**** If you don't know the answer to a "fill in the box" question – write NF in the question's response box.***

For Questions 12 – 25, refer to patient's medical history PRIOR TO the Hospital AMI Admit Date in # 11 above.

12. Patient's Home Zip Code: ☐☐☐☐☐

13. Patient's Ethnicity: ☐
1 – Non-Hispanic
2 – Hispanic, Mexican American
3 – Hispanic, Puerto Rican
4 – Hispanic, Cuban American
5 – Hispanic, Other
6 – Unable to determine

14. Regular cigarette smoking status: ☐
1 – Active smoker at AMI Date
2 – Stopped smoking **less than 1 year** before AMI Date
3 – Stopped smoking **more than 1 year** before AMI Date
4 – Never smoked
5 – Unable to determine

15. History of Cerebrovascular Disease: *(prior to AMI Admit Date)*
1 – Yes 3 – Questionable
2 – No 4 – Unable to determine

a. **Diagnosis of Cerebrovascular Accident (CVA, Stroke):** ☐
(If answer to 15a is Yes – Skip 15b and go to 16)

b. **History of Transient Ischemic Attacks (TIA's)?** ☐

16. History of Coronary Heart Disease (CHD) or Coronary Artery Disease (CAD): *(prior to AMI Admit Date)*
1 – Yes 3 – Questionable
2 – No 4 – Unable to determine

a. **Prior diagnosis of CHD/CAD:** ☐
b. **Angina:** ☐
c. **Myocardial Infarction (MI):** ☐
d. **Bypass Surgery (CABG):** ☐
e. **Coronary angioplasty (PTCA) or stent:** ☐
f. **Coronary angiography:** ☐
(1) **Abnormal Results?** ☐
g. **Cardiac arrest:** ☐

HOSPITAL AMI DATE (Label item #11 in MM/DD/YYYY): __ __/__ __/__ __ __ __ **& PATIENT INITIALS** _____

17. History of Peripheral Vascular Disease (PVD):
(Prior to Hospital AMI Date)
1 – Yes 3 – Questionable
2 – No 4 – Unable to determine

a. **Diagnosis of PVD:** ☐
b. **Limb amputation due to PVD:** *(See instructions)* ☐
c. **Limb amputation/other cause:** *(See instructions)* ☐
d. **Absent foot pulses:** ☐
e. **Claudication:** ☐

18. History of Heart Disease (Other than CAD/CHD):
(Prior to Hospital AMI Date)
1 – Yes 3 – Questionable
2 – No 4 – Unable to determine

a. **Congestive Heart Failure:** ☐
b. **Pericarditis:** ☐
c. **Pulmonary Edema:** ☐

19a. Diagnosis of diabetes: *(Prior to Hospital AMI Date)* ☐
1 – Yes 3 – Questionable
2 – No 4 – Unable to determine

→ ***If the answer to Question 19a is "No", SKIP Questions 19b and 19c and go to Question 20.***

19b. Insulin therapy: *(prior to Hospital AMI Admit Date)* ☐
1 – Active 3 – Never
2 – Former 4 – Unable to determine

19c. Oral Medications (hypoglycemic agents): ☐
(prior to Hospital AMI Admit Date)
1 – Active 3 – Never
2 – Former 4 – Unable to determine

20. Renal transplant: *(prior to Hospital AMI Date)* ☐
1 – Yes 2 – No 3 – Unable to determine

21. Nephrectomy: *(prior to Hospital AMI Date)* ☐
1 – Yes, one kidney removed 3 – No
2 – Yes, both kidneys removed 4 – Unable to determine

22. History of Chronic Obstructive Pulmonary Disease (COPD): *(prior to Hospital AMI Date)* ☐
1 – Yes 3 – Questionable
2 – No 4 – Unable to determine

23. History of cancer (other than skin cancer): ☐
(prior to Hospital AMI Date)
1 – Yes 3 – Questionable
2 – No 4 – Unable to determine

24. HIV Status: *(prior to Hospital AMI Date)* ☐
1 – Positive 3 – Can't Disclose
2 – Negative 4 – Unable to determine

25. AIDS Diagnosis: *(prior to Hospital AMI Date)* ☐
1 – Positive 3 – Can't Disclose
2 – Negative 4 – Unable to determine

For Questions 26 – 30, use information obtained within the 30 days PRIOR TO Hospital AMI Admit Date.

