The Influence of Distance on Ambulatory Care Use, Death, and Readmission Following a Myocardial Infarction

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Objective. To examine whether patients admitted for treatment of a myocardial infarction (MI) who live farther from their source of care are less likely to be followed in an outpatient clinic, and whether patients who receive follow-up care are less likely to die or to have a subsequent acute care admission.

Data Source. Department of Veterans Affairs (VA) databases to identify a national sample of 4,637 MI patients discharged in 1992, their use of care, and vital status within the subsequent year. Sociodemographics, comorbid diagnoses, invasive cardiac procedures, hospital teaching status, and distance to patients' admitting hospital were determined.

Study Design. Using these longitudinal data, we examined the relationship between patient characteristics, distance to care, and use of outpatient care after discharge. We then examined the relationship between the use of ambulatory care and subsequent death and readmission.

Principal Findings. Patients living more than 20 miles from their admitting hospital were less likely to use ambulatory services. Patients receiving ambulatory care were 79 percent as likely to die within the year as those without any follow-up care (95% C.I. = 0.66, 0.94). Patients living more than 20 miles from their admitting hospital were more likely to die independent of their likelihood of receiving VA outpatient follow-up. Among patients who did not die in the subsequent year, those receiving ambulatory care were 33 percent more likely to be readmitted to a VA hospital with a cardiac diagnosis (95% C.I. = 1.12, 1.57).

Conclusions. Distance may pose a barrier to outpatient follow-up for some VA patients after a MI. It also may limit patients' ability to access medical care quickly in the event of a recurrent acute event. Ambulatory care after discharge may be an important factor determining survival for patients with cardiac disease.

Key Words. Myocardial infarction, access to care, outpatient care, distance to care

Because myocardial infarction (MI) is one of the most common causes of morbidity and mortality in the United States (American Hospital Association [AHA] 1991), researchers have focused considerable attention on the care of MI patients. In recent years, researchers have examined the non-clinical determinants of cardiac acute care use including patients' race (Peterson et al. 1994; Whittle et al. 1993; Hannan, Kilburn, O'Donnell, et al. 1991), source of payment (Kahn, Pearson, Harrison, et al. 1994), and hospital characteristics such as size and academic affiliation (McClellan, McNeil, and Newhouse 1994; Peterson et al. 1994). The findings suggest that patients with inadequate access to care and those served outside of academic medical centers receive less aggressive treatment. Because of the substantial cost and equity issues involved, these studies have increased the focus on the inpatient events that often accompany the management of MI (Goldman 1990; Ayanian 1994).

However, after the initial acute event, patients who have had a MI receive most of their follow-up, treatment, and secondary preventive services in outpatient settings, and many return to the community following multiple inpatient episodes (AHA 1988). As a result, most MI care occurs among patients previously diagnosed, and there is substantial potential for risk reduction and cost savings associated with ambulatory care and secondary preventive services (Siegel et al. 1988; Oldridge, Furlong, Feeny, et al. 1993).

After a cardiac admission, management of patients with a MI has multiple goals (Konstam, Dracup, Baker, et al. 1994). Physicians need to closely monitor patients' physiologic and functional stability (Neill, Branch, DeJong, et al. 1985). Drug therapies need to be initiated, adjusted, and monitored (Thadani 1991; Jafri et al. 1991). Physicians and nurses need to counsel and encourage patients' efforts to modify their lifestyles through dietary changes, smoking cessation, and exercise (Ornish, Brown, Scherwitz, et al. 1990; Pashkow 1993). Although practice patterns vary, these activities inevitably require multiple post-discharge outpatient visits.

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Comorbid medical problems such as congestive heart failure, diabetes mellitus, or a prior infarction may increase a patient's risk of readmission and death (Orchard 1992; Konstam, Dracup, Baker, et al. 1994). Other problems such as an alcohol abuse disorder may influence patients' course of illness by affecting their health directly or by impairing their ability to adhere to treatment regimens (Ketterer 1993). As a result, careful monitoring of patients with these problems during the post-discharge period is especially important.

