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Heart Failure Care in the Outpatient Cardiology Practice Setting

Findings From IMPROVE HF

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Background—Few data exist regarding contemporary care patterns for heart failure (HF) in the outpatient setting. IMPROVE HF is a prospective cohort study designed to characterize current management of patients with chronic HF and ejection fraction $\leq 35\%$ in a national registry of 167 US outpatient cardiology practices.

Methods and Results—Baseline patient characteristics and data on care of 15 381 patients with diagnosed HF or prior myocardial infarction and left ventricular dysfunction were collected by chart abstraction. To quantify use of therapies, 7 individual metrics (use of angiotensin-converting enzyme inhibitor/angiotensin receptor blocker, β -blocker, aldosterone antagonist, anticoagulation, implantable cardioverter defibrillator, cardiac resynchronization therapy, and HF education) and composite metrics were assessed. Care metrics include only patients documented to be eligible and without contraindications or intolerance. Among practices, 69% were nonteaching. Patients were 71% male, with a median age of 70 years, and a median ejection fraction of 25%. Use of angiotensin-converting enzyme inhibitor/angiotensin receptor blocker (80%) and β -blocker (86%) was relatively high in eligible patients in the outpatient cardiology setting; other metrics, such as aldosterone antagonist (36%), device therapy (implantable cardioverter defibrillator/cardiac resynchronization therapy with defibrillator, 51%; cardiac resynchronization therapy, 39%), and education (61%), showed lower rates of use. A median 27% of patients received all HF therapies for which they were potentially eligible on the basis of chart documentation. Use of guideline-recommended therapies by practices varied widely.

Conclusions—These data are among the first to assess treatment in the outpatient setting since the release of the latest national HF guidelines and to demonstrate substantial variation among cardiology practices in the documented therapies provided to HF patients. (*Circ Heart Fail.* 2008;1:98-106.)

Key Words: heart failure ■ outpatient ■ quality of care

Heart failure (HF) is a chronic progressive disease that continues to result in substantial morbidity and mortality, despite marked advances in therapeutic options.¹⁻⁴ Numerous clinical trials provide evidence that pharmacological therapies, including angiotensin-converting enzyme inhibitors (ACEI) or angiotensin II receptor blockers (ARB), β -adrenergic receptor blockers, aldosterone antagonists, and

isosorbide dinitrate/hydralazine, as well as implantable cardioverter defibrillators (ICD) and cardiac resynchronization therapy (CRT) devices with defibrillation (CRT-D) can reduce morbidity and mortality in patients with HF and left

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ventricular systolic dysfunction.^{2,5-11} However, despite extensive clinical trial experience and strong recommendations in national guidelines, prior studies have suggested that a substantial number of eligible patients fail to receive indicated therapies.¹²⁻¹⁴

For individuals hospitalized with HF, variations among hospitals between patient treatment and published evidence-based guidelines have been described.¹⁵ However, little is known about the rates of use of guideline-recommended therapies in the outpatient setting or their variability across practices. Data regarding baseline care in the outpatient cardiology setting and, in particular, variations in care across practices may provide important insights into the clinical characteristics and patterns of treatment of these patients and where future quality improvement efforts should be focused. Using baseline data from the Registry to Improve the Use of Evidence-Based Heart Failure Therapies in the Outpatient Setting (IMPROVE HF), we characterized contemporary outpatient HF care, as well as the variation in care among 167 outpatient cardiology practices in the United States.

Methods

The methods of IMPROVE HF and the overall study objective have been described in detail elsewhere.¹⁶ Briefly, IMPROVE HF is a prospective cohort study designed to characterize the current management of patients with diagnosed HF or prior myocardial infarction and left ventricular dysfunction (LVD) in the outpatient cardiology (single specialty or multispecialty) practice setting. LVD must be demonstrated by a quantitative left ventricular ejection fraction (LVEF) $\leq 35\%$ measured by the most recent echocardiogram, nuclear multiple gated acquisition (MUGA) scan, contrast ventriculogram, or magnetic resonance imaging (MRI) scan. Community and academic cardiology or multispecialty outpatient practices from all regions of the country were invited to participate as previously described.¹⁶ Data collected include demographic and clinical characteristics, medical history, previous treatments, laboratories, diagnostic testing, treatments, contraindications, intolerance, or other documented reasons (including economic, social, and religious reasons; noncompliance; and other reasons for refusal) for not prescribing evidence-based therapies. Self-identified race or ethnicity was collected by administrative or medical staff and abstracted as documented in the medical record. A representative sample of patient medical records was screened to yield an average of 90 eligible patients from each practice for each study assessment period, using the methodology described in detail in the design article.¹⁶ The present analysis of baseline care metric data was prespecified in the study protocol.