26. Height: ☐ ft ☐☐ in* **OR** ☐☐☐ cm*
**If patient is a bilateral amputee, enter pre-amputation height and check this box* → ☐

27. Prescribed dry weight closest to AND PRIOR to Hospital AMI Admit Date:
☐☐☐.☐ lbs **OR** ☐☐☐.☐ kgs

28. Undernourished or cachectic (malnourished) at Hospital AMI Admit Date: *(See Instructions)* ☐
1 – Yes 3 – Questionable
2 – No 4 – Unable to determine

29. Pre and Post dialysis SITTING BLOOD PRESSURES & WEIGHTS from last three treatments BEFORE Hospital AMI Admit Date: *(Include treatment on AMI admit date if applicable)*

→ ***For PD patients** - Use last 3 daily BP's and weights taken before AMI Admit date and entered on home log sheets. Enter in Pre-BP/Pre-weight boxes.*
(If no home logs, use BP's/wt. from last 3 clinic visits)

Treatment Date #1 ☐☐ ☐☐ ☐☐☐☐ (M M D D Y Y Y Y)
(Treatment closest to Hospital AMI Admit Date)

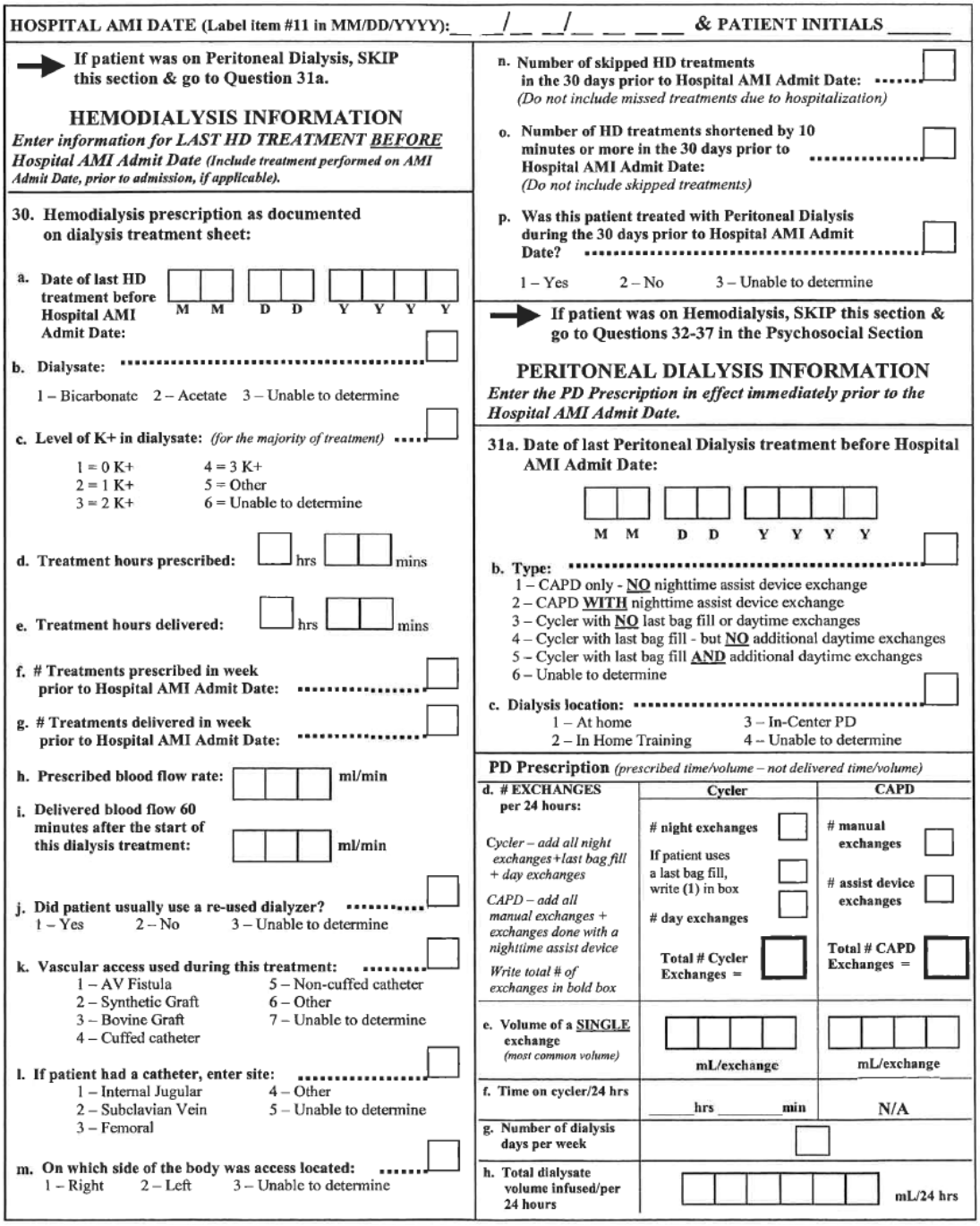
	Systolic	Diastolic	Weight	CIRCLE lbs or kgs
Pre BP & weight	☐☐☐	☐☐☐ →	☐☐☐.☐	
Post BP & weight	☐☐☐	☐☐☐ →	☐☐☐.☐	

