

Specialty of Principal Care Physician and Medicare Expenditures in Patients with Coronary Artery Disease: Impact of Comorbidity and Severity

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Objective: To explore differences in expenditures for elderly patients with acute and chronic coronary artery disease according to the specialty of the principal care physician.

Study Design: Retrospective analysis of Medicare claims.

Patients and Methods: A total of 250,514 patients with coronary artery disease (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] codes 410-414) were drawn from a national random sample of 1992 Medicare expenditures. Patients were classified by the physician type with the highest number of Medicare Part B outpatient claims into a cardiologist group and a generalist group. The outcome was mean total expenditures, stratifying (1) by comorbidity as measured by the modified Charlson Index and (2) by severity defined as the proportion of patients with acute myocardial infarction or unstable angina.

Results: Those patients in the cardiologist group had lower comorbidity and higher severity than those in the generalist group. Overall mean expenditures were significantly higher for the cardiologist group than for the generalist group (\$7658 vs \$6047; $P < .001$). These differences in mean expenditures were evident at each level of comorbidity. However, when stratified by severity of diagnosis, differences were seen predominantly in those with acute diagnoses. For those with either acute myocardial infarction or unstable angina, the mean expenditures were higher for the cardiologist group than for the combined generalist group (\$15,378 vs \$12,260; $P < .001$); however, the mean expenditures for those with only chronic conditions were similar (\$4856 vs \$4745; $P = .53$).

Conclusion: Expenditures were higher when cardiologists were the principal care physicians treating patients with acute disease but not chronic disease.

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Managed care organizations often use generalists as gatekeepers in an attempt to control costs by limiting access to specialists. Although this system often conflicts with a patient's desire to choose his or her own physicians¹⁻³ and with increasing evidence of better outcomes with specialist care in certain patient groups,^{4,6} there is a perception that specialists provide care that is more resource intensive and thus more expensive than care provided by generalists. However, evidence about the actual cost of care is mixed.⁷⁻⁹

To determine whether specialty care for elderly patients with coronary artery disease (CAD) is more resource intensive for fee-for-service patients, we examined Medicare expenditures. We divided the patients into a cardiologist group and a generalist group (incorporating general practitioners, family physicians, and internists) based on the specialty with the most outpatient claims for an individual patient. To examine the potential influence of patient mix, we evaluated expenditures stratified in 2 ways: by comorbidity from illness other than coro-

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nary artery disease and by severity of coronary artery disease.

...METHODS ...

Patient Selection

Data for this study came from the Standard Analytical Files obtained from the Health Care Financing Administration, which contain a 5% nationwide random sample of Medicare patients and all of their Medicare paid claims. Demographic information on each Medicare patient was obtained from a matching enrollment file, and individual diagnoses and expenditures for all Medicare-covered services were obtained from the claims file. Medicare Part A files (including hospital inpatient and outpatient claims) and Part B files (including professional and supplier inpatient and outpatient claims) were combined. Hospice claims were excluded. All data were analyzed at the level of the individual Medicare patient.

We excluded patients who were less than 65 years old, did not have both Part A and Part B coverage, or lived outside the United States. Those who were enrolled in a managed care plan during the year also

were excluded because utilization data for these patients were incomplete.

The *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes 410-414 were used to define coronary artery disease. To limit misclassification of coronary artery disease known to exist in claims databases,¹⁰ each patient was required to have at least 2 codes indicating coronary artery disease, with at least 1 claim coming from Medicare Part B. The 2 codes could come from 2 sources (eg, Part A and Part B) indicating the same event. We excluded patients without 2 separate claims involving coronary artery disease (n = 56,820), without any Medicare Part B claims involving coronary artery disease (n = 4278), and with claims of zero dollars for coronary artery disease (n = 3042). Thus, the final sample consisted of 250,514 patients.

