

Classification of Health Plans Based on Relative Resource Use and Quality of Care

Sally E. Turbyville, MA, MS; Robert C. Saunders, PhD; Manasi A. Tirodkar, PhD, MS; Sarah H. Scholle, DrPh, MA; and L. Gregory Pawlson, MD, MPH

Reducing the rate of increase in healthcare costs, while addressing gaps in quality of care, is the most challenging and pressing healthcare issue facing the United States and other developed countries.¹⁻³ Studies⁴⁻⁶ documenting problems with quality and cost of healthcare in the United States have given rise to a growing interest in understanding the relationship between cost and quality. The science of measuring quality has advanced considerably over the past 2 decades; given the widespread use of Healthcare Effectiveness Data and Information Set (HEDIS), ORYX (an initiative by the Joint Commission on Accreditation of Healthcare Organizations), and related measures,^{1,6} there is substantial consistency around the content and scope of quality measurement. While methodological approaches to measuring differences in cost are emerging, whether through a focus on resource use or through various formulations of expenditures, there is no widely used way to directly compare costs among entities.

APPROACHES TO MEASURING RESOURCE USE AND QUALITY OF CARE

Focus on Resource Use

Premiums represent the cost of care to the employer and employee but have an imperfect relationship with the actual costs of medical care and reflect relative market power, benefit design, and other factors. By contrast, actual prices paid reflect resource use and local market forces but often vary among providers, making it difficult or impossible to use in cost comparative analysis among entities. Using a standardized set of prices applied to actual utilization is a common method for analysis that provides more transparency than premiums alone and avoids the challenges associated with using actual prices. Finally, resource use largely reflects the framework of interactions among patients, providers, and others within the healthcare delivery system.

Focus on Chronic Care

The rise in chronic diseases has been directly linked to the increase in healthcare spending to treat them.⁶ The American Diabetes Association⁴ estimates that in 2007 the total estimated cost of diabetes was \$174 billion, including \$116 billion in excess medical expenditures and \$58 billion in reduced

Objective: To examine variation among commercial health plans in resource use and quality of care for patients with diabetes mellitus or cardiovascular disease.

Study Design: Cohort study using Healthcare Effectiveness Data and Information Set data submitted to the National Committee for Quality Assurance in 2008.

Methods: Composite measures were estimated for diabetes and cardiovascular disease resource use and quality of care. A "value" classification approach was defined. Obtained were descriptive statistics, Pearson product moment correlations between resource use and quality of care, and 90% confidence intervals around each health plan's composite measures of resource use and quality of care. Health plans were classified based on their results.

Results: For patients with diabetes, the correlation between combined medical care services resource use and composite quality of care is negative ($-0.201, P = .008$); the correlation between ambulatory pharmacy services resource use and composite quality of care is positive ($0.162, P = .03$). For patients with cardiovascular disease, no significant correlation was found between combined medical care services resource use and composite quality of care ($-0.007, P = .94$) or ambulatory pharmacy services resource use ($0.170, P = .06$).

Conclusions: Measures of resource use and quality of care provide important information about the value of a health plan. Although our analysis did not determine causality, the statistically weak or absent correlations between resource use and quality of care suggest that health plans and practices can create higher value by improving quality of care without large increases in resource use or by maintaining the same quality of care with decreased resource use.

(Am J Manag Care. 2011;17(8):e301-e309)

In this article

Take-Away Points / e302
Published as a Web exclusive
www.ajmc.com

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METHODS

Take-Away Points

An examination of variation among health plans in resource use and quality of care for patients with diabetes mellitus or cardiovascular disease suggests that plans can demonstrate higher value under either of the following conditions:

- By improving quality of care without large increases in resource use
- By maintaining the same quality of care with decreased resource use.

national productivity. Furthermore, the American Heart Association and the National Heart, Lung, and Blood Institute estimated that in 2009 the cost of cardiovascular diseases and stroke in the United States was \$475.3 billion.⁵