THE ROLE OF DISTANCE IN THE CARE OF MI PATIENTS

Distance to care is an important determinant of health service use. Studies of hospital market share have consistently shown that patients who travel longer distances to reach their source of care use fewer health services than patients with greater access (McGuirk and Porell 1984; Luft, Garnick, Mark, et al. 1990; Holloway, Medendorp, and Bromberg 1990). Because of the extensive needs of patients who have had a MI, the role of distance in determining their use of outpatient follow-up care is especially important. Difficulties in reaching outpatient centers may put these patients at risk of death or may influence their subsequent use of inpatient care.

For a number of reasons, Department of Veterans Affairs (VA) health care utilization databases may contribute significant insights into the impact of distance on the pattern of care for patients after a MI. Compared to other patient populations, VA patients may have to travel relatively far to receive health services (Schaefer et al. 1990). Thus, VA data may allow for examination of a wider range of the distance–service use relationship. Although the greater distances traveled by some VA patients are currently atypical elsewhere, these distances may become increasingly common as other health systems regionalize services. As a result VA care may provide insights regarding the impact of such regionalization efforts on patients' service use and outcomes. The VA patient population is of interest per se, because more than 32 million days of inpatient care and 24 million outpatient clinic visits are provided in VA facilities annually at significant taxpayer expense. Last, like Medicare databases, VA databases provide information on a large, nationally representative sample of patients. However, unlike Medicare files, VA data allow examination of the impact of distance on health services use among MI patients under 65 years of age.

A recent study found that, although VA patients are less sensitive to travel distance than are other health care users, those who live farther from a source of care use fewer services than those who live nearby (Burgess

and DeFiore 1994; Zwanziger 1994). Another study of VA patients found that those who lived farther from their admitting hospital were more likely to be readmitted within 30 days (Hollaway, Medendorp, and Bromberg 1990). However, patients' use of ambulatory care and its relationship with subsequent admission and death were not examined.

The goals of this study were to determine whether VA patients who live farther from their source of care are less likely than closer-in patients to be followed in an outpatient clinic after an admission for a MI, and whether MI patients who receive no VA follow-up care are more likely to die or to be readmitted for cardiac care within the subsequent year.

METHODS

DATA SOURCES

Data for this study were drawn from the clinical and administrative databases used to document all health services events occurring within VA facilities. Inpatient data were obtained from the Patient Treatment File (PTF) that has information on acute admissions to VA hospitals including the patient's sociodemographic characteristics, eligibility for VA services, up to ten ICD-9-CM discharge diagnoses, procedures, and zip code of residence. Data on the severity of a patient's MI were not available.

Other databases were linked to PTF data to produce the analytic data set. Outpatient visits occurring within the 90 days following a patient's index admission were identified from the Outpatient Care files (OPC). The teaching status of the admitting hospital was determined through VA costing databases. We identified deaths and dates of death through two sources. The VA Beneficiary Identification and Record Locator Subsystem (BIRLS) contains dates of death for veterans for whom a death benefit was claimed. We supplemented the BIRLS data with information from the Social Security Administration (SSA) death file to maximize the likelihood that deaths would be identified.

Previous studies indicate that the data within these files are valid and reliable and therefore appropriate for studies of health services use and outcomes. For patients with a primary diagnosis of MI, PTF data agree with medical charts in 94 percent of all cases, a level of agreement as good or better than that of Medicare or other similar databases (Hunter-Young, Hamann, Cagan, et al. 1994; Romano and Luft 1992). Because the VA death benefit is known to virtually all mortuary administrators and most family members of eligible patients, BIRLS data are also reliable (Department of Health and

Human Services 1991; Fisher et al. 1995). A recent reliability study of BIRLS data found that 94 percent of all deaths in VA hospitals were recorded in BIRLS although other deaths were less likely to be included (Yu and Peterson 1994). Using the SSA death file to supplement the BIRLS data increased our enumeration of deaths and attenuated any biases in underreporting that may exist within the BIRLS data set.

PATIENT SELECTION

We selected our analytic sample from patients admitted to VA acute care hospitals in fiscal year 1992 with a discharge diagnosis of MI defined by ICD-9-CM code 410. We selected 1992 as the index year in order to allow a minimum of 18 months for deaths to be reported to the BIRLS and SSA systems. Because only 1.3 percent of all VA MI patients in 1992 were women, and because studies have found that women with acute cardiac illness differ from men in their treatment and outcomes (Goldberg, Gorak, Yarzebski, et al. 1993; Kitler 1992; Maynard et al. 1992), we limited the analytic sample to men.