All practices participating in this quality improvement study were approved by a local institutional review board or central institutional review board, or received institutional review board waivers. Data quality is addressed in this program through the use of highly trained, centralized chart review specialists who are subject to ongoing training and testing to maintain accuracy in data abstraction. To further ensure the accuracy of the data collected, there are 1.7 automated data quality checks per data field. In addition, data quality is monitored, and reports are generated to ensure the completeness and accuracy of the submitted data. The registry coordinating center is Outcome Sciences, Inc. (Cambridge, Mass).

Baseline Characteristics

This analysis is based on all baseline data entered into the IMPROVE HF registry between 2005 and 2007. The results of the baseline chart review, reported here, will serve as a pre-quality-improvement intervention control for patients included in the longitudinal cohort. The proportion of patients receiving therapy out of those indicated were stratified by practice and reported, along with the 95%

Table 1. IMPROVE HF Care Metrics

Use of angiotensin-converting enzyme inhibitor or angiotensin receptor blocker or both in eligible patients without documented contraindications or intolerance
Use of β -blocker in eligible patients without documented contraindications or intolerance
Use of aldosterone receptor antagonist in eligible patients without documented contraindications or intolerance*
Use of anticoagulation therapy in eligible patients with atrial fibrillation without documented contraindications
Use of an implantable cardioverter defibrillator in eligible patients without documented contraindications*
Use of cardiac resynchronization therapy in eligible patients without documented contraindications*
Documentation that HF education (including discussion of salt-restricted diet, monitoring of daily weight, warning signs of worsened heart failure, and activity recommendations) was provided to eligible patients

HF indicates heart failure.

*These metrics are not American College of Cardiology/American Heart Association performance measures for outpatients with HF.

confidence interval (CI), at baseline; these data will again be obtained and reported at 12 and 24 months. Data from 167 cardiology practices and 15 381 patients were entered into the registry for the baseline report. Demographics, clinical characteristics, laboratories, diagnostic studies, and baseline care metric data in eligible patients were collected.

Guideline-Recommended Care Metrics

Seven care metrics were prospectively selected by the IMPROVE HF Steering Committee, as previously described.¹⁶ This process predated the 2005 American College of Cardiology/American Heart Association (ACC/AHA) guidelines for the care and management of patients with chronic HF and the development of ACC/AHA Performance Measures for HF in the outpatient setting. The strength of evidence, the clinical relevance, and the magnitude of the relationship between the care process and outcome were carefully considered, and a potential set of 16 metrics were developed and then ranked to choose the 7 highest-rated metrics to form the basis of the quality improvement program. The rationale for the selection of each metric and the clinical evidence that supports each metric are discussed in greater detail elsewhere.¹⁶ The selection and creation of these care metrics were done by the IMPROVE HF Steering Committee members, independent of the sponsor, and were based on the potential of the metric to improve patient outcomes, the precision of its definition, its construct and content validity, and its feasibility.^{17,18} It is important to note that although 4 of the metrics selected for IMPROVE HF are ACC/AHA outpatient HF performance measures, 3 (use of aldosterone antagonist, ICD, and CRT) are not. Patients eligible for inclusion in an individual care metric calculation are defined as those who meet the criteria for a given therapy that has been proven to be beneficial in clinical trials and is recommended in the ACC/AHA guidelines and for whom there are no contraindications, intolerance, or documented rationale as to why the indicated therapy should not be provided.¹⁶

In this analysis, the 7 individual IMPROVE HF metrics (Table 1) were assessed at baseline before any practice-based quality improvement intervention. Documentation of the New York Heart Association (NYHA) functional class is a prerequisite for ICD, CRT, and aldosterone antagonist care metric eligibility, and these care metrics only include patients with quantitative or qualitative documentation of NYHA functional class at a level consistent with the metric specification.¹⁶ Two aggregate metrics at baseline were also assessed: the total composite score (defined as the percentage of all indicated metric interventions that were provided) and the all-or-none care metric (defined as the proportion of patients who received

each of the metric interventions for which they were documented to be eligible).