Principal Care Physician Group Definition

A principal care physician was identified for each patient based on the highest number of total outpatient claims (Part B) for that patient that year. These included both coronary artery disease and noncoronary artery disease claims. We classified each patient into 1 of 6 groups: (1) general practitioner, (2) family physician, (3) internist, (4) cardiologist, (5) all other specialties, and (6) no dominant specialty. For example, if a patient's record included 5 claims from an internist and 3 claims from a cardiologist, we classified the patient into the internist group. The first 3 groups were combined to form a generalist group.

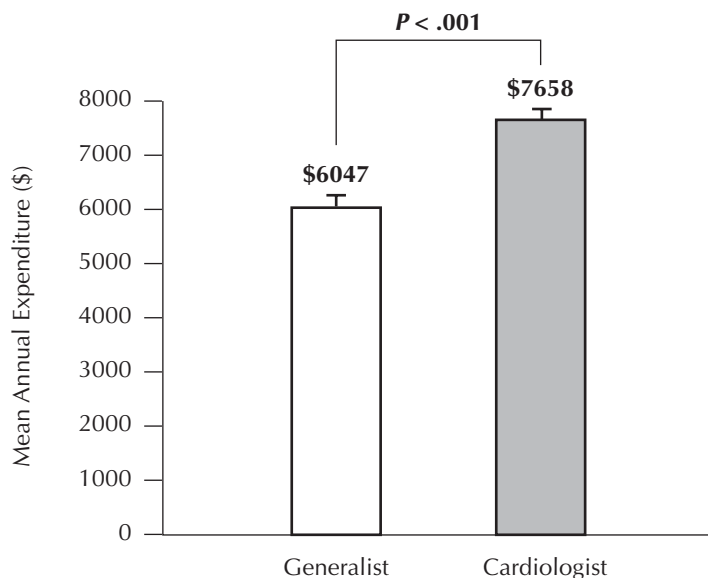
Comorbidity Definition

All diagnostic codes in the record were used to determine comorbidity. Comorbidity was measured by the Charlson Index¹¹ as adapted for use with administrative databases by Deyo et al.¹² For this scale, a value from 1 to 6 is assigned for each of 17 comorbid conditions. For example, diabetes is assigned a weight of 1, and metastatic solid tumor is assigned a weight of 6. The Charlson Index is the sum of these values for the comorbidities for each patient. If no comorbidities exist for a given patient, the Charlson Index is zero.

Severity Definition

All diagnostic codes in the record also were used to determine severity. Patients

Figure 1. Mean Expenditures by Principal Care Physician Specialty



Shown are the mean Part A and Part B 1992 Medicare expenditures for the patients with coronary artery disease according to the specialty of their principal care physician.

were divided into an acute coronary artery disease group and a chronic coronary artery disease group based on the 3-digit codes (410-414) comprising coronary artery disease. The acute group, considered more severely ill, consisted of those patients with an acute myocardial infarction (410) or unstable angina (411). The remaining patients, with coronary artery disease but no acute myocardial infarction or unstable angina, were classified as the chronic group.

Analysis

The analytic strategy was to compare mean total 1992 expenditures between subgroups of our sample based on the specialty of the principal care physician group. Dollar amounts are expressed as 1992 dollars. Our primary focus is relative expenditures for cardiologists and generalists. A chi-square analysis was performed for statistical significance regarding differences in proportions. The Student *t* test was performed for statistical significance regarding differences between means. Standard deviations in the generalist group were calculated based on the standard deviations in the general practitioner, the family physician, and the internist groups.

... RESULTS ...

The principal care physician group was classified as follows: 62% generalists, 13% cardiologists, 18% another specialty, and 7% no dominant specialty (tie between 2 or more specialties). Annual total Medicare expenditures per capita were significantly higher for the cardiologist group compared with the generalist group (\$7658 vs \$6047; *P* < .001) (Figure 1).