A total of 9,094 patients with a primary diagnosis of MI admitted from the community or VA outpatient clinics were identified. We excluded 1,472 patients who were readmitted to a VA hospital within 90 days of their index discharge because these patients were not eligible for outpatient care during their readmission, and because it was not clear whether subsequent outpatient use was related to their index episode, the readmission, or another problem. We also excluded 2,900 patients who died during the first 90 days post-discharge so that we could clearly identify the relationship between ambulatory care use within this period and subsequent deaths or readmissions. From the remaining patients, we excluded those whose index length of stay was greater than 100 days ($n = 16$) and those living more than 100 miles from a source of VA care or more than 200 miles from their admitting facility ($n = 69$).

VARIABLE DEFINITION

Sociodemographic characteristics of the patient (age, race, and marital status) were determined from the PTF. We also determined whether patients were eligible for VA care as the result of a service-connected disability or solely on the basis of their income, because service-connected patients may have access to a wider range of outpatient services. We used the Charlson comorbidity index (Charlson et al. 1987) as modified by Deyo for use with ICD-9 codes (Deyo, Cherkin, and Ciol 1992) in order to control for comorbidities. In

calculating patients' comorbidity scores, we counted ischemic diagnoses as comorbidities only if they occurred prior to a patient's index admission. The final comorbidity scores were categorized as 0, 1, 2, 3, or 4+. We also included an indicator for whether patients had a diagnosed alcohol abuse disorder, because alcohol abuse is a common comorbid diagnosis for VA patients (Piette, Swindle, Baisden, et al. 1995) and because alcohol abuse has been shown to affect the health status of patients with cardiac illness (National Institute on Alcohol Abuse and Alcoholism [NIAAA] 1993; Wicklund, Oden, Sanne, et al. 1988). Inpatient cardiac catheterization and revascularization procedures (coronary angioplasty or bypass surgery, or both) occurring during a patient's index admission were identified from the PTF inpatient procedure and surgery files (see Appendix for ICD-9-CM procedure codes). A binary variable was used to identify patients initially discharged from a teaching hospital.

We examined several ways to operationalize patients' distance to VA care, including distance to any VA facility, distance to any inpatient medical facility with outpatient clinics on site, and distance to any outpatient clinics including satellite outpatient clinics. In the final analyses, we chose to present our results using the distance to the inpatient facility in which a patient's initial MI treatment took place. However, the relationships presented here do not differ markedly regardless of which distance measure is used. For more than half of all patients in the analytic sample, the admitting facility was the nearest source of VA care, and in all admitting medical centers outpatient medical care was available. Among those who had outpatient follow-up, the admitting facility was either the site of follow-up or was within five miles of the site for more than 80 percent of the sample. In addition, the ability to receive inpatient and outpatient care at the same source is important to ensure continuity of care after discharge.

The distance between a patient's residence and source of care was defined as the straight-line distance from the geographic center of the patient's five-digit zip code to the center of the admitting facility's five-digit zip code. Some unknown number of patient zip codes were associated with post office boxes; however, it is unlikely that most of these patients lived more than a few miles from where they received their mail. We identified the latitude and longitude for each zip code from a zip code locator file, and used a trigonometric formula to calculate the distance between patients and their source of VA care based on these coordinates (for a similar application, see Garnick, Luft, and Romano 1987). Multiple functional forms of the distance measures were examined including transformations using logarithms. The

final distance variable was categorized as ≤5, 6–20, 21–50, and 51+ miles in order to capture the logarithmic nature of the distance-access relationship and to maximize the interpretability of the findings.

DEFINITION OF DEPENDENT VARIABLES AND STATISTICAL ANALYSES

Use of Ambulatory Care Post-Discharge. Although ongoing use of ambulatory care over an extended period may have an important effect on a patient's health and mortality risk, our interest was in the use of outpatient follow-up care in the post-discharge period. Thus, we determined the number of days in which patients received one or more ambulatory medical care visits from a VA facility within the 30 and 90 days post-discharge. We identified outpatient visits for mental health services, using the "clinic stop" codes available in the outpatient database, and excluded these visits from our analytic files before we enumerated ambulatory medical care utilization. Because VA outpatient databases do not code the reason for visits, we counted all post-discharge medical care visits. Thus, the amount of follow-up care during this period that related directly to the MI admission may be overestimated for some patients. Bivariate analyses focused on the differences in the amount of ambulatory care across patient groups.

