

Left Ventricular Ejection Fraction Test Rates for Medicare Beneficiaries With Heart Failure

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Abstract:

The left ventricular ejection fraction (LVEF) test rate is increasingly used as a quality of care indicator for patients with heart failure. Our study produced benchmark LVEF test rates in a Medicare fee-for-service population for consideration by a clinical panel assembled by the Health Care Financing Administration. Our sample consisted of 46,583 beneficiaries admitted to the hospital for heart failure and with a complete set of Medicare fee-for-service bills dated 1996 or 1997. The national 2-year LVEF test rate was 79% for Medicare fee-for-service beneficiaries hospitalized for heart failure. Except for 1 state, the test rate ranged from 61% to 89% across states. Our analysis demonstrates the feasibility of using billing data to compute LVEF test rates. Using a 2-year time window and measuring tests performed in outpatient as well as inpatient settings, we find a higher LVEF test rate than has been reported by most previous studies.

Key words: Heart failure, Left ventricular ejection fraction, Medicare + Choice, Medicare fee-for-service, Quality of care.

Article:

According to the American Heart Association, approximately 3 million Americans are currently diagnosed with heart failure. Among these patients, more than 80% are over the age of 65, and most are Medicare enrollees (1). Heart failure is the leading cause of hospital admission among Medicare beneficiaries, with approximately 700,000 hospitalizations each year. In the past decade, explicit criteria to evaluate the quality of care for patients with heart failure have been developed. The Agency for Health Care Policy and Research released a clinical practice guideline for heart failure in 1994 based on a comprehensive review of the scientific literature (2). The guideline stated that the heart failure category (systolic vs diastolic) should be defined and angiotensin-converting enzyme inhibitors should be prescribed for patients with systolic dysfunction, unless specific contraindications are present.

An increasing number of studies have used or recommended the left ventricular ejection fraction (LVEF) test rate as a quality of care indicator for patients with heart failure (3-8). The guideline issued by the American Society of Health-System Pharmacists in 1997 states that "Measurement of left-ventricular performance is a critical step in the evaluation and management of almost all patients with suspected or clinically evident heart failure" (9). The Health Care Financing Administration (HCFA) is using the LVEF test rate as one measure of quality of care of Medicare beneficiaries with heart failure, based on recommendations of the American College of Cardiology, American Heart Association, and Agency for Health Care Policy and Research (10). Recently, HCFA established a policy of extra payments to Medicare managed care organizations that demonstrate that they have exceeded threshold levels for LVEF test rates and angiotensin-converting enzyme inhibitor prescription rates among their enrollees hospitalized for heart failure (11).

Through an extensive literature search, we identified 6 studies that reported LVEF test rates (4-8, 10). Four of the 6 studies' subjects were Medicare fee-for-service beneficiaries. One study (5) targeted Medicare beneficiaries, but it is unclear whether it included only fee-for-service patients, only managed care patients, or both. Another study (7) did not specifically target Medicare beneficiaries. Three of the 6 studies (4-6) were conducted in single states, 2 studies (7, 8) were conducted in multiple states, and 1 study (10) was based on national sample data and reported estimates for all states. Two studies (5, 8) randomly selected participant

hospitals; 3 other studies (4, 6, 7) selected participating hospitals on a volunteer basis. The number of patients with heart failure included in the studies ranged from 522 (7) to 17,764 (10). The 6 studies reported LVEF test rates for hospitalized patients with heart failure ranging from 53% to 83%.

We conducted an analysis using administrative billing data of LVEF test rates for Medicare fee-for-service enrollees hospitalized for heart failure. The purpose of our study was to produce benchmark LVEF test rates in a Medicare fee-for-service population for consideration by a clinical panel assembled by HCFA (12). The clinical panel suggested threshold rates for LVEF testing and angiotensin-converting enzyme inhibitor prescription that Medicare managed care organizations must meet or exceed to receive extra payment for high-quality care of patients with heart failure. Our study represents an advance over previous studies in 3 key respects. First, we measured LVEF tests over a 2-year period, whereas all previous studies measured LVEF tests during single inpatient episodes only. Second, we included LVEF tests in outpatient settings in measuring test rates. Third, we employed a nationally representative random sample of Medicare beneficiaries that is much larger and therefore more statistically accurate than any previous study sample.