Comorbidity

To assess the effect of comorbidity differences between principal care physician groups, we divided the patients within each specialty group according to their Deyo-modified Charlson Index. Patients under the principal care of cardiologists had less comorbidity compared with those under the principal care of generalists (Table). For example, 38% of those in the cardiologist group had a Charlson Index of zero, indicating none of the predefined comorbidities, compared with 28% in the generalist group. Expenditures were significantly higher for the cardiologist group compared with the generalist group at all levels of comorbidity (Figure 2).

Severity

The cardiologist group had a higher proportion of patients with acute myocardial infarction or unstable angina compared with the generalist group (27% vs 22%; *P* < .001) (Table). In those with these acute diagnoses, the cardiologist group had higher expenditures compared with the generalist group (\$15,378 vs \$12,260, *P* < .001) (Figure 3). However, the mean expenditures for those with chronic conditions were similar for the cardiologist and generalist groups (\$4856 vs \$4745; *P* = .53). Thus, the increase in mean expenditures by specialization was seen only in those with acute myocardial infarction or unstable angina.

... DISCUSSION ...

In the Medicare population with coronary artery disease, we confirmed the widespread belief that mean expenditures are higher when the principal care physician is a cardiologist as opposed to a generalist. Because patient mix has been shown to

Table. Comorbidity and Severity by Specialty*

Specialty	No.	Charlson Index of Comorbidity (%)				Diagnosis Severity (%)	
		0	1	2	3+	Chronic Only (ICD-9-CM: 414, 413, or 412)	Acute (ICD-9-CM: 411 or 410)
Generalist	156,120	28	27	19	26	78	22

ICD-9-CM = *International Classification of Diseases, Ninth Revision, Clinical Modification.*

**P* < .001 for comparisons between cardiologist and generalist for both comorbidity and severity.

influence costs,^{13,14} we stratified expenditures by measures of comorbidity (due to illnesses other than coronary artery disease) and severity (due to coronary artery disease). Comorbidity did not affect the relationship between specialization and expenditures; expenditures were higher for the cardiologist group regardless of comorbidity score. Similarly, expenditures were higher for the cardiologist group when patients had more severe disease: acute myocardial infarction or unstable angina. However, patients with less severe, or chronic, coronary artery disease had similar expenditures regardless of the principal care physician specialty.

Substantial evidence exists to support specialist care for patients with acute coronary artery disease. Cardiologists have been shown to have a more accurate perception of cardiovascular risk in high-risk patients than generalists have.¹⁵ They also have more up-to-date knowledge of well-established drug therapy for myocardial infarction.^{16,17} In addition, patients with myocardial infarction under the care of a cardiologist were shown to have better 1-year outcomes,⁵ and patients with unstable angina also fared better under the care of a cardiologist.⁶ Improved outcomes for specialty care also has been shown for other illnesses such as stroke,¹⁸ muscu-

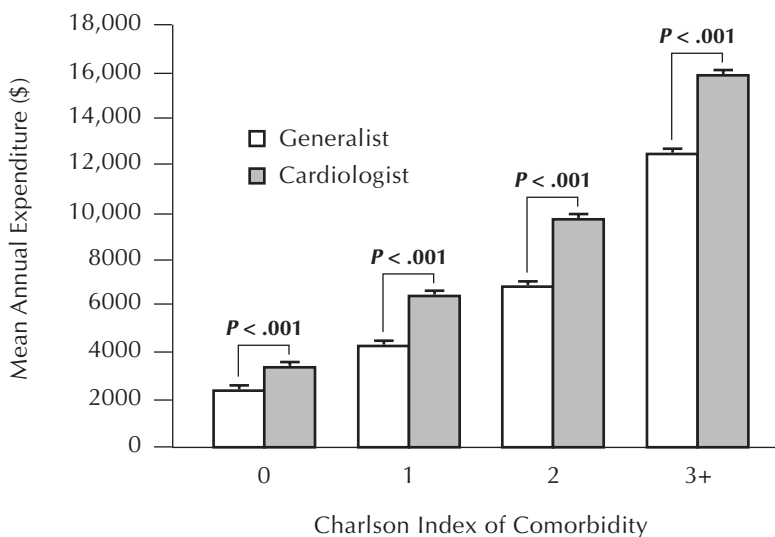
loskeletal and rheumatic conditions,¹⁹ and asthma.²⁰ In contrast, the Medical Outcomes Study did not find measurable differences in outcomes by specialty for patients with hypertension or diabetes.²¹