In multivariate analyses of ambulatory care use, we focused on the likelihood that patients would have any follow-up visits (yes/no) within 30 and 90 days post-discharge. This was done because, although some patients receive ambulatory care in order to monitor their recovery and prevent further complications, others are seen for treatment of ongoing or newly diagnosed disorders. Thus, it is unclear whether frequent follow-up care represents preventive medicine, aggressive treatment, or poorer case mix. However, regardless of health status, lack of any follow-up care represents poor patient follow-up.

Survival and Readmission Analyses. The goal of these analyses was to determine whether death and recurrent admissions for cardiac care were associated with distance to care, lack of follow-up, patient characteristics, or characteristics of the index episode. We examined these outcomes in two stages. After a MI, patients are at risk for recurrent infarctions and other events that may not allow time for treatment within a VA hospital. For patients who die outside a VA facility, the cause of death cannot be determined from the current data set. Thus, we examined factors predictive of death from all causes occurring between 91 days and 365 days after discharge. Many of those who

died outside a VA facility likely died from heart-related causes either in a non-VA hospital or elsewhere. Including these patients as observations "censored by death" in our cardiac readmission analyses would result in substantial misclassification bias because they, in fact, represent some of the most acute recurrent episodes of cardiac illness. Thus, we selected the subset of patients who were not reported dead within one year and examined the factors predictive of a recurrent cardiac admission occurring between 90 and 365 days after discharge. In both the mortality and cardiac readmission analyses, proportional hazards models were used to determine differences associated with patient and service use factors. Statistically nonsignificant terms were deleted from the final models. We have chosen to use proportional hazards modeling because these models are best suited for situations such as this, in which the dependent variable is the length of time to a given event and in which many patients do not experience the event of interest before the end of follow-up (Cox and Oakes 1984).

RESULTS

SAMPLE DESCRIPTION

A total of 4,637 male patients with a MI diagnosis were included in the analytic sample (Table 1). The sample included patients from all states except Alaska and Hawaii as well as the District of Columbia and Puerto Rico. A total of 78.3 percent of all patients were white, 38.9 percent were unmarried at the time of their index admission, and 40.3 percent had a service-connected disability. Forty-eight percent of all patients were 65 years of age or older. One in four patients had some comorbid diagnosis measured by the Charlson index. For example, 8.1 percent had one or more additional MI admissions in the prior year, 8.3 percent had a diagnosis of chronic pulmonary disease, and 11.3 percent had diabetes mellitus. In addition, 9.1 percent had an alcohol abuse disorder diagnosed either during their index admission or during an admission in the prior year.

Patients traveled significant distances to reach their admitting medical center. Fewer than 15 percent of all patients lived within five miles of their admitting hospital, and nearly half (44.6 percent) lived more than 50 miles from the facility in which their index admission took place. Other data indicate that half of all patients lived more than 33 miles from *any* VA source of care. We examined the bivariate association between distance to care and the Charlson comorbidity score in order to determine whether patients traveling

Table 1: Patient Description (N = 4,637)

	% of Patients (N)
Caucasian	78.3 (3,632)
Unmarried	38.9 (1,802)
Service-connected disability	40.3 (4,637)
Age in years	
<55	20.4 (946)
55–64	31.6 (1,467)
65–74	37.3 (1,731)
75+	10.6 (493)
Modified Charlson comorbidity score	
0	74.2 (3,442)
1	11.3 (523)
2	6.5 (301)
3	3.7 (172)
4	4.3 (199)
Alcoholism	9.1 (422)
Teaching hospital	82.1 (3,806)
Characteristics of the index episode	
Cardiac catheter	36.5 (1,692)
Revascularization	14.4 (669)
Miles to admitting hospital	
≤5	14.9 (690)
6–20	21.6 (1,003)
21–50	18.9 (875)
51+	44.6 (2,069)

greater distances to their admitting hospital were more severely ill, possibly representing transfers to tertiary care hospitals. Despite the large sample size, no such association was observed ($p = .26$). If anything, the data suggested that patients traveling farther were healthier. For example, whereas 27.4 percent of patients living within five miles of their admitting hospital had comorbidities, only 23.9 percent of those living more than 50 miles from their admitting hospital had any Charlson-coded comorbid diagnoses.