Classifying Performance

While HEDIS has for years included measures reporting health plan utilization of services, these measures do not directly relate to any HEDIS quality measure, are not case mix adjusted, and cannot be aggregated across categories, thus providing a limited amount of useful comparative information. In 2007, the National Committee for Quality Assurance (NCQA) introduced HEDIS measures of relative resource use (RRU) for 6 prevalent high-cost areas of care, including diabetes mellitus, cardiovascular disease, uncomplicated hypertension, chronic obstructive pulmonary disease, asthma, and low back pain, that use standardized prices and case mix adjustment to better define the cost portion of efficiency. Roski et al⁷ provide an overview of the NCQA HEDIS resource use measurement approach and results from a small pilot test project (<25 health plans) related to diabetes care. Turbyville et al⁸ examine the implications of wide national variation in RRU and quality results among commercial health maintenance organizations (HMOs) for their members with diabetes. The present study focuses on results for RRU and quality of care among commercial HMOs but goes further by examining the ability to construct a health plan classification approach based on resource use and quality-of-care performance in patients with diabetes or cardiovascular disease.

METHODS

Data

The data used in this study are part of the HEDIS 2008 health plan submission to the NCQA based on services rendered in 2007. Before submitting performance data to the NCQA, health plans must undergo an independent audit review that assesses the validity of data collection and measure calculations. Analyses reported herein are based on commercial HMO plans that submitted summarized member month, claim, and medical record data for diabetes and cardiovascular disease resource use and quality performance. Individual variables in the RRU measures are based on a patient population

perspective and include all services rendered (not just those that are attributed to the disease) in the specified service categories. Health plans submit their summarized data within specified patient cohorts, which allow for risk adjustment once the data are submitted

(Table 1). The denominator inclusion criteria for HEDIS RRU measures are designed to be representative of patients included in the related quality measure denominator population, allowing for a more direct examination of the relationship between resource use and quality of care.

Variables

To estimate the quality of care, we calculated 2 combined composite quality measures based on calendar year 2007 results, 1 for diabetes and 1 for cardiovascular disease. The diabetes composite quality measure components are as follows: glycated hemoglobin testing, glycated hemoglobin poor control (>9.0% [inverted]), retinal eye examination, low-density lipoprotein cholesterol screening, low-density lipoprotein cholesterol control (<100 mg/dL [to convert cholesterol level to millimoles per liter, multiply by 0.0259]), medical attention for nephropathy, and blood pressure control (<130/80 mm Hg). The cardiovascular disease composite quality measure components are as follows: cholesterol screening, cholesterol control (<100 mg/dL), blood pressure control (<140/90 mm Hg), and persistence of β -blocker treatment after a heart attack. We further indexed each health plan's results for diabetes or cardiovascular disease against the mean HMO commercial plan performance for each condition, allowing us to demonstrate its relative performance (eg, an index result of 1.12 implies 12% above average, whereas a result of 0.90 implies 10% below average).

To examine RRU among health plan members with diabetes or cardiovascular disease, we used 2 resource use variables for each condition, the combined medical care services variable and the ambulatory pharmacy services variable. The discrete service categories of the RRU measure for total medical care services include inpatient facility services, procedure and surgery services (inpatient and outpatient), and evaluation and management services (inpatient and outpatient). Within these service categories, the measures examine all resources expended during the 2007 calendar year. Detailed characteristics of these measures are included in the NCQA's HEDIS technical specifications.⁹ The category of inpatient facility services accounts for a patient's stay and is adjusted for severity of diagnosis, occurrence of major surgery (defined in the specifications), and length of stay. The procedure and surgery services and the evaluation and management ser-

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■ **Table 1.** Patient Cohorts by Hierarchies and Comorbid Groups