METHODS

Sample Selection

To investigate national patterns of LVEF testing for patients with heart failure, we used a 5% random sample of Medicare beneficiaries for 1996 and 1997. We identified patients with at least 1 principal discharge diagnosis of heart failure in 1996 or 1997, defined by International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes 402.01, 402.11, 402.91, 404.01, 404.11, 404.91, or 428.x. A total of 56,150 patients with heart failure were identified. This sample was restricted to Medicare enrollees expected to have a complete set of fee-for-service bills describing their medical treatment in 1996 and 1997. The following were excluded: 1505 beneficiaries because they were not enrolled in both Medicare Part A and Part B for all months of 1996 and 1997 or until their death; 1483 beneficiaries who were hospice residents in either 1996 or 1997; 4012 beneficiaries who were capitated managed care enrollees in either 1996 or 1997; 31 beneficiaries who were non-US residents at some time in 1996 or 1997; and 358 beneficiaries who had employment-based primary insurance in either 1996 or 1997. Also excluded were 2178 beneficiaries who were Medicare eligible because of end-stage renal disease in either 1996 or 1997. Sensitivity analysis was conducted by including and excluding beneficiaries first becoming eligible for Medicare after January 1, 1996, and beneficiaries who died before December 31, 1997. LVEF test rates were insensitive to including or excluding new Medicare enrollees and/or decedents. Our final analysis sample included new enrollees and decedents and consisted of 46,583 beneficiaries admitted to the hospital for heart failure in 1996 or 1997 with a complete set of Medicare fee-for-service bills.

Identifying LVEF Tests

A list of *Current Procedural Terminology, Fourth Edition* (CPT-4) procedure codes indicating an LVEF test was provided to us by HCFA. We cross-walked these codes, using commercially available software, to ICD-9-CM procedure codes. ICD-9-CM procedure codes are used for hospital inpatient procedure coding, whereas CPT-4 codes are used in billing for physician services in either the inpatient or outpatient settings. Hospital outpatient departments predominantly use CPT-4 codes but may use ICD-9-CM codes. A beneficiary was considered to have had an LVEF test if 1 or more of these codes was present on an administrative claim submitted to HCFA for payment dated 1996 or 1997. Physician bills are expected to be sensitive and specific indicators of the performance of an LVEF test in any setting because physicians must submit a bill to be paid, and submitting a bill for an unperformed test constitutes fraud. Hospital bills, on the other hand, underidentify LVEF tests because reporting LVEF tests does not affect payment (which is based on Diagnosis Related Group assignment).

We measured LVEF tests during the same 2-year period, 1996-1997, from which our sample of patients with heart failure was drawn. We did not use a beneficiary-specific 2-year window around an index admission, but rather the fixed 2-year period 1996-1997. This approach was used to be consistent with HCFA's payment policy for identifying LVEF tests, which al-

Table 1

Left Ventricular Ejection Fraction Test Rate by Type of Bill and Procedure Code^{a-e}

Type of Bill	Procedure Code Type		
	Total	CPT-4	ICD-9-CM
Total	79	78	25
Physician	78	78	0
Hospital outpatient department	12	11	3
Hospital inpatient	23	0	23

^a Source: Health Economics Research, Inc, analysis of 1996 and 1997 5% sample of Medicare fee-for-service claims data. Rates are expressed as percentages. CPT-4 indicates *Current Procedural Terminology, Fourth Edition*; ICD-9-CM, *International Classification of Diseases, Ninth Revision, Clinical Modification*.

^b Two-year (1996–1997) test rate among fee-for-service Medicare beneficiaries with a principal discharge diagnosis of heart failure in 1996 or 1997.