Treatment Date #2 ☐☐ ☐☐ ☐☐☐☐ (M M D D Y Y Y Y)

	Systolic	Diastolic	Weight	CIRCLE lbs or kgs
Pre BP & weight	☐☐☐	☐☐☐ →	☐☐☐.☐	
Post BP & weight	☐☐☐	☐☐☐ →	☐☐☐.☐	

Treatment Date #3 ☐☐ ☐☐ ☐☐☐☐ (M M D D Y Y Y Y)

	Systolic	Diastolic	Weight	CIRCLE lbs or kgs
Pre BP & weight	☐☐☐	☐☐☐ →	☐☐☐.☐	
Post BP & weight	☐☐☐	☐☐☐ →	☐☐☐.☐	



HOSPITAL AMI DATE (Label item #11 in MM/DD/YYYY): __ __/__ __/__ __ __ __ & PATIENT INITIALS _____

→ If patient was on Peritoneal Dialysis, SKIP this section & go to Question 31a.

HEMODIALYSIS INFORMATION

Enter information for LAST HD TREATMENT BEFORE Hospital AMI Admit Date *(Include treatment performed on AMI Admit Date, prior to admission, if applicable).*

30. Hemodialysis prescription as documented on dialysis treatment sheet:

a. **Date of last HD treatment before Hospital AMI Admit Date:** M M D D Y Y Y Y

b. **Dialysate:**
1 – Bicarbonate 2 – Acetate 3 – Unable to determine

c. **Level of K+ in dialysate:** *(for the majority of treatment)*
1 = 0 K+ 4 = 3 K+
2 = 1 K+ 5 = Other
3 = 2 K+ 6 = Unable to determine

d. **Treatment hours prescribed:** ☐ hrs ☐☐ mins

e. **Treatment hours delivered:** ☐ hrs ☐☐ mins

f. **# Treatments prescribed in week prior to Hospital AMI Admit Date:**

g. **# Treatments delivered in week prior to Hospital AMI Admit Date:**

h. **Prescribed blood flow rate:** ☐☐☐ ml/min

i. **Delivered blood flow 60 minutes after the start of this dialysis treatment:** ☐☐☐ ml/min

j. **Did patient usually use a re-used dialyzer?**
1 – Yes 2 – No 3 – Unable to determine