In our study, expenditures were higher among patients most likely to benefit from a cardiologist's care: those with acute myocardial infarction or unstable angina. However, the specialization of the physician group made less difference with respect to expenditures for patients with chronic coronary artery disease than it did for patients with acute coronary artery disease (Figure 3). Allowing patients with coronary artery disease, whether acute or chronic, to choose a cardiologist as their principal care provider may cost managed care organizations little, if anything, and may increase patient satisfaction.^{1,2}

Comorbidity, which included chronic illnesses other than coronary artery disease, was lower in those patients with cardiologists as their principal care physicians rather than generalists (Table). Interestingly, the Medical Outcomes Study found patients under the care of cardiologists had higher comorbidity (including coronary artery disease) than those under the care of family physicians or internists.²² However, our study included only patients with coronary artery disease and excluded acute myocardial infarction from the comorbidity score. Our findings suggest that patients with other medical conditions may have chosen to have a generalist as their principal care physician. One hypothesis is that having a generalist or internist act as the principal care physician may work best for patients with significant comorbidity, with a cardiologist acting as a consultant. Patients with coronary artery disease but without other major medical conditions may benefit from having a cardiologist as their principal care physician. Unfortunately, Medicare files are not conducive to testing this hypothesis.

Because Medicare files have limited clinical information and confidentiality of Medicare files precluded linkage with outcome data, we can only speculate on the specific reasons for the differences and similarities in expenditures for patients with different principal care physicians. Beneficiaries

Figure 2. Mean Expenditures by Principal Care Physician Specialty and by Comorbidity



Shown are the mean Part A and Part B 1992 Medicare expenditures for the patients with coronary artery disease according to the specialty of their principal care physician and the 4 levels of comorbidity as defined by a modified Charlson Index.

with acute coronary syndromes such as acute myocardial infarction and unstable angina likely are treated more aggressively by cardiologists than by generalists. Thus, more expenditures due to expensive procedures such as coronary angiography, coronary angioplasty, and coronary bypass surgery are accumulated. However, for those with more chronic coronary artery disease, the treatment patterns may not differ as much, leading to similar expenditures.

Study Limitations

Using Medicare claims to compare expenditures also has other limitations. First, a patient's actual choice of principal care physician may not be the same as our utilization-derived definition of principal care physician. For example, physician referral patterns may be influencing physician specialty. However, referral in cases of acute disease would likely bias toward increased expenditures for increased specialization.²³ Second, Medicare data files were not designed for clinical analysis. Many of the data are not as complete as in a clinical database.⁵ Our definitions of comorbidity and acuity are crude, miscoding within Medicare files has been well documented,^{9,24,25} and diagnostic codes could be manipulated by some providers.²⁶ A bias could be introduced if the physician groups differed in the frequency of coding. Third, our analysis only included participants with fee-for-service coverage. Since our analysis used data from 1992 (when the number of managed care participants in Medicare was low), the generalizability of our results to the entire Medicare population is high. However, the applicability of these data to managed care plans is not known. Fourth, given changing practice patterns, data from 1992 may not reflect current expenditure patterns. Fifth, even though Medicare files are a good source of expenditure data, they do not include some items such as pharmaceutical costs and certain elective procedures. Sixth, our analysis included 1 year only. Expenditures in 1 year may not accurately reflect costs in subsequent years.²⁷ Finally, analysis of data on the elderly may not be applicable to other age groups. However, the majority of patients with coronary artery disease are older than 65 years of age.