^c Beneficiaries enrolled in traditional Medicare fee-for-service only (excludes capitated managed care enrollees).

^d Includes only beneficiaries with a complete set of fee-for-service bills (see "Sample Selection").

^e Excludes beneficiaries enrolled in Medicare because of end-stage renal disease.

Table 2

Left Ventricular Ejection Fraction Test Rate by Place of Service, Physician Bills^{a-f}

Place of Service	Rate, %
Total	78
Inpatient	68
Hospital outpatient or emergency department	15
Other setting	17

^a Source: Health Economics Research, Inc, analysis of 1996 and 1997 5% sample of Medicare fee-for-service claims data.

^b Two-year (1996–1997) test rate among fee-for-service Medicare beneficiaries with a principal discharge diagnosis of heart failure in 1996 or 1997.

^c Beneficiaries enrolled in traditional Medicare fee-for-service only (excludes capitated managed care enrollees).

^d Includes only beneficiaries with a complete set of fee-for-service bills (see "Sample Selection").

^e Excludes beneficiaries enrolled in Medicare because of end-stage renal disease.

^f Includes tests identified on physician bills only.

lows tests to be documented for a period of years rather than only during a single hospitalization or for a beneficiary-specific time window.

Eighteen CPT-4 codes were used to identify LVEF tests. A complete list of these procedure codes and their frequencies in our data is available in our report to HCFA (12). By far the largest number of beneficiaries with LVEF tests (34,895) were identified by the CPT-4 procedure code 93307 ("Echo, transthoracic, real-time with image documentation [2D] with or without M-mode recording; complete"). The 18 CPT-4 codes cross-walked to only 4 ICD-9-CM procedure codes: Among the 4 matched ICD-9-CM codes, codes 88.72, "diagnostic ultrasound of heart," and 88.53, "angiocardiography of left heart structures," identified the largest numbers of beneficiaries with LVEF tests, 6509 and 6156, respectively.

RESULTS

LVEF Test Rates by Type of Bill, Procedure Code, and Place of Service

LVEF test rates by type of bill (physician, hospital outpatient, or hospital inpatient) and procedure code (CPT-4 or ICD-9-CM) among our sample of 46,583 beneficiaries hospitalized for heart failure are shown in Table 1. The values shown are 2-year rates of at least 1 LVEF test in 1996 or 1997 for beneficiaries hospitalized for heart failure at least once during those 2 years. Among these patients, 36,717 patients had documentation of an

LVEF test, which was indicated by either CPT-4 or ICD-9-CM procedure codes; 9866 patients had no documentation of an LVEF test during the 2-year period. The LVEF test rate for the national sample was 79%.

The test rate calculated from physician bills alone was 78%. Physician bills may be from any place of service, inpatient or outpatient, and are coded with CPT- 4 procedure codes only. The physician bill rate was very close to the total rate calculated from both physician and hospital bills, only 1% lower. Since physician bills identify almost all LVEF tests, we used physician bills to measure the test rate by place of service, as shown in Table 2. Most patients with congestive heart failure received their LVEF tests in the inpatient setting-68% of such patients received a test in the inpatient setting over the 2-year period. Only 15% received a test in the hospital outpatient or emergency department setting, and only 17% received a test in all other settings. (The rates by setting are not mutually exclusive: 1 person may have had LVEF tests in more than 1 setting.)

Returning to Table 1, according to the hospital outpatient department bills, 5459 patients had an LVEF test indicated by either CPT-4 or ICD-9-CM procedure codes. The documented test rate was 12%. This rate was comparable to, but slightly lower than, the outpatient and emergency department rate of 15% computed from physician bills alone (Table 2). Hospital outpatient bills document most, but not all, tests occurring in the outpatient department.