Statistical Methods

All statistical analyses were performed by an independent biostatistician contracted by the contract research organization, Outcome Sciences, Inc. Descriptive statistics of baseline patient characteristics and baseline practice characteristics were calculated and reported. Each care metric was evaluated separately. For each care metric, the proportion of patients receiving therapy out of those indicated was calculated across all practices. The composite score and all-or-none care metric were calculated for each practice. To determine the total composite score, the numerators of all individual care metrics were summed to produce a composite numerator, and the denominators of all individual care metrics were summed to produce a composite denominator. The final composite score is produced by dividing the composite numerator by the composite denominator. All-or-none care is measured as the percentage of patients who received all eligible interventions (ie, patients who received all the care for which they were documented to be eligible), where 100% equals all eligible care. The mean and median values for each metric, across all practices, are reported. The 10th and 90th percentiles of each care metric for all practices were calculated to present the range of results among practices. All analyses were completed using SAS statistical software, version 9.1 (SAS Institute, Cary, NC). All statistical inference testing was two-sided. Results were considered statistically significant if the probability value was less than an α -level of 0.05.

The authors had full access to the data and take full responsibility for its integrity. All authors have read and agree to the manuscript as written.

Results

Baseline Clinical Characteristics

The medical records of 15 381 patients at 167 outpatient cardiology practices in the United States are included in this analysis. There was a median of 90 (25th to 75th percentile, 58 to 107) patients entered per practice. Baseline patient and practice characteristics are shown in Tables 2 and 3. Mean/median patient age was 69/70 years, and 71% of the patients were male. Mean LVEF was 25.5%, and an ischemic etiology was seen in 65% of patients. A history of hypertension (62%), diabetes (34%), and other important conditions, including atrial fibrillation (31%) and chronic obstructive pulmonary disease (17%), was common. The mean initial blood pressure of registry patients was 120/70 mm Hg. The mean creatinine level was 1.42 ± 2.21 mg/dL. The characteristics of participating practices are shown in Table 3. Most of the participating cardiology practices are not attached to an academic center or university setting, and less than half have a dedicated HF clinic in the practice. Among IMPROVE HF outpatient cardiology practices, NYHA functional class was quantitatively (numerically) documented in 31.5% and qualitatively documented by symptoms and functional limitations in an additional 27.0% of medical records (58.5% total).

Baseline Care Metric Documentation

Care metrics at baseline are shown in Figure 1. For aggregate practices, an ACEI or ARB was prescribed in 11 271 (80%) of 14 167 eligible patients, a β -blocker was prescribed in 12 039 (86%) of 14 058 eligible patients, and an aldosterone antagonist was prescribed in 905 (36%) of 2505 eligible patients. Anticoagulant therapy was prescribed in 2450 (69%) of 3533 eligible patients with permanent, persistent, or paroxysmal atrial fibrillation or flutter. Of patients eligible for

Table 2. Baseline Patient Characteristics

Characteristic	Study Population (n=15 381)
Age, mean (SD)/median, y	68.7 (13.2)/70.0
Age <65 y, %	34.5
Age 65–76 y, %	33.7
Age >76 y, %	31.1
Male, %	71.0
White, %	41.4
African American, %	9.1
Race not documented or missing, %	47.8
Heart failure etiology, ischemic, %	65.2
History of atrial fibrillation, %	30.8
History of diabetes, %	34.0
History of hypertension, %	61.7
Prior myocardial infarction, %	39.4
History of chronic obstructive pulmonary disease, %	16.5
History of coronary artery bypass grafting, %	30.9
History of peripheral vascular disease, %	11.3
History of depression, %	8.8
Left ventricular ejection fraction, mean/median, %	25.5/25.0
Systolic blood pressure, mean (SD)/median, mm Hg	120 (18.9)/120
Diastolic blood pressure, mean (SD)/median, mm Hg	70 (11.3)/70
Resting heart rate, mean (SD)/median, bpm	72 (11.5)/71
Rales on most recent examination, %	3.7
Edema on most recent examination, %	19.7
Sodium, mean (SD)/median, mEq/L	139 (4.2)/140
Blood urea nitrogen, mean (SD)/median, mg/dL	26 (14.9)/22
Creatinine, mean (SD)/median, mg/dL	1.42 (2.21)/1.20
QRS duration, mean (SD)/median, ms	129.1 (40.1)/124.0

SD indicates standard deviation.

CRT (CRT-D/CRT with pacemaker), 528 (39%) of 1361 patients received therapy, and ICD/CRT-D therapy was provided to 3630 (51%) of 7169 eligible patients. Among all patients, 9459 (61%) were provided with documented HF education. Select contraindications, intolerance, or documented rationale as to why otherwise indicated therapy was not provided are listed in the Data Supplement Appendix for each care metric. Identification of certain patient exclusions necessitates explicit statements by the charting physicians, such as for anticipated noncompliance for potassium monitoring or anticipated survival less than 1 year.