Clinical Category	Comorbidity	Sex and Age Groups, y
Diabetes Mellitus		
Type 1	Yes	M/F 18-44, 45-54, 55-64, 65-75
Type 1	No	M/F 18-44, 45-54, 55-64, 65-75
Type 2	Yes	M/F 18-44, 45-54, 55-64, 65-75
Type 2	No	M/F 18-44, 45-54, 55-64, 65-75
Cardiovascular Disease		
CHF	Yes	M/F 18-44, 45-54, 55-64, 65-75
CHF	No	M/F 18-44, 45-54, 55-64, 65-75
AMI	Yes	M/F 18-44, 45-54, 55-64, 65-75
AMI	No	M/F 18-44, 45-54, 55-64, 65-75
CAD	Yes	M/F 18-44, 45-54, 55-64, 65-75
CAD	No	M/F 18-44, 45-54, 55-64, 65-75
Angina	Yes	M/F 18-44, 45-54, 55-64, 65-75
Angina	No	M/F 18-44, 45-54, 55-64, 65-75

AMI indicates acute myocardial infarction; CAD, coronary artery disease; CHF, congestive heart failure.

vices include inpatient-based or outpatient-based care, such as that provided by an internist or a surgeon, and are adjusted for intensity. Ambulatory pharmacy services include all prescriptions rendered in ambulatory settings and are based on National Drug Code identifiers. Ambulatory pharmacy services were analyzed separately because of variation in benefit status or eligibility in pharmacy services and owing to past research on their relationship to quality. Benefit status variation results in the pharmacy component having a different per-member divisor than the medical service categories, rendering a total resource use composite computationally difficult when using summarized data. Furthermore, evidence shows that resource uses for medical and pharmacy services have different, sometimes inverse, correlations with quality.⁷ The RRU index is the ratio of the health plan's observed (submitted) per-member-per-month resource use to the expected per-member-per-month resource use across the service categories. Health plans estimate their observed per-member-per-month resource use by following the RRU HEDIS specification that includes application of the NCQA standardized prices to the specified health service units. Pricing algorithms are designed to reflect service pricing levels for HMOs for the most recent period. The NCQA estimates the expected amounts based on all submitted data using indirect standardization to adjust for each health plan's patient population distribution by age, sex, the presence of comorbid conditions, and severity of condition (eg, congestive heart failure vs angina). The ratio of each health plan's observed results to expected results is indexed to the mean HMO commercial plan performance.

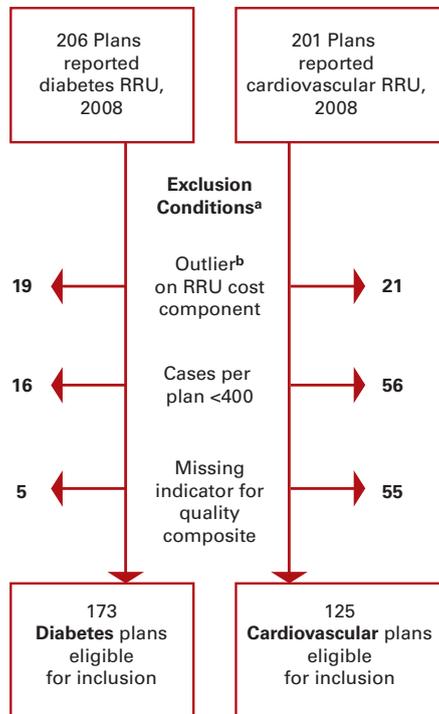
Statistical Analysis

Statistical software (SAS version 9.1; SAS Institute, Cary, North Carolina) was used to calculate health plan descriptive statistics and Pearson product moment correlations for the diabetes and cardiovascular disease resource use and quality-of-care measures (combined medical care services and pharmacy services) for the ratio of observed results to expected result. We excluded health plans that did not submit complete RRU and quality-of-care data, submitted RRU data for fewer than 400 members with the given disease, or had a ratio of observed results to expected results of less than 0.33 or greater than 3.00. The NCQA based these exclusion decisions on previous research, consideration of standard errors and sample size needs for reliability purposes, and investigation of larger-than-expected observed variation among health plans, which revealed that a ratio of observed results to expected results of less than 0.33 or greater than 3.00 was caused by plan data submission errors in almost all cases. We did not report regression estimates because the direction of causality is unclear: do changes in resource use lead to changes in quality, or do changes in quality lead to changes in resource use? Furthermore, the study design did not permit us to test the direction of causality.