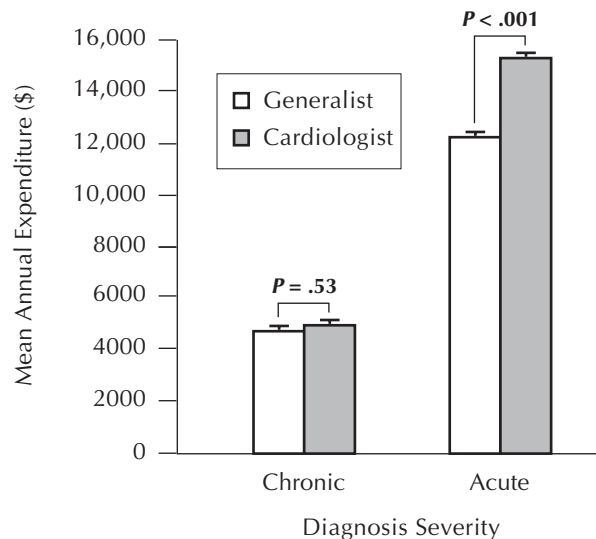
Future research using linked administrative and clinical databases would expand this first level of analysis substantially. It would address the major question of whether the increased expenditures for patients with the acute coronary syndromes improve outcome. More accurate case-mix adjustments, increasing the validity of comparing beneficiaries who see different types of physicians, could

be performed. More homogeneous subsets of beneficiaries could be studied. Different practice patterns and procedures for both cost and effectiveness could be evaluated.

... CONCLUSION ...

For acute coronary artery disease, patients of cardiologists had higher expenditures compared with those of generalists. However, for chronic coronary artery disease, mean expenditures for patients of cardiologists and those of generalists were not significantly different. Patients and payers need to consider comorbidity and severity when evaluating the potential trade-offs between additional costs and additional benefits that may derive from specialty care. Managed care organizations should consider these findings in designing systems of care that utilize generalists and specialists appropriately.

Figure 3. Mean Expenditures by Principal Care Physician Specialty and by Severity of Illness



Shown are the mean Part A and Part B 1992 Medicare expenditures for the patients with coronary artery disease according to the specialty of their principal care physician and the 2 levels of severity. Acute disease included acute myocardial infarction or unstable angina (ICD-9-CM codes 410 and 411, respectively) during 1992. Chronic disease included old myocardial infarction, stable angina, and unspecified atherosclerosis only (ICD-9-CM codes 412, 413, and 414, respectively). ICD-9-CM = *International Classification of Diseases, Ninth Revision, Clinical Modification*.

... REFERENCES ...