The ICD-9-CM procedure codes are the sole source for indicating LVEF tests from hospital inpatient bills. A total of 10,914 patients had documentation of LVEF

Table 3

Left Ventricular Ejection Fraction Test Rates by State
for Medicare Beneficiaries^{a-e}

State	No. of Beneficiaries Hospitalized for Heart Failure in 1996/1997	LVEF Test Rate, ^e %	95% Confidence Interval for Rate, %	
			Lower	Upper
United States	46,583	79	79	79
New Jersey	1682	89	87	90
New Hampshire	189	88	83	93
District of Columbia	129	86	80	92
Michigan	2074	84	83	86
Maryland	843	84	82	87
New York	3101	84	83	85
Florida	2831	83	82	85
Pennsylvania	3013	83	82	85
Nevada	149	83	76	89
Rhode Island	249	82	77	87
Ohio	2532	82	80	83
Virginia	1140	81	78	83
Delaware	137	80	73	87
Arizona	351	80	76	84
Missouri	1207	80	78	82
California	2485	80	78	81
South Carolina	777	80	77	82
Louisiana	949	79	76	82
Vermont	91	79	70	88
Indiana	1289	79	77	81
Massachusetts	1161	79	76	81
North Carolina	1402	79	76	81
Connecticut	598	78	75	82
Alabama	1075	78	76	81
Illinois	2208	78	76	80
Tennessee	1300	77	75	80
West Virginia	541	77	73	80
Hawaii	81	77	67	86
Georgia	1281	76	74	79
Kentucky	891	76	73	78
Wisconsin	1019	75	73	78
Mississippi	819	74	71	77
Texas	2842	73	71	75
Oklahoma	687	72	69	75
Arkansas	683	72	69	75
Kansas	553	72	68	76
Iowa	644	72	68	75
Maine	253	71	65	77
Puerto Rico	392	71	66	75
Nebraska	302	71	65	76
Minnesota	597	70	66	74
Colorado	273	69	64	75
Alaska	41	68	53	84
Washington	547	68	64	72
Utah	123	67	59	76
Idaho	132	66	57	74
New Mexico	162	65	58	73
Montana	158	65	57	72
South Dakota	121	64	56	73
Oregon	269	64	58	70
North Dakota	149	61	53	69
Wyoming	51	47	32	62

^a Source: Health Economics Research, Inc. analysis of 1996 and 1997 5% sample of Medicare fee-for-service claims data. States are ranked in descending order of test rate. LVEF indicates left ventricular ejection fraction.

^b Beneficiaries enrolled in traditional Medicare fee-for-service only (excludes capitated managed care enrollees).

tests on inpatient bills, implying a test rate of 23% (Table 1). This percentage is much lower than the inpatient rate of 68% documented from physician bills (Table 2). Coding of LVEF tests in hospital bills is incomplete,

presumably because not coding LVEF tests does not affect payment (which is based on Diagnosis Related Group assignment), so there is no financial incentive or necessity to code these tests.

In summary, we found an overall 1996-1997 LVEF test rate of 79% for Medicare fee-for-service beneficiaries hospitalized for heart failure in 1996 or 1997. Almost all beneficiaries with LVEF tests can be identified using physician bills alone (test rate, 78%). Using hospital bills alone will grossly underestimate the rate of LVEF testing.

LVEF Test Rates by State

We calculated LVEF test rates by state to examine geographic variation in the rate. The state rates in Table 3 were computed using the same methodology used for our "total" rates in Table 1, that is, using both CPT- 4 and ICD-9-CM procedure codes for all places of service. To determine whether differences in rates by state were meaningful, 95% confidence intervals around the mean were constructed. Rates for the 50 states plus the District of Columbia and Puerto Rico are listed in Table 3. Recall that our sample excluded Medicare beneficiaries enrolled in capitated managed care. Hence, states with a high Medicare managed care penetration (for example, California and Arizona) have fewer heart failure admissions in our sample relative to their total Medicare-eligible population.