POST-DISCHARGE AMBULATORY CARE

On average, patients were seen four times in an ambulatory care clinic during the 90 days after their discharge (the equivalent of one visit every three weeks). However, patients living nearer to their source of care were more likely to

receive outpatient care than those who had to travel farther (Table 2). For example, 9.3 percent of patients living five or fewer miles from their admitting hospital had no follow-up care within the VA as compared to 11.6 percent of those in the farthest group.

Controlling for covariates, patients' age and whether they had a service-connected disability were independently associated with the likelihood of receiving ambulatory care (Table 3). Patients who were 55 years old or older were more likely to receive one or more follow-up visits than those under 55. We observed a number of predictors of receipt of care in the first month post-discharge that failed to be predictive of receipt of care in the first 90 days. Patients with one or more comorbidities were more likely to receive follow-up care within the first month post-discharge. In contrast, patients with a history of alcohol abuse were substantially less likely than other patients to be seen in outpatient clinics within the first month. Controlling for covariates, patients initially treated in a teaching hospital were significantly more likely to receive follow-up care within the first month than their counterparts admitted to nonteaching hospitals.

Distance to care was a significant predictor of whether patients received follow-up in outpatient clinics. Compared to patients living within 20 miles of their admitting VA hospital, patients living 21–50 miles were .84 times as likely to receive outpatient follow-up in the first 30 days and .89 times as likely to receive care in the first 90 days. Patients living more than 50 miles away were .67 times as likely to be seen for follow-up within the first 30 days of discharge and were only .56 times as likely to be seen within the first 90 days as patients living closer to their admitting hospital.

MORTALITY AND RECURRENT CARDIAC ADMISSIONS

A total of 291 patients, 6.3 percent of the sample, died within one year of their index discharge. As expected, older patients were more likely to die than their

Table 2: Percent of Patients with 0, 1–3, and 4 Visits within 90 Days of Discharge by Miles to VA Care

Miles to Admitting Hospital	*0 Visits*	*1–3 Visits*	*4+ Visits*
≤5	9.3 (64)	28.6 (197)	62.2 (429)
6–20	6.0 (60)	27.8 (279)	66.2 (664)
21–50	7.8 (68)	33.1 (290)	59.0 (517)
51+	11.6 (240)	35.0 (724)	53.4 (1,105)

Table 3: Adjusted Relative Risk (ARR) of One or More Ambulatory Care Visits within 30 and 90 Days Postdischarge

	1+ Visits in 30 Days		*1+ Visits in 90 Days*	
	ARR	*95% C.I.*	*ARR*	*95% C.I.*
Service-connected disability	1.35	(1.14,1.53)	1.27	(1.03,1.57)
Age in years				
55–64	1.27	(1.06,1.51)	1.96	(1.48,3.75)
65–74	1.40	(1.18,1.66)	1.65	(1.27,2.14)
75+	1.18	(0.93,1.49)	1.16	(0.83,1.63)
Modified Charlson comorbidity score				
1	1.32	(1.08,1.62)	–	
2	1.28	(0.98,1.65)	–	
3	2.49	(1.68,3.67)	–	
4+	1.38	(0.79,2.40)	–	
Alcoholism	0.78	(0.63,0.97)	–	
Teaching hospital	1.47	(1.25,1.72)	–	
Characteristics of index episode				
Cardiac catheter	–		1.46	(1.14,1.85)
Revascularization	1.70	(1.55,1.87)	2.40	(1.56,3.71)
Miles to admitting hospital				
21–50	0.84	(0.77,0.91)	0.89	(0.65,1.23)
51+	0.67	(0.58,0.77)	0.56	(0.44,0.70)

Note: Patients in the referent group had no service-connected disability, were less than 55 years of age, had a modified Charlson comorbidity score of zero, had no alcoholism diagnosis, were initially discharged from a nonteaching hospital, received no cardiac catheterization or revascularization procedure during their index episode, and lived within 20 miles of their admitting hospital.

younger counterparts. The Charlson score was monotonically associated with mortality risk. For example, patients with one comorbidity were 1.33 times as likely to die as those with no comorbidities, and patients with four or more comorbidities were 2.19 times as likely to die (Table 4).

