Risk Adjustment in the Medicare Atrial Fibrillation Population
Final Progress Report

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	GRANT
FINAL PROGRESS REPORT SUMMARY	Longer Life Foundation Grant 2001-004

PRINCIPAL INVESTIGATOR AND TITLE	PERIOD COVERED BY THIS REPORT	
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ORGANIZATION	8/1/01	7/31/03
Washington University		

TITLE OF PROJECT

Risk Adjustment in the Medicare Atrial Fibrillation Population

This grant focused on mortality in elderly patients with heart disease. We studied patients with heart failure (Project 1) and atrial fibrillation (Project 2).

Project 1: Predictors of mortality in younger and older patients with heart failure and preserved or reduced left ventricular ejection fraction

Introduction: Heart failure affects at least 5 million Americans. Prior research has focused on heart failure in patients who have systolic dysfunction (inability of the heart to squeeze normally). However, among the elderly, diastolic dysfunction (inability of the heart to relax normally) is more common than systolic dysfunction and both types of heart failure increase mortality and decrease quality of life. Although half of elderly patients with heart failure have diastolic dysfunction, little was known about predictors of mortality in this group.

Method: In this retrospective cohort study, we correlated how gender, age, heart function, laboratory tests, and medications affect the risk of death in 373 patients (mean age 69.1 years, 56.0% female, 47.5% non-white) who had heart failure.

Results: After a mean follow-up of 25 months, we found that predictors of mortality were different in the two subpopulations: among elderly patients with diastolic dysfunction a common test of renal function (BUN) was the only independent predictor of death; among elderly patients with systolic dysfunction the independent predictors of death were advanced age, prior heart attack, high-dose diuretics, or more severe systolic dysfunction on echocardiography. Patients with systolic dysfunction had a significantly greater risk of death.

Conclusions: Thus, although both types of heart failure have similar signs (e.g. ankle swelling) and symptoms (e.g. shortness of breath), their prognosis and factors affecting prognosis differed. Traditional predictors of mortality in patients with systolic dysfunction may not apply to elderly patients with diastolic dysfunction. For more information please see:

Kerzner R, Gage BF, Freedland KE, Rich MW. Predictors of mortality in younger and older patients with heart failure and preserved or reduced left ventricular ejection fraction. *Am Heart J.* Aug 2003;146(2):286-290.

Dr. Kerzner presented at the American Geriatrics Society in 2002.

Project 2: Comorbidity Indices to Predict Mortality from Medicare Data: Results from the National Registry of Atrial Fibrillation

Introduction: Medicare-aged patients with atrial fibrillation have a high rate of mortality, depending on their comorbid conditions. Common comorbid conditions in this population are stroke, heart failure, coronary heart disease, hypertension, diabetes mellitus, and cancer. Compared to patients without comorbid conditions, patients with them are less likely to have aggressive treatments, more likely to have complications from medical procedures, and less likely to respond to therapy. Severity of comorbidity condition is usually measured by an index -- typically a sum of weighted conditions. Because few studies compare the accuracy of the various comorbidity indices in patients with heart disease, it is unclear which index would be a better predictor of death in patients with atrial fibrillation. The purpose of this project was to compare the accuracy of four comorbid indices (Deyo, Romano, Elixhauser, and chart review) in predicting mortality.

Method: In this retrospective cohort study, we studied 2728 elderly (mean 77 years) Medicare beneficiaries with atrial fibrillation as their primary diagnosis who were admitted to a hospital and discharged alive between 04/01/1998 and 03/31/1999. As part of the National Stroke Project, Quality Improvement Organization reviewed their medical records and obtained MEDPAR A data and death information from Medicare denominator files of living beneficiaries.

We quantified correlations among comorbidity indices using Spearman's rank correlation coefficient. We calculated risk of death and 95% confidence intervals for each index by the person-year method. We used a Cox proportional hazard model to quantify predictive ability of each index and the C-statistic to quantify discrimination. The C-statistic measures the probability that a patient with a lower comorbidity score has a lower risk of death in randomly selected pairs of patients.

Results: The correlation between administrative data based indices and chart review index was low. Among the administrative data based indices, there was a strong correlation between Deyo index and Romano index, but low correlation between Charlson type indices and Elixhauser index. For all four indices, there was a steady increase in mortality for greater scores, indicating their validity for predicting death in this cardiac population: as scores increased, death rate increased from less than 6 to more than 42 deaths per 100 patient-years. All four comorbidity

indices significantly increased predictive ability of death compared to the base model in this population. The base model included only age, race, and gender. The c-index for the base model was only 0.636. However, the index increased to 0.759 for the Deyo model, to 0.776 for Romano, and to 0.780 and for chart review.