We estimated all results and statistical estimations after removing health plans that failed to meet the conditions for inclusion in the study. For each included health plan, we then estimated the 90% confidence intervals around each variable (combined medical care services, and ambulatory pharmacy services, and quality of care). Using STATA version 10 statistical software,¹⁰ we constructed boxplots to examine the

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■ Figure 1. Commercial Health Maintenance Organization Plans Included for Analysis of Diabetes Mellitus and Cardiovascular Disease Relative Resource Use (RRU)^a



^aIn total, 266 health plans submitted at least 1 Healthcare Effectiveness Data and Information Set measure (206 submitted for diabetes mellitus RRU and 201 submitted for cardiovascular disease RRU). The numbers of plans dropped by each exclusion condition are not mutually exclusive.

^bOutliers were judged on a ratio of observed results to expected results of less than 0.33 or greater than 3.00. Outliers were indicative of data reporting errors by health plans rather than of exceptional performance.

distribution of health plan results and fabricated scatterplots to illustrate the variation in results and the plan “value” classifications.

Using the index value (1.00) for each condition, we categorized each health plan into 1 of the following 4 value groups for each condition: (1) high quality (>1.00) and low resource use (<1.00), (2) high quality (>1.00) and high resource use (>1.00), (3) low quality (<1.00) and low resource use (<1.00), and (4) low quality (<1.00) and high resource use (>1.00).

RESULTS

Figure 1 shows the effect on the initial sample of health plans for each condition by sequential application of exclusion criteria. The final analysis included 173 health plans for diabetes and 125 health plans for cardiovascular disease. **Table 2** gives basic information about health plans included in and excluded from the analysis. Across both conditions,

two-thirds were for-profit health plans, 95% publicly reported their quality data, and 90% were accredited by the NCQA. All Health and Human Services regions of the country were represented. Health plans included in the diabetes analysis were significantly more likely to publicly report their quality data and to be accredited by the NCQA, and health plans included in the cardiovascular analysis were somewhat less likely to be for-profit health plans. In terms of regional patterns across both conditions, health plans in the East (regions in Boston, Massachusetts; New York, New York; and Philadelphia, Pennsylvania) were significantly more likely to meet the criteria for inclusion than health plans in the West (regions in Dallas, Texas; Denver, Colorado; and Seattle, Washington).

Figure 2 shows the distribution of HMO results for RRU and quality of care for diabetes and cardiovascular disease. By construction, the mean for all variables is 1.00. As expected, health plans exhibited greater variation in RRU than in quality of care, as seen by the greater interquartile range (width of the boxes), the more extreme adjacent values (width of the whiskers extending from the boxes), and the presence of health plans beyond the adjacent values (dots). The variation for ambulatory pharmacy services in both disease conditions is more compressed on the upper range than that for combined medical care services. Different components of resource use, such as inpatient and outpatient services and pharmacy, may relate to measurable quality in different ways. For patients with diabetes, the correlation between combined medical care services resource use and composite quality of care is negative (-0.201 , $P < .008$); the correlation between ambulatory pharmacy services resource use and composite quality of care is positive (0.162 , $P = .03$; **Table 3**). While we cannot determine a causal relationship, this finding suggests that for members with diabetes, health plans having better diabetes composite quality of care tend to use fewer combined medical care resources (ie, inpatient facility services, procedure and surgery services, and evaluation and management services) but use correspondingly more ambulatory pharmacy resources. Considering medical care services resource use elements individually, we find that inpatient facility services (-0.164 , $P = .03$) and procedure and surgery services (-0.219 , $P = .006$) have significant negative correlations with diabetes quality, while there is no demonstrated relationship between diabetes quality and evaluation and management services. By contrast, for patients with cardiovascular disease, no significant correlation was found between combined medical care services resource use (-0.007 , $P = .94$) and ambulatory pharmacy services resource use (0.170 , $P = .06$), nor for any individual medical care services element. For diabetes and cardiovascular disease, scatterplots of quality of care and combined medical care services RRU index results and ambulatory pharmacy services RRU index results show the covariation between quality of care and