Variation in Documented Care

Care metrics varied widely across practices. Across all practices, the median rates for each metric were ACEI/ARB, 79.5% (range, 5.9% to 96.3%); β -blocker, 87.6% (8.6% to 100%); aldosterone antagonist, 33.3% (0% to 100%); anticoagulation therapy for atrial fibrillation, 70.0% (0% to 100%); CRT (CRT-D/CRT with pacemaker), 33.3% (0% to 100%); ICD/CRT-D, 49.1% (0% to 100%); and HF education, 60.7%

Table 3. Baseline IMPROVE HF Practice Characteristics

Characteristic	Practice Sites (n=165*)
Census region: South, %	39.4
Census region: Northeast, %	32.7
Census region: Central, %	15.8
Census region: West, %	12.1
University practice setting, %	8.3†
Nonuniversity teaching setting, %	22.9†
Nonuniversity, nonteaching setting, %	68.8†
Multispecialty, %	24.2
Heart failure clinic in practice, %	41.7‡
Average No. cardiologists in practice, mean (SD)/median	12.0 (10.7)/9.0
Average No. heart failure patients managed annually by practice, mean (SD)/median	3213.5 (3971.9)/1837.5

SD indicates standard deviation.

*Two sites did not provide any survey data. †n=157. ‡n=163.

(0% to 100%). Figure 2 is a box plot depicting the frequency distribution of care metric rates by practice. For each metric, there were substantial differences between practices at different percentile levels. For aldosterone antagonist therapy, there was a 9-fold difference in treatment rates at the 10th and 90th percentile practices. In contrast, there was only a 1.3-fold difference in the use of ACEI/ARB therapy at these percentile practices. Rates for each metric stratified by patient age, renal function, and comorbidities are shown in Table 4. Patient characteristics for care metric-eligible patients who received and did not receive an ICD device are shown in the Data Supplement Appendix. Patients receiving an ICD are slightly younger, more likely to be male and have an ischemic etiology for HF, have similar rates of diabetes and chronic obstructive pulmonary disease, and have lower LVEF than those not eligible to receive an ICD.

The frequency distribution by practice for each individual care metric is illustrated in Figure 3. Median rates for each metric are indicated with a solid line. As shown in these graphs, the largest differences were for the metrics of CRT (CRT-D/CRT with pacemaker), ICD/CRT-D, patient education, and anticoagulation for atrial fibrillation.

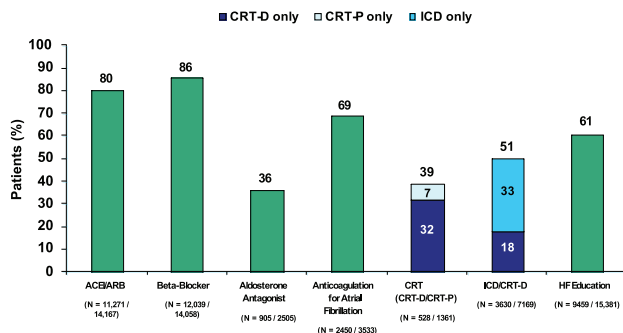


Figure 1. IMPROVE HF care metrics at baseline. Aldosterone antagonist, cardiac resynchronization therapy (CRT), or implantable cardioverter defibrillators (ICD) therapy care metrics are not American College of Cardiology/American Heart Association (ACC/AHA) outpatient heart failure (HF) performance measures.

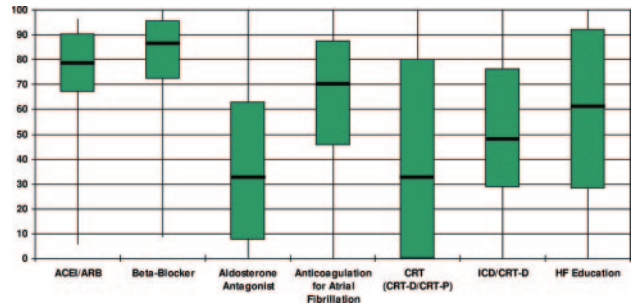


Figure 2. Frequency distribution of care metric rates by practice. Box plots represent median, 10th, and 90th percentiles, and lines for minimum and maximum conformity rates across practices.

Composite Score and All-or-None Care

The composite quality score and percentage of patients receiving all eligible care as documented in the medical record were also assessed. The mean and median total composite scores were 68.5% and 68.9%, respectively, with practices falling in the 10th percentile at 58.3% and practices falling in the 90th percentile at 78.5%. The all-or-none care metric was provided to patients at a mean and median of 27.5% and 27.2%, respectively, and varied widely by practice, with practices in the 10th percentile at 11.8% and those in the 90th percentile at 45.3%. No practice provided all eligible care to more than 62% of patients who qualified as documented in the medical record.