k. **Vascular access used during this treatment:**
1 – AV Fistula 5 – Non-cuffed catheter
2 – Synthetic Graft 6 – Other
3 – Bovine Graft 7 – Unable to determine
4 – Cuffed catheter

l. **If patient had a catheter, enter site:**
1 – Internal Jugular 4 – Other
2 – Subclavian Vein 5 – Unable to determine
3 – Femoral

m. **On which side of the body was access located:**
1 – Right 2 – Left 3 – Unable to determine

n. **Number of skipped HD treatments in the 30 days prior to Hospital AMI Admit Date:**
(Do not include missed treatments due to hospitalization)

o. **Number of HD treatments shortened by 10 minutes or more in the 30 days prior to Hospital AMI Admit Date:**
(Do not include skipped treatments)

p. **Was this patient treated with Peritoneal Dialysis during the 30 days prior to Hospital AMI Admit Date?**
1 – Yes 2 – No 3 – Unable to determine

→ If patient was on Hemodialysis, SKIP this section & go to Questions 32-37 in the Psychosocial Section

PERITONEAL DIALYSIS INFORMATION

Enter the PD Prescription in effect immediately prior to the Hospital AMI Admit Date.

31a. Date of last Peritoneal Dialysis treatment before Hospital AMI Admit Date:
M M D D Y Y Y Y

b. **Type:**
1 – CAPD only - NO nighttime assist device exchange
2 – CAPD WITH nighttime assist device exchange
3 – Cycler with NO last bag fill or daytime exchanges
4 – Cycler with last bag fill - but NO additional daytime exchanges
5 – Cycler with last bag fill AND additional daytime exchanges
6 – Unable to determine

c. **Dialysis location:**
1 – At home 3 – In-Center PD
2 – In Home Training 4 – Unable to determine

PD Prescription *(prescribed time/volume – not delivered time/volume)*

	Cycler	CAPD
d. **# EXCHANGES per 24 hours:** *Cycler – add all night exchanges+last bag fill + day exchanges* *CAPD – add all manual exchanges + exchanges done with a nighttime assist device* *Write total # of exchanges in bold box*	**# night exchanges** ☐ If patient uses a last bag fill, write (1) in box ☐ **# day exchanges** ☐ **Total # Cycler Exchanges =** ☐	**# manual exchanges** ☐ **# assist device exchanges** ☐ **Total # CAPD Exchanges =** ☐
e. **Volume of a SINGLE exchange** *(most common volume)*	☐☐☐☐ mL/exchange	☐☐☐☐ mL/exchange
f. **Time on cycler/24 hrs**	____hrs ____min	N/A
g. **Number of dialysis days per week**	☐	
h. **Total dialysate volume infused/per 24 hours**	☐☐☐☐☐☐ mL/24 hrs	

HOSPITAL AMI DATE (Label item #11 in MM/DD/YYYY):__ __/__ __/__ __ __ __ & PATIENT INITIALS _____

Peritoneal Dialysis Information (Continued)

31i. Was this patient treated with hemodialysis during the 30 days prior to the Hospital AMI Admit Date? ☐

1 – Yes 2 – No 3 – Unable to determine

PSYCHOSOCIAL EVALUATION

Complete this section for both HD and PD Patients. For Questions 32 – 35, use information from the 30 days PRIOR TO Hospital AMI Admit Date.

32. Activities of daily living: *(prior to AMI Admit Date)*

1 – Yes 2 – No 3 – Unable to determine

a. **Was able to eat independently:** ☐

b. **Was able to transfer independently:** ☐

c. **Was able to ambulate independently:** ☐
(Includes ambulation with assistance device – i.e., cane, walker)

33. Employment Status: *(prior to AMI Admit Date)* ☐

1 – Employed FT or FT student
2 – Employed PT or PT student
3 – Homemaker
4 – Retired
5 – Unemployed
6 – Other _____
7 – Disabled
8 – Never employed
9 – Unable to determine

34. Marital Status: *(prior to AMI Admit Date)* ☐

1 – Never Married
2 – Married or Domestic Partner
3 – Widowed
4 – Divorced
5 – Separated
6 – Unable to Determine

35. Living Status: *(prior to AMI Admit Date)* ☐

1 – House/Apartment
2 – Homeless
3 – Assisted living setting
4 – Nursing home/ institution
5 – Unable to determine

For Questions 36 & 37, refer to the Social Work Assessment.