1. **Wyn R, Collins KS, Brown ER.** Women and managed care: Satisfaction with provider choice; access to care, plan costs and coverage. *J Am Med Womens Assoc* 1997;52:60-64.
2. **Kerr EA, Hays RD, Mitchinson A, Lee M, Siu AL.** The influence of gatekeeping and utilization review on patient satisfaction. *J Gen Intern Med* 1999;14:287-296.
3. **Lewis CL, Wickstrom GC, Kolar MM, et al.** Patient preferences for care by general internists and specialists in the ambulatory setting. *J Gen Intern Med* 2000;15:75-83.
4. **Mark DB, Naylor CD, Hlatky MA, et al.** Use of resources and quality of life after myocardial infarction in Canada and the United States. *N Engl J Med* 1994;331:1130-1135.
5. **Jollis JG, DeLong ER, Peterson ED, et al.** Outcome of acute myocardial infarction according to the specialty of the admitting physician. *N Engl J Med* 1996;335:1880-1887.
6. **Schreiber TL, Elkhatib A, Grines CL, O'Neill WW.** Cardiologist versus internist management of patients with unstable angina: Treatment patterns and outcomes. *J Am Coll Cardiol* 1995;26:577-582.
7. **Glassman PA, Kravitz RL, Peteren LP, Rolph JE.** Differences in clinical decision making between internists and cardiologists. *Arch Intern Med* 1997;157:506-512.
8. **Greenfield S, Nelson EC, Zubcuff M, et al.** Variations in resource utilization among medical specialties and systems of care: Results from the Medical Outcomes Study. *JAMA* 1992;267:1624-1630.
9. **Harjai KJ, Boulos L, Smart FW, et al.** Effects of caregiver specialty on cost and clinical outcomes following hospitalization for heart failure. *Am J Cardiol* 1998;82:82-85.
10. **Van Walraven C, Wang B, Ugnat A, Naylor CD.** False-positive coding for acute myocardial infarction on hospital discharge records: Chart audit results from a tertiary centre. *Can J Cardiol* 1990;6:383-386.
11. **Charlson ME, Pompei P, Ales KL, MacKenzie CR.** A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *J Chronic Dis* 1993;40:373-383.
12. **Deyo RA, Cherkin DC, Ciol MA.** Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol* 1992;45:613-619.
13. **Schwartz M, Iezzoni LI, Moskowitz MA, Ash AS, Sawitz E.** The importance of comorbidities in explaining differences in costs. *Med Care* 1996;34:767-782.
14. **Rice DP, LaPlante MP.** Medical expenditures for disability and disabling comorbidity. *Am J Public Health* 1992;82:739-741.
15. **Friedman PD, Brett AS, Mayo-Smith MF.** Differences in generalists' and cardiologists' perceptions of cardiovascular and the outcomes of preventive therapy in cardiovascular disease. *Ann Intern Med* 1996;124:414-421.
16. **Ayanian JZ, Hauptman PJ, Guadagnoli E, Antman EM, Pashos CL, McNeil BJ.** Knowledge and practices of generalist and specialist physicians regarding drug therapy for acute myocardial infarction. *N Engl J Med* 1994;331:1136-1142.
17. **Stafford RS.** Aspirin use is low among United States outpatients with coronary artery disease. *Circulation* 2000;101:1097-1101.
18. **Kaste M, Palomaki H, Sarna S.** Where and how should elderly stroke patients be treated: A randomized trial. *Stroke* 1995;26:249-253.
19. **Solomon DH, Bates DW, Panush RS, Katz JN.** Costs, outcomes, and patient satisfaction by provider type for patients with rheumatic and musculoskeletal conditions: A critical review of the literature and proposed methodologic standards. *Ann Intern Med* 1997;127:52-60.
20. **Freund DA, Stein J, Hurley R, Engel W, Woomert A, Lee B.** Specialty differences in the treatment of asthma. *J Allergy Clin Immunol* 1989;84:401-406.
21. **Greenfield S, Rogers W, Mangotich M, Carney MF, Tarlov AR.** Outcomes of patients with hypertension and non-insulin-dependent diabetes mellitus treated by different systems and specialties: Results from the Medical Outcomes Study. *JAMA* 1995;274:1436-1444.
22. **Kravitz RL, Greenfield S, Rogers W, et al.** Differences in the mix of patients among medical specialties and systems of care: Results from the Medical Outcomes Study. *JAMA* 1992;267:1617-1623.
23. **Jollis JG, Ancukiewicz M, DeLong ER, Pryor DB, Muhlbaier LH, Mark DB.** Discordance of databases designed for claims payment versus clinical information systems: Implications for outcomes research. *Ann Intern Med* 1993;119:844-850.
24. **Whittle J, Steinberg EP, Anderson GF, Herbert R.** Accuracy of Medicare claims data for estimation of cancer incidence and resection rates among elderly Americans. *Med Care* 1991;29:1226-1236.
25. **Iezzoni LI, Burnside S, Sickles L, Moskowitz MA, Sawitz E, Levine PA.** Coding of acute myocardial infarction: Clinical and policy implications. *Ann Intern Med* 1988;109:745-751.
26. **Assaf AR, LaPane KL, McKenney JL, Carleton RA.** Possible influence of the prospective payment system on the assignment of discharge diagnoses for coronary heart disease. *N Engl J Med* 1993;329:931-935.
27. **Welch WP.** Regression toward the mean in medical care costs. Implications for biased selection in health maintenance organizations. *Med Care* 1985;23:1234-1241.