Discussion

The IMPROVE HF registry offers a unique opportunity to evaluate the current state of cardiology outpatient HF care. Unlike clinical trials, which may have multiple exclusion criteria for enrollment and care driven by study protocols, this registry reflects real-world management in a variety of cardiology practices from all regions of the United States.

The baseline characteristics of patients in the IMPROVE HF registry provide insights into patients with HF and left ventricular systolic dysfunction managed in outpatient cardiology practices across the United States. The mean age of patients cared for in outpatient practices participating in IMPROVE HF is greater than that for some outpatient HF clinical trials^{6,8,19–21} but is less than that of patients hospitalized with HF. The mean age of patients with left ventricular systolic dysfunction hospitalized with HF in OPTIMIZE-HF²² was 70.4 years, when compared with 68.7 years in IMPROVE HF. The greater ratio of men to women in IMPROVE HF (almost 3:1) is notable when compared with that in in-hospital registries but is largely due to the inclusion parameter of systolic dysfunction (LVEF ≤35%) and is similar to clinical trials. In OPTIMIZE-HF, although women made up 52% of the patients hospitalized with HF overall, among patients with LVEF <40%, only 38% were female.^{22,23} Data from IMPROVE HF indicate that although a history of hypertension is common in patients seen in the outpatient setting, the mean blood pressure for this patient group is within normal limits, similar to most outpatient HF clinical trials. This is in contrast to previous findings from in-hospital registries in which as many as half of the hospi-

Table 4. Care Metric Rates in Patient Subgroups

Patient Population	ACEI/ARB	β -Blocker	Aldosterone Antagonist	CRT	ICD/CRT-D	Anticoagulation for Afib	HF Education
Age <65 years (n=5307)	84.9 (69.2, 96.4)	92.2 (75.8, 100.0)	48.3 (0.0, 100.0)	33.3 (0.0, 100.0)	50.0 (20.0, 90.0)	75.0 (33.3, 100.0)	67.7 (33.3, 96.4)
Age 65–76 years (n=5176)	80.0 (65.9, 92.6)	88.9 (70.6, 100.0)	28.6 (0.0, 66.7)	33.3 (0.0, 100.0)	57.1 (25.0, 88.2)	75.0 (40.0, 100.0)	57.9 (22.2, 93.7)
Age >76 years (n=4791)	73.9 (57.1, 87.8)	83.0 (65.2, 100.0)	25.0 (0.0, 87.5)	26.8 (0.0, 100.0)	42.9 (9.1, 80.0)	66.7 (41.7, 100.0)	58.0 (24.1, 88.9)
Creatinine \leq 1.4 mg/dL (n=9092)	83.3 (72.7, 92.6)	88.9 (70.8, 96.7)	34.1 (0.0, 66.7)	33.3 (0.0, 100.0)	50.0 (25.0, 84.8)	68.8 (40.0, 91.7)	60.9 (28.3, 92.6)
Creatinine >1.4 mg/dL (n=4156)	71.9 (50.0, 88.2)	88.9 (70.8, 100.0)	33.3 (0.0, 100.0)	33.3 (0.0, 100.0)	52.1 (18.2, 83.3)	67.7 (33.3, 100.0)	58.8 (28.6, 92.3)
COPD (n=2530)	75.8 (57.1, 100.0)	81.4 (53.3, 100.0)	33.3 (0.0, 100.0)	33.3 (0.0, 100.0)	50.0 (0.0, 100.0)	71.4 (0.0, 100.0)	60.4 (20.0, 97.3)
No COPD (n=12 851)	80.0 (66.7, 90.4)	88.9 (73.3, 96.4)	32.5 (0.0, 66.7)	33.3 (0.0, 100.0)	50.0 (27.5, 75.0)	70.0 (50.0, 88.2)	60.3 (28.0, 91.4)
Diabetes (n=5229)	77.8 (61.9, 90.9)	87.5 (72.2, 97.0)	33.3 (0.0, 66.7)	33.3 (0.0, 100.0)	50.0 (20.5, 83.3)	71.4 (37.5, 100.0)	59.3 (27.3, 92.3)
No diabetes (n=10 152)	80.6 (68.4, 90.6)	87.1 (72.2, 95.6)	33.3 (0.0, 66.7)	33.3 (0.0, 100.0)	50.0 (25.0, 75.0)	69.8 (45.5, 89.5)	60.0 (27.3, 93.0)

ACEI indicates angiotensin-converting enzyme inhibitors; ARB, angiotensin II receptor blockers; CRT, cardiac resynchronization therapy; ICD, implantable cardioverter defibrillators; CRT-D, cardiac resynchronization therapy devices with defibrillation; Afib, atrial fibrillation; HF, heart failure; COPD, chronic obstructive pulmonary disease.