36. Education: ☐

1 – Less than 12 years and no GED
2 – High school graduate or GED
3 – Some college
4 – College graduate
5 – Unable to determine

37. Primary occupation before ESRD: ☐

1 – Clerical
2 – Professional
3 – Tradesperson
4 – Manual Labor
5 – Student
6– Other (specify) _____
7 – Homemaker
8 – Military
9 – Disabled
10 – Unable to determine

CARDIAC DIAGNOSTIC TESTS

For Questions 38-41, use diagnostic data obtained closest to AND PRIOR TO Hospital AMI Admit Date. *Do NOT use data obtained MORE than 12 months before the AMI Admit Date.*

38. Cardiomegaly by X-ray: ☐

1- Yes 2 – No 3 – Unable to determine

39. Left ventricular hypertrophy (LVH): ☐

1 – Yes 2 – No 3 – Unable to determine

40. If LVH was documented, how was it diagnosed?

a. **Diagnosed by EKG?** ☐

1 – Yes 2 – No 3 – Unable to determine

b. **Diagnosed by echocardiography?** ☐

1 – Yes 2 – No 3 – Unable to determine

41a. Left Ventricular Ejection Fraction Measured: ☐

1 – Yes 2 – No 3 – Unable to determine

b. **Left Ventricular Ejection Fraction:** ☐☐ **%**
(if known) *(Please read instructions for this section carefully)*

c. **Date when above test for Left Ventricular Ejection Fraction was performed in MM/DD/YYYY:**

☐☐ ☐☐ ☐☐☐☐
M M D D Y Y Y Y

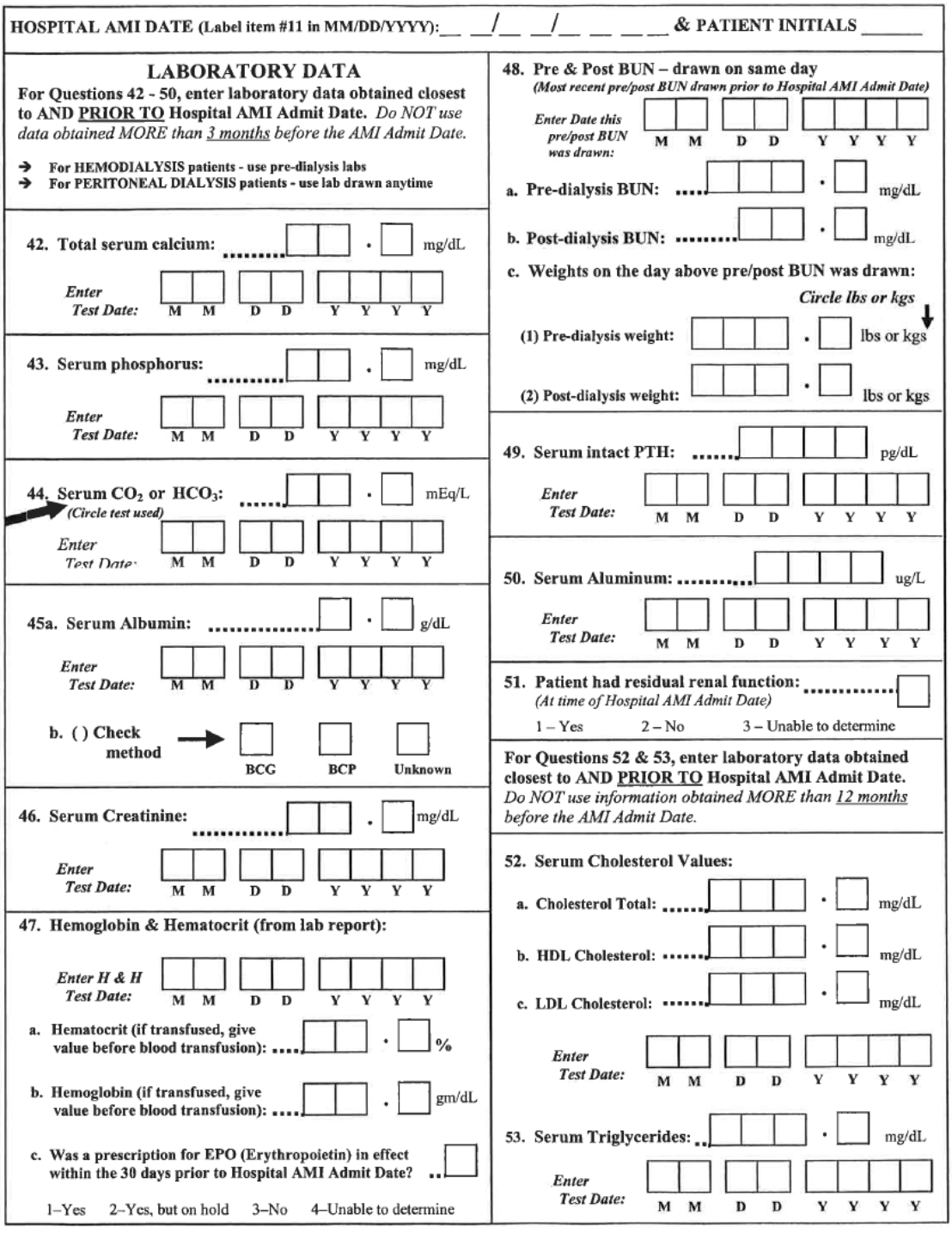
d. **Ejection fraction measured by:** *(Check all boxes that apply)* ( )