Controlling for age, comorbidities, revascularization procedures, and ambulatory care use, patients living more than 20 miles from their admitting hospital were significantly more likely to die within the first year post-discharge than their counterparts living closer. We observed no trend in the distance-mortality relationship; rather, the relevant factor appeared to be whether patients lived within 20 miles of their admitting VA hospital. In contrast, patients who used any VA post-discharge ambulatory care were significantly less likely to die than their counterparts who had no VA follow-up.

Table 4: Adjusted Relative Risk (ARR) of Death within One Year and ARR of a Recurrent Acute Cardiac Admission for Survivors at One Year

	ARR of Death	*95% C.I.*	*ARR of Readmission*	*95% C.I.*
Age in years				
55–64	1.50	(1.10,1.99)	1.10	(0.99,1.23)
65–74	2.12	(1.60,2.82)	1.20	(1.08,1.35)
75+	2.90	(2.14,3.93)	1.23	(1.05,1.44)
Modified Charlson comorbidity score				
1	1.33	(1.10,1.59)	1.63	(1.46,1.83)
2	1.42	(1.15,1.75)	1.87	(1.63,2.14)
3	1.88	(1.51,2.34)	1.97	(1.66,2.35)
4+	2.19	(1.80,2.65)	2.07	(1.75,2.45)
Characteristics of index episode				
Revascularization	0.73	(0.57,0.94)	–	
Miles to admitting hospital				
21–50	1.23	(1.06,1.49)	–	
51+	1.25	(1.07,1.41)	–	
Any VA ambulatory care in 90 days	0.79	(0.66,0.94)	1.33	(1.12,1.57)

Note: Patients in the referent group were less than 55 years of age, had a comorbidity score of 0, received no revascularization procedure during their index episode, lived within 20 miles of their admitting hospital, received no ambulatory care visits within 90 days of their index discharge.

A total of 4,346 patients were alive one year following discharge from the hospital. For these patients, we estimated the effect of patient characteristics, process of care, and distance on recurrent cardiac readmission. As with mortality, race, marital status, service-connected disability, alcohol abuse, and cardiac catheterization had no effect on the likelihood of readmission for MI care. However, patients who were older and those with more comorbidities were more likely to be readmitted than their counterparts.

Controlling for covariates including the use of post-discharge ambulatory care, distance to care had no independent effect on patients' likelihood of being readmitted with a cardiac diagnosis. However, patients who had any VA ambulatory care within 90 days of discharge were 1.33 times as likely to be readmitted as their counterparts receiving no outpatient care.

DISCUSSION

We found that VA patients treated for MI often travel great distances to reach their source of care. A total of 63.5 percent of all patients admitted from

the community (i.e., non-transfer patients) lived more than 20 miles from their admitting hospital, a distance twice as far as patients treated in private hospitals (Luft et al. 1989; Williams et al. 1983). These results are consistent with recent analyses using the 1987 National Medical Expenditure Survey, in which VA patients were found to have significantly longer travel times to their source of care than other Americans (51 minutes versus 17 minutes) (McKinney, Carmody, and McIntire 1994).

Patients living farther from their source of care were less likely to receive follow-up care after discharge. As in other studies (Adams et al. 1991; Luft, Garnick, Mark, et al. 1990; McGuirk and Porell 1984), these data indicate that patients are sensitive to travel distance, and for some chronically ill MI patients, travel distance may play a significant role in determining their use of ambulatory care.

Patients coded as receiving no follow-up may have received outpatient care from sources outside of the VA. Studies indicate that some VA patients have multiple sources of care, particularly patients with Medicare or private insurance (Fleming, Fisher, Chang, et al. 1992). Thus, the results of the current study should be viewed as preliminary, and no conclusive estimates of the distance–outpatient care relationship can be derived until a data set merging VA and non-VA information can be developed. In addition, some patients who in the current study were coded as receiving VA follow-up may actually have received the bulk of that follow-up care in a facility other than the one that treated them as an inpatient. To the extent that patients receive care from multiple sources (either within or outside of the VA), their treatment increases the burden on providers to coordinate those patients' treatment plans and to share information regarding their medical and social histories. Patients with chronic diseases such as cardiac disease, particularly those with comorbid illnesses, place special burdens on providers' efforts to coordinate specialty treatment (Starfield et al. 1976; Holmes et al. 1978).