Median (10th and 90th percentiles) at the practice level.

talized HF patients have been frankly hypertensive.^{23–25} Comorbidities among IMPROVE HF patients, such as concomitant diabetes, previous myocardial infarction, and renal dysfunction, were similar to that seen in HF patients enrolled in recent US clinical trials.^{6,19}

Outpatient Heart Failure Care Documentation

The IMPROVE HF data reveal that based on information as documented in the medical record, the use of ACEI or ARB and β -blockers was higher than that observed in previous outpatient surveys and in-hospital registries. A representative picture of general outpatient care was assessed by 2 independent samples of visits to office-based physicians in the United States, the National Disease and Therapeutic Index for 1990–2002, and the National Ambulatory Medical Care Surveys for 1990–2000.²⁶ In the National Disease and Therapeutic Index, ACEI use in HF increased from 24% in 1990 to 36% in 1996 but increased to only 39% by 2001; the same pattern was observed in the National Ambulatory Medical Care Surveys.²⁶ An international study of outpatient HF care showed that in 2000, only 60% of patients received an ACEI and 34% received a β -blocker.²⁷

The higher rates of use for ACEI/ARB and β -blockers seen in IMPROVE HF at baseline may reflect an increased appreciation of the benefit of these agents in recent years or may indicate that patients cared for in cardiology practices are more likely to receive these therapies, when compared with general care practices or both. Although the mean percent of patients treated with a β -blocker or ACEI/ARB at baseline was reasonably high, close to 1 in 5 eligible patients were not treated, suggesting that there remains additional room for improvement in the use of these therapies in eligible patients.

Lower rates of documented use were observed for device therapy, aldosterone antagonists, anticoagulation for atrial fibrillation, and HF education. Another study of device

therapy in outpatients showed that ICDs were not used in 66% of patients, despite being indicated as a Class I ACC/AHA treatment in the patients included in the analysis.²⁸ In the National Disease and Therapeutic Index, use of warfarin for atrial fibrillation increased from 12% in 1990 to 41% in 1995 to 58% in 2001, and similar increases were seen in the National Ambulatory Medical Care Surveys.²⁶ IMPROVE HF showed slightly higher rates of anticoagulation use, but they were still potentially suboptimal. The median documented delivery of HF education in the hospital setting was 57.4% in OPTIMIZE-HF²⁹ and 61% in the outpatient setting in IMPROVE HF. As the amount of time a physician is able to spend with a patient is a critical barrier to the implementation of HF education in the outpatient setting, it is interesting to observe that delivery of HF education was equally as prevalent in the inpatient and outpatient setting.

The documentation of functional status was only 58.5% and could have contributed to a missed opportunity to use therapies that rely on this assessment for use, such as prescription of an aldosterone antagonist and use of CRT (CRT-D/CRT with pacemaker) or ICD/CRT-D. In-hospital registries documented even lower rates for NYHA functional class; in the Acute Decompensated Heart Failure National Registry, there was only an 8% rate of NYHA functional class documentation.³⁰ Although data from the IMPROVE HF show better documentation of functional status than that in some inpatient registries, an increased emphasis on documentation of functional status of HF patients in the outpatient setting is still needed.

The wide variations in care metrics across practices in this study may reflect differences in training, guideline familiarity, and implementation of tools and systems to ensure that recommended care is provided. The variation in care metrics in this study may also reflect differences in the documentation of care that was actually provided. For example, clinicians may have provided complete HF education, but because