(1) Echocardiography ☐
(2) Nuclear imaging ☐
(3) Cardiac Cath (Ventriculography) ☐
(4) One of the above tests was done, but report gives a qualitative description of the Ejection Fraction and not a numerical percent value ☐
(5) Unable to determine ☐

If you entered a Left Ventricular Ejection Fraction percent value for Question 41b OR If there is no evidence that Ejection Fraction was measured – SKIP 41e below and go to Question 42.

e. **If Ejection Fraction WAS reported as a qualitative measure, check the left ventricular systolic function category reported in patient's chart:** ( )

(1) Normal ☐
(2) Mildly reduced ☐
(3) Moderately reduced ☐
(4) Severely reduced ☐
(5) Unable to determine ☐



HOSPITAL AMI DATE (Label item #11 in MM/DD/YYYY):__ __/__ __/__ __ __ __ & PATIENT INITIALS _____

LABORATORY DATA

For Questions 42 - 50, enter laboratory data obtained closest to AND PRIOR TO Hospital AMI Admit Date. *Do NOT use data obtained MORE than 3 months before the AMI Admit Date.*

→ **For HEMODIALYSIS patients - use pre-dialysis labs**
→ **For PERITONEAL DIALYSIS patients - use lab drawn anytime**

42. Total serum calcium: ..... . mg/dL

Enter Test Date: M M D D Y Y Y Y

43. Serum phosphorus: ..... . mg/dL

Enter Test Date: M M D D Y Y Y Y

44. Serum CO_2 or HCO_3: ..... . mEq/L
(Circle test used)

Enter Test Date: M M D D Y Y Y Y

45a. Serum Albumin: ..... . g/dL

Enter Test Date: M M D D Y Y Y Y

b. ( ) Check method → BCG BCP Unknown

46. Serum Creatinine: ..... . mg/dL

Enter Test Date: M M D D Y Y Y Y

47. Hemoglobin & Hematocrit (from lab report):

Enter H & H Test Date: M M D D Y Y Y Y

a. Hematocrit (if transfused, give value before blood transfusion): ..... . %

b. Hemoglobin (if transfused, give value before blood transfusion): ..... . gm/dL

c. Was a prescription for EPO (Erythropoietin) in effect within the 30 days prior to Hospital AMI Admit Date? ..