Except for Wyoming, which had a much lower rate than the rest of the states (47%, based on only 51 patients with heart failure), the test rate ranged from 61% to 89% across states. New Jersey and New Hampshire had the highest rates, 89% and 88%, respectively. The states with the highest test rates were primarily located in the eastern part of the country. New York State had the largest number of fee-for-service beneficiaries with heart failure (3101) and also a high LVEF rate of 84%. The lowest rates other than those for Wyoming were for North Dakota (61%) and Oregon (64%). Many of the states with lower test rates are

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^c Includes only beneficiaries with a complete set of fee-for-service bills (see "Sample Selection").

^d Excludes beneficiaries enrolled in Medicare because of end-stage renal disease.

^e Percentage of beneficiaries hospitalized for heart failure who received an LVEF test in 1996 or 1997.

more rural in character than average, potentially indicating lesser access to care or practice style differences in rural areas.

COMMENT

The existing literature on LVEF testing has focused on the inpatient setting (3-8, 10). These studies abstracted data from patients' medical records for a single index hospitalization used to identify the sample of patients with heart failure. In contrast, our study used both inpatient and outpatient billing data to identify the LVEF test rate. Our study was also unique in using a 2-year time window (1996-1997) for capturing LVEF tests in either the inpatient or outpatient setting. In addition, in contrast to previous studies, our study used a large nationally representative random sample to analyze LVEF test rates.

Because of the identification of outpatient tests and the longer time window, it is not surprising that our national LVEF test rate (79%) is higher than that found by most previous studies (range, 53% to 83%) (48, 10). A good comparison is to the study of Jencks et al (10), which examined inpatient charts for a sample of 17,764 Medicare fee-for-service heart failure admissions for the years 1998-1999 nationwide and found an LVEF test rate of 64%. Our data, therefore, indicate that the LVEF test rate is 15 percentage points higher when outpatient tests are included and a 2-year time period is used.

A national test rate of 79% is still below an ideal standard of care. The HCFA Clinical Panel on Quality Indicator Thresholds for Congestive Heart Failure (12) suggested that in an ideal world, a 90% LVEF test rate would represent an achievable high-quality standard of care. Approximately 10% of patients with heart failure would not be referred for an LVEF test because of terminal illness, hospice residence, dementia, or other considerations. Some states approach the 90% target rate, whereas others are far below (Table 3).

In the real world, especially in managed care plans, the measured LVEF test rate is not likely to achieve the ideal standard. Three factors will limit the rate suggested by the HCFA Clinical Panel (12). First, medical practice is not perfect—physicians will not always order an LVEF test when indicated. Second, physicians' documentation of LVEF tests is incomplete. Third, existing documentation may not be readily available to an insurer or managed care plan. Some tests may be done before a patient joins a plan, or a plan may subcontract providers with no data-reporting requirements. Moreover, interpretation of vague documentation may be difficult, and a heart failure diagnosis may be mistakenly coded, in which case no LVEF test is indicated.

Taking these real world considerations and other data into account, the HCFA Clinical Panel (12) suggested a threshold rate of 70-80% for documented LVEF testing for Medicare managed care organizations to qualify for extra payment for high-quality heart failure care. After the panel discussion, HCFA (13) established an LVEF testing threshold of 75% for extra payment. Managed care organizations would also have to document prescription of angiotensin-converting enzyme inhibitors to at least 80% of their patients with heart failure who have left ventricular systolic dysfunction (determined by an LVEF test) to qualify for extra payment under HCFA's policy.

Our analysis demonstrates the feasibility of using billing data to compute LVEF test rates. Previous studies have relied on medical chart review (3-8, 10). Chart review is very costly compared with administrative data analysis. To the extent that insurers or managed care organizations have access to automated claims or encounter data systems, they may provide a more cost-effective means of documenting LVEF test rates than chart reviews. We have also documented, however, that the completeness with which LVEF tests are recorded in claims data is closely linked to the use of such data in payment. Encounter data in capitated managed care organizations, which has not been used for payment, may initially grossly underrecord test performance. But if financial incentives are tied to quality of care process indicators as measured on encounter data, the completeness of such data can be expected to improve over time.

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