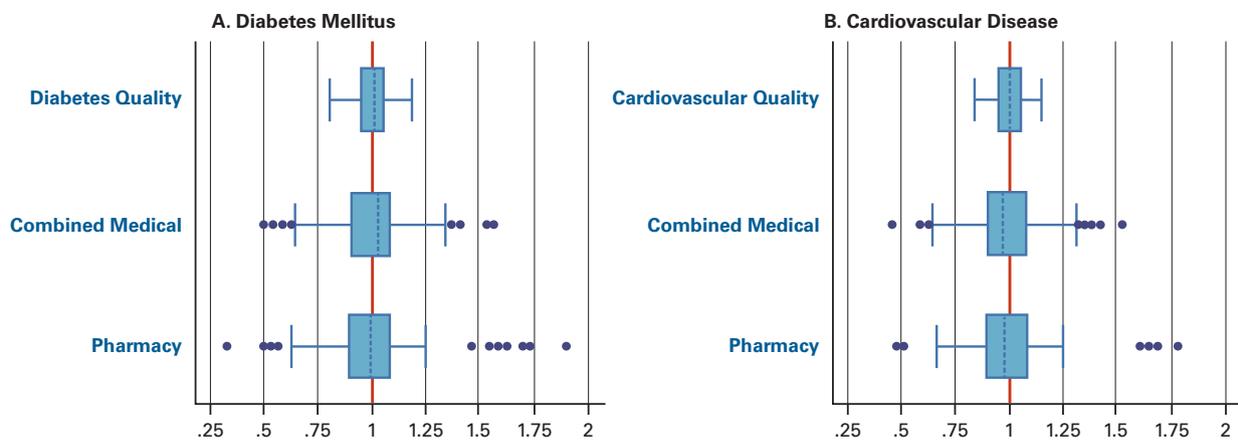
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Table 2. Characteristics of Health Plans That Met Selection Criteria vs Did Not Meet Selection Criteria for the Study

Characteristic	Diabetes Mellitus (n = 266)			Cardiovascular Disease (n = 266)		
	Met, No. (%) (n = 173)	Did Not Meet, No. (%) (n = 93)	P	Met, No. (%) (n = 125)	Did Not Meet, No. (%) (n = 141)	P
Health plan						
For profit	119 (68.8)	71 (76.3)	.19	81 (64.8)	109 (77.3)	.02
Publicly reported their quality data	165 (95.4)	75 (80.6)	<.001	121 (96.8)	119 (84.4)	<.001
Accredited by the NCOA	153 (88.4)	59 (63.4)	<.001	115 (92.0)	97 (68.8)	<.001
Health and Human Services region						
			.02			.001
Atlanta, Georgia	19 (11.0)	14 (15.1)		13 (10.4)	20 (14.2)	
Boston, Massachusetts	19 (11.0)	6 (6.5)		10 (8.0)	15 (10.6)	
Chicago, Illinois	35 (20.2)	15 (16.1)		22 (17.6)	28 (19.9)	
Dallas, Texas	13 (7.5)	19 (20.4)		11 (8.8)	21 (14.9)	
Denver, Colorado	8 (4.6)	5 (5.4)		3 (2.4)	10 (7.1)	
Kansas City, Missouri	14 (8.1)	8 (8.6)		10 (8.0)	12 (8.5)	
New York, New York	22 (12.7)	5 (5.4)		22 (17.6)	5 (3.5)	
Philadelphia, Pennsylvania	21 (12.1)	7 (7.5)		18 (14.4)	10 (7.1)	
San Francisco, California	16 (9.2)	6 (6.5)		13 (10.4)	9 (6.4)	
Seattle, Washington	6 (3.5)	8 (8.6)		3 (2.4)	11 (7.8)	

NCOA indicates National Committee for Quality Assurance.