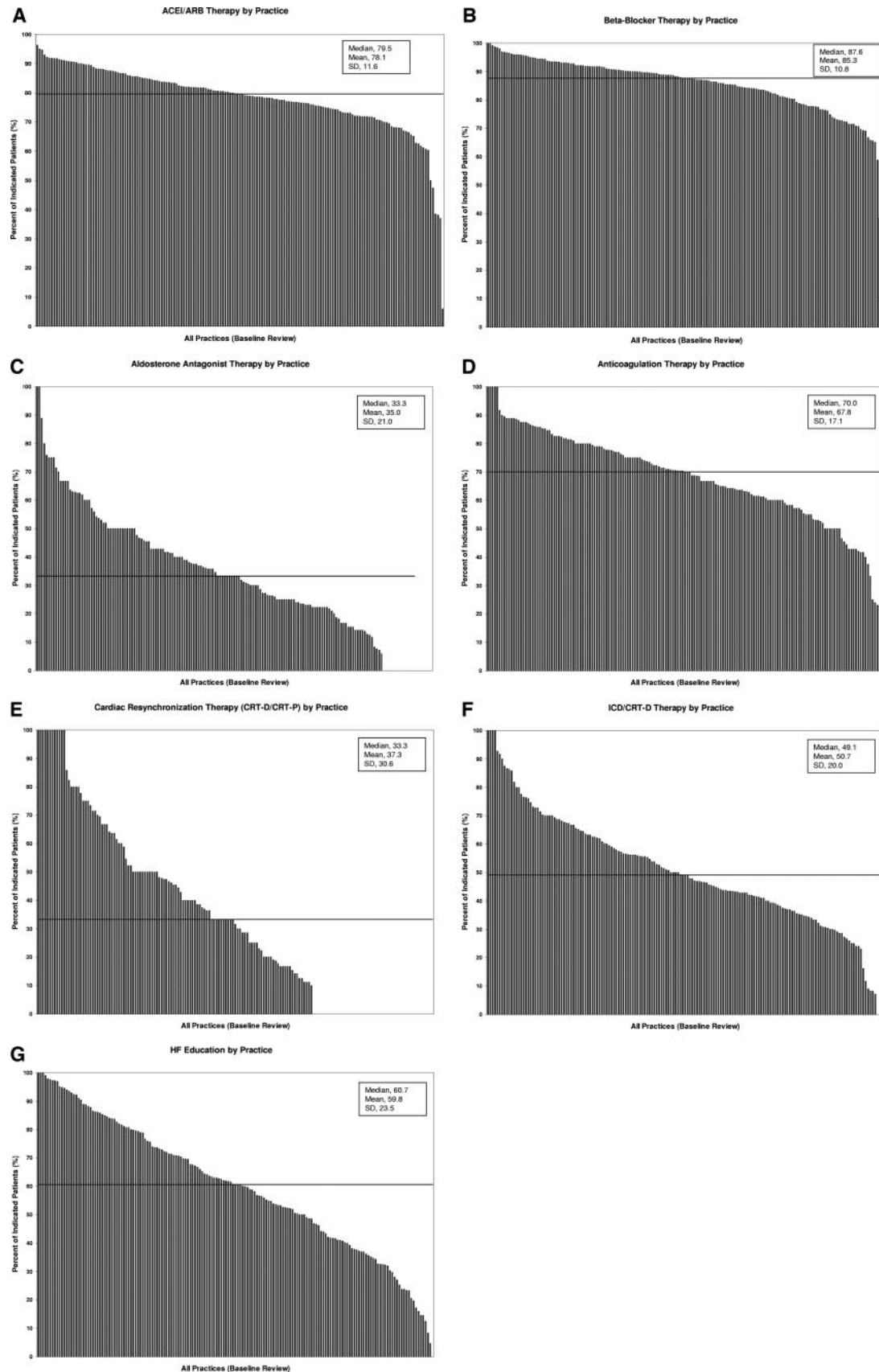


Figure 3. Frequency distribution of care metric rates by practice for (A) angiotensin-converting enzyme inhibitors (ACEI) or angiotensin II receptor blockers (ARB), (B) β -blocker, (C) aldosterone antagonist, (D) anticoagulation therapy, (E) cardiac resynchronization therapy (CRT) (devices with defibrillation [CRT-Ds]/CRT with pacemaker), (F) implantable cardioverter defibrillators (ICD)/CRT-D, and (G) heart failure (HF) education.

of time constraints or other reasons, they may not have documented this in the medical record. Furthermore, differences in the documentation of current HF symptoms, contraindications, intolerances, and patient reasons and physician reasons for not providing guideline-recommended therapies may have varied across practices. The decision to proceed with device therapy often requires in-depth and multiple discussions with patients but may not always be documented in the medical record, especially when the decision is to forego use of an otherwise indicated device. As a result, patients may have appeared in the medical record to be eligible for treatment, but an appropriate decision led to withholding that intervention. Lower care metric rates for these reasons would indicate that there is a need for better documentation of decision making and patient exclusions for guideline-recommended therapies, if they are indeed present, rather than deficiencies in care. Attempts to improve documentation may, however, consume additional time when providing HF care, which is already quite time intensive and frequently underreimbursed.

IMPROVE HF reveals that large variations in care metrics exist in the outpatient cardiology practice setting. Variations in documented care were particularly notable for the use of anticoagulation for atrial fibrillation, device therapy, and HF education. Although patients, payers, and regulatory agencies may have expectations that care among outpatient cardiology practices across the country would be similar, this did not appear to be the case. Certain cardiology practices participating in IMPROVE HF were able to more rapidly translate the strongest clinical evidence and national guideline-recommended therapies into routine clinical practice or provide better documentation of the therapies provided or both than were others. Best practice methodologies in the outpatient cardiology practice setting need to be identified.