1–Yes 2–Yes, but on hold 3–No 4–Unable to determine

48. Pre & Post BUN – drawn on same day
(Most recent pre/post BUN drawn prior to Hospital AMI Admit Date)

Enter Date this pre/post BUN was drawn: M M D D Y Y Y Y

a. Pre-dialysis BUN: ..... . mg/dL

b. Post-dialysis BUN: ..... . mg/dL

c. Weights on the day above pre/post BUN was drawn:

Circle lbs or kgs

(1) Pre-dialysis weight: . lbs or kgs

(2) Post-dialysis weight: . lbs or kgs

49. Serum intact PTH: ..... pg/dL

Enter Test Date: M M D D Y Y Y Y

50. Serum Aluminum: ..... ug/L

Enter Test Date: M M D D Y Y Y Y

51. Patient had residual renal function: .....
(At time of Hospital AMI Admit Date)

1 – Yes 2 – No 3 – Unable to determine

For Questions 52 & 53, enter laboratory data obtained closest to AND PRIOR TO Hospital AMI Admit Date.
Do NOT use information obtained MORE than 12 months before the AMI Admit Date.

52. Serum Cholesterol Values:

a. Cholesterol Total: ..... . mg/dL

b. HDL Cholesterol: ..... . mg/dL

c. LDL Cholesterol: ..... . mg/dL

Enter Test Date: M M D D Y Y Y Y

53. Serum Triglycerides: .. . mg/dL

Enter Test Date: M M D D Y Y Y Y

HOSPITAL AMI DATE (Label item #11 in MM/DD/YYYY):__ __/__ __/__ __ __ __ & PATIENT INITIALS _____

54. MEDICATIONS – Please LEGIBLY PRINT the names of ALL prescribed and over the counter medications that patient was taking in the 30 days prior to Hospital AMI Admit Date (generic or trade names).

Include medications given routinely and/or PRN at the dialysis unit (EPO, Iron, Calcijex, Valium, Mannitol, etc.)

Frequency Codes →

A = Every Day (QD)	E = QID (4 times/day)	I = 2 times/week	M = Monthly
B = Every other day (QOD)	F = More than 4 x/day	J = 3 times/week	N = PRN
C = BID (2 times/day)	G = Less than 1 x/week	K = 4 times/week	
D = TID (3 times/day)	H = 1 time/week	L = 5 – 6 times/week	

MEDICATION & DOSAGE STRENGTH	ROUTE	FREQUENCY	START DATE	STOP DATE
Example: Lotensin 40 mg.	p.o.	A	10/01/1999	----------
1.				
2.				
3.				
4.				
5.				
6.				
7.				
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13.				
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16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				

HOSPITAL AMI DATE (Label item #11 in MM/DD/YYYY):__ __/__ __/__ __ __ __ & PATIENT INITIALS _____

54. MEDICATIONS (Continued)

If patient has more than 25 medications:

- *PRINT Patient's name in this space* **Patient Name:**_____
- ***LEGIBLY PRINT*** *additional medications on this page*
- *Staple this page to the completed tri-fold form*

Frequency Codes →

A = Every Day (QD)	E = QID	I = 2 times/week	M = Monthly
B = Every other day (QOD)	F = More than 4 x/day	J = 3 times/week	N = PRN
C = BID	G = Less than 1 x/week	K = 4 times/week	
D = TID	H = 1 time/week	L = 5 – 6 times/week	

MEDICATION & DOSAGE STRENGTH	ROUTE	FREQUENCY	START DATE	STOP DATE
***Example*:** **Lotensin 40 mg.**	**p.o.**	**A**	**10/01/1999**	----------
26.				
27.				
28.				
29.				
30.				
31.				
32.				
32.				
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