We assume that some patients with no VA follow-up care did not receive ambulatory care from any source. Our findings that patients who were alcoholic or discharged from nonteaching hospitals were less likely to receive outpatient care within the first 30 days post-discharge are consistent with this explanation (Wiklund, Oden, Sanne, et al. 1988). In addition, patients less than 65 years old were less likely to receive ambulatory care than those over age 65 who were eligible for Medicare Part B coverage. If out-of-system use fully explained lack of VA ambulatory care use, we would expect that those eligible to purchase health care elsewhere would be less likely to receive VA follow-up care than those without this option. These data illustrate some of

the factors affecting service use even when financial burdens are minimized, as they are within VA.

Controlling for case mix, patients who received follow-up care were less likely to die within the subsequent year. The measure of comorbidity examined in the current study suggests that more severely ill patients were actually more likely to receive follow-up in the first month, and we assume that any unmeasured differences in severity of illness also correlate with a greater likelihood of receiving outpatient services. Thus, it is unlikely that the poorer outcomes for patients without post-discharge ambulatory care can be explained in terms of poorer prognosis at discharge. The importance of outpatient follow-up may be underestimated if some patients without VA follow-up care received services elsewhere and if (as a result) their likelihood of dying was lower than that of "true" non-users. Other patients noted as having follow-up care in the current study may have been receiving treatment for a new or unrelated health problem and therefore may have been in poorer health status than patients "well enough" to forgo VA aftercare. In addition, patients who were either readmitted or died within 90 days of their index discharge were excluded from the current study. Thus, these data suggest that ambulatory care post-discharge plays an important role in preventing death for some MI patients. Further investigation is needed with more complete enumeration of comorbidities, the causes of patients' deaths, and the content of outpatient visits.

Distance to care was found to be associated with one-year mortality over and above its association with the likelihood of receiving follow-up care. Controlling for severity of illness, initial inpatient procedures, and outpatient follow-up, patients living more than 20 miles from their admitting hospital were 25 percent more likely to die. Some of this association may represent unmeasured differences in severity of illness associated with distance to VA care. However, we excluded transfer patients from our analytic sample and found no correlation between distance to care and patients' Charlson comorbidity scores. An alternative explanation is that once these patients become acutely ill, they have difficulty gaining access to urgent care (within or outside of VA) to prevent death.

As expected, increased age and comorbidities were associated with a greater risk of cardiac readmission among patients not reported dead. In addition, those receiving follow-up care within 90 days were more likely to be readmitted to a VA hospital for treatment of heart disease within their first year post-discharge. As with outpatient care, the data are inconclusive regarding whether these readmissions are proactive and avert a fatal event, or

whether they represent adverse outcomes. Further investigation merging secondary databases with medical record data would allow for a more definitive determination of the significance of these readmissions.

Several efforts have been suggested to increase access to primary care for patients living far from standard medical facilities. Mobile clinics may provide at least some of the services to patients who cannot reach their usual source of care (Lee and O'Neil 1994; Stein 1993; Oboler and Meyer 1988). Other efforts have focused on telephone follow-up for patients who need assistance in managing their drug regimen or in identifying symptoms that signal a need for acute care (Weinberger, Kirkman, Samsa, et al. 1994). These alternatives may help prevent adverse outcomes associated with lack of follow-up care.

More generally, these findings have implications for both VA and non-VA care of patients after a MI. Within VA, the data suggest that greater efforts are warranted to increase MI patients' use of outpatient services after an acute event. Veterans Affairs currently is restructuring its clinical services, administrative systems, quality monitoring, and physical plant so that outpatient care will receive greater emphasis over coming years. Recent reports suggest that these efforts already are resulting in greater use of outpatient care (Piette et al. 1995). Further, we observed a mortality difference for patients associated with distance from VA care that may be addressed by increasing patients' access to non-VA services. Although VA reimburses other providers for emergency care, expanding reimbursement for more routine services in instances where patients live far from VA ambulatory clinics may address this disturbing finding. Finally, these estimates should stimulate vigorous efforts to monitor the impact on MI patients of regionalizing aftercare services within non-VA health care systems if these efforts increase the distance some patients must travel to receive care.

APPENDIX

ICD-9-CM Codes Used to Define Cardiac Procedures:

- **Revascularization (36.0x; 36.1)**
- **Catheterization (37.21–37.23; 88.55–88.57)**

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