Limitations

Certain limitations inherent in the design of IMPROVE HF should be considered when these registry findings are interpreted. Data were collected by medical chart reviews and are dependent on the accuracy and completeness of documentation and abstraction, and eligibility/ineligibility for care metrics is based on this documentation. As such, a proportion of patients reported to be eligible for treatment but not treated may have had contraindications or intolerance that were present but not documented. This retrospective chart review would in most cases not have identified patients with anticipated noncompliance for potassium monitoring or anticipated survival less than 1 year, except when explicitly stated by the charting physician. Although aldosterone antagonist, CRT, or ICD therapy in eligible patients have class I recommendations in the ACC/AHA guidelines, the ACC/AHA outpatient performance measure sets do not include measures for these therapies; some experts question whether such measures are appropriate for quality assessment and improvement.^{16,17} As such, it may not be reasonable to expect medical record documentation regarding contraindications or patient refusal for therapies that have not been selected as ACC/AHA performance measures. These findings may not apply to practices that differ in patient characteristics or care

patterns from IMPROVE HF outpatient cardiology practices. The patients seen in the IMPROVE HF practices may not be fully representative of the general outpatient population of HF patients, as these patients were followed in cardiology practices and a bias of ascertainment may be related to this point of care. Patients in IMPROVE HF were drawn from practices participating in a quality-improvement registry, had left ventricular function measured and documented, and were seen in the practice at least twice in the last 2 years. If the foregoing are indicative of more intensive disease management, even greater variation in the use of therapies for HF patients may exist among usual outpatient practices in the United States.

Conclusions

These data provide new insights into the characteristics and care patterns for HF patients followed up in outpatient cardiology practices since the release of the latest national HF guidelines. Substantial variations in care metrics among eligible HF patients based on medical record documentation are observed. The use of ACEI/ARB and β -blocker therapy is higher than has been reported previously in the outpatient practice setting and is closer to that seen among select patients enrolled in randomized clinical trials. Lower rates of documented use are observed for anticoagulation for atrial fibrillation, device therapy, aldosterone antagonists, and HF education. The variation in care metrics in this study may reflect differences in the documentation of eligibility, ineligibility, and therapy that was actually provided rather than deficiencies in care. Certain practices participating in the registry were able to provide higher rates of therapies as judged by the IMPROVE HF care metrics. Opportunities may exist to improve documentation, care, or both for many HF patients in the outpatient setting.

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Role of the Sponsor

Medtronic provided financial and material support for the IMPROVE HF registry. The sponsor had no role or input into the selection of end points or quality measures used in the study. A contract research organization, Outcome Sciences, Inc. (Cambridge, Mass), independently performs the practice site chart abstractions for IMPROVE HF and is responsible for performing data checks, storing site-specific and aggregate data, as well as providing benchmarked quality of care reports to practice sites. The contract research organization receives funding from Medtronic. Identified, individual practice site data are not shared with either the steering committee or the sponsor. The authors had complete control and authority over the study design, the manuscript preparation, and the decision to submit this manuscript to *Circulation: Heart Failure* for publication. The manuscript was submitted to Medtronic before submission for publication.

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CLINICAL PERSPECTIVE

More than 5 million men and women in the United States have heart failure, and this disease results in substantial morbidity and mortality. Providing optimal care for heart failure patients is critical; however, contemporary care patterns for these patients in the outpatient setting have not been well studied. Greater insight into heart failure care in outpatient cardiology practices can provide important information as to the patterns of treatment and potentially guide future quality improvement efforts. Among 15,381 patients cared for within 167 cardiology practices participating in a national heart failure registry, IMPROVE HF, chart review indicated that use of angiotensin-converting enzyme inhibitor or angiotensin receptor blocker (80%) and β -blocker (86%) was relatively high among eligible patients in the outpatient cardiology setting; other heart failure therapies showed lower rates of use: aldosterone antagonist (36%), device therapy (implantable cardioverter defibrillator/cardiac resynchronization therapy with defibrillator, 51%; cardiac resynchronization therapy, 39%), and education (61%). Use of recommended therapies by cardiology practices varied widely. Certain cardiology practices participating in this registry were able to demonstrate higher rates of treatment, as indexed by the IMPROVE HF metrics. These variations in therapies, as assessed from chart review, may reflect differences in the documentation of eligibility, ineligibility, and treatment that was actually provided, rather than deficiencies in care. These findings suggest that opportunities exist for healthcare providers to improve documentation or treatment, or both, for patients with heart failure in the outpatient setting.