Figure 2. Boxplots of the Composite Quality of Care, Combined Medical Care Services, and Ambulatory Pharmacy Services^a



^aVertical dashed lines represent the median. The red reference line indicates the average health plan's value, set at 1.00 by construction. The box indicates the interquartile range (25%-75% of the distribution). The whiskers indicate the lower and upper adjacent values, or 1.5 times the interquartile range below and above the interquartile range. Dots indicate health plans outside values.

resource use (Figure 3 and Figure 4). Health plans for which 90% confidence intervals did not include the mean on both dimensions are represented by red triangles; these plans were excluded from the value classification. Table 4 summarizes the value classification illustrated by the 4 quadrants of the scatterplots. For combined medical services only, approximately 30% of health plans can be classified as high value (high quality and

low resource use) and another 15% as low value (low quality and high resource use).

The findings reported herein suggest that it is possible to categorize health plans into quadrants that indicate significantly higher or lower quality and higher or lower resource use. Analysis of correlations between quality and resource use data collected from commercial HMO plans suggests a com-

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■ **Table 3.** Correlation of Data Elements

Resource Use	Composite Quality of Care	Combined Medical Care Services	Inpatient Facility Services	Procedure and Surgery Services	Evaluation and Management Services	Ambulatory Pharmacy Services
Diabetes Mellitus						
Combined medical care services	-0.201 (<i>P</i> = .008)					
Inpatient facility services	-0.164 (<i>P</i> = .03)	0.896 (<i>P</i> < .001)				
Procedure and surgery services	-0.209 (<i>P</i> = .006)	0.818 (<i>P</i> < .001)	0.542 (<i>P</i> < .001)			
Evaluation and management services	-0.079 (<i>P</i> = .30)	0.577 (<i>P</i> < .001)	0.306 (<i>P</i> < .001)	0.428 (<i>P</i> < .001)		
Ambulatory pharmacy services	0.162 (<i>P</i> = .03)	0.009 (<i>P</i> = .91)	-0.058 (<i>P</i> = .45)	-0.002 (<i>P</i> = .98)	0.193 (<i>P</i> = .01)	
Cardiovascular Disease						
Combined medical care services	-0.007 (<i>P</i> = .94)					
Inpatient facility services	0.007 (<i>P</i> = .94)	0.952 (<i>P</i> < .001)				
Procedure and surgery services	-0.058 (<i>P</i> = .52)	0.681 (<i>P</i> < .001)	0.445 (<i>P</i> < .001)			
Evaluation and management services	0.048 (<i>P</i> = .59)	0.542 (<i>P</i> < .001)	0.388 (<i>P</i> < .001)	0.429 (<i>P</i> < .001)		
Ambulatory pharmacy services	0.170 (<i>P</i> = .06)	0.155 (<i>P</i> = .09)	0.096 (<i>P</i> = .29)	0.133 (<i>P</i> = .14)	0.365 (<i>P</i> < .001)	

plex and probably disease-specific relationship between measures of healthcare service delivery and quality.

DISCUSSION

Our findings demonstrate that we are able to examine the relationship between RRU and quality (as measured by process and intermediate outcome variables) and can classify a substantial number of health plans based on their RRU and quality performance. This represents a modest first step toward determining the relative value of health plans. While some researchers have related quality to cost, we are aware of no previous studies that use large-scale observations for 2 major chronic conditions to classify the relative value of health plans. Furthermore, this study includes quality measures that reflect control of key physiological variables, such as blood pressure and cholesterol and glycosylated hemoglobin levels. The importance of including ambulatory pharmacy services is obvious: pharmacy may account for more than half of the mean total costs for many chronic illnesses