In addition to the comorbidity indices, the discharge location and the length of stay at the baseline hospitalization predicted mortality. In this patient population, the addition of these two variables into the base model (race, age and gender) raised C from 0.64 to 0.71, and the further addition of any comorbidity index only increased C up to a maximum of 0.79.

There was a good agreement in ranking the states among the four indices. For example, the top five states selected by the models with administrative data based indices were very similar to each other, and only one state different from the gold standard (a chart-review based model).

Conclusions:

1. Comorbid conditions are important in predicting mortality in patients with atrial fibrillation.
2. Comorbidity is a confounding factor for outcomes research in this area: When researchers assess outcomes across hospitals, payers, providers, or other organizational structures, they should control for comorbid conditions.
3. For datasets similar to our (N = 2728; mean age = 77), it is better to construct a comorbidity index with population-specific weights rather than the fixed weights of the Charlson and Deyo comorbidity indices.
4. The two adaptations of the Charlson index to administrative data (Deyo and Romano) perform similarly to each other and nearly as well as predication from chart-abstracted data.
5. Outcomes researchers and epidemiologists could confidently use Elixhauser's algorithm to code comorbid conditions when data are available from only one hospitalization.
6. They can use the length of stay and discharge location as surrogates of comorbid conditions for risk adjustment when no comorbidity information is available.
7. As there is no comorbidity index reported from the atrial fibrillation population, this work demonstrated that several existing comorbidity indices could be used to predict death in this population.

Lay Summary

In the US and other industrialized countries, heart disease is the most common cause of death. We studied predictors of death in two growing populations: patients with heart failure and patients with a common irregular heart beat, atrial fibrillation.

Heart failure causes shortness of breath and ankle swelling and increases the risk of dying. There are two common causes of heart failure: inability of the heart to squeeze normally, and inability of the heart to relax normally. Based on prior literature, we postulated that the risk of death and predictors of death would differ, depending on the cause of heart failure. To answer this question, we studied 373 patients who had heart failure and who underwent an echocardiogram of their heart at Barnes–Jewish Hospital at Washington University Medical Center. Using chart review, we obtained information about their heart function, age, prior heart attacks, medicines, and laboratory tests.

Using the social security index we were able to determine dates of death over an average follow-up of 25 months. We found that the rate of death was especially high (38%-54%, depending on age) in patients whose hearts failed to squeeze normally. We found that their predictors of death were advanced age, prior heart attack, high-dose water pills, and worse heart function. (The water pills probably don't cause these patients to die, but they are markers for patients with more severe heart disease.) Among elderly patients whose hearts failed to relax properly, the only predictor of death was a common test of renal function, with greater mortality with more disease.

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Our second study focused on how to use Medicare or other administrative data to predict death. We studied patients with atrial fibrillation because we had Medicare data from these patients and because this common irregular heart beat increases the risk of dying by about 31%. Our goal was to compare the predictive accuracy of using information obtained from data review with the accuracy of using administrative data to predict death in 2728 patients who had been hospitalized with atrial fibrillation.

We found that compared to using information from administrative data, information from chart review barely improved our ability to predict death. Because there are several conflicting ways to use administrative data to predict death, and we compared them. We found that these

methods had similar predictive accuracy, but there was trend favoring Romano's adaptation of the Charlson index to administrative data. We also found that patients who were not well enough to be discharged home from the hospital (often going to a skilled nursing facility instead) were more likely to die than patients discharged home. Likewise, patients who had a long hospitalized were more likely to die than patients who had short hospitalization. Other important predictors of death in the population were: cancer; dementia; and heart, lung, liver, or kidney disease. Use of the blood thinner warfarin in the patients with atrial fibrillation was associated with a 60% reduction of death.

For more information see:

Yan Y, Birman-Deych E, Radford MJ, Nilasena DS, Gage BF "Comorbidity Indices to Predict Mortality from Medicare Data: Results from the National Registry of Atrial Fibrillation". **Medical Care** 2005

Related Work from the Research Team

Yan Yan, MD, PhD has shifted his research towards the study of comorbidity, especially in patients with cancer.

Brian Gage, MD is collaborating with Drs. Kerzner and Rich on a study about the prognostic value of anemia in patients with heart failure.

Brian Gage, MD is collaborating with Drs. Park and Vijayan on a study about the mortality effect of erythropoietin in ill patients with acute renal failure.

Brian Gage, MD et al. continue to study the epidemiology and prevention of adverse events in patients with atrial fibrillation through a newly funded 5-year AHA Established Investigator Award.

Brian Gage, MD et al. are studying Pharmacogenetics, Biomarkers, and Antithrombotic Therapy in patients who have heart disease (R01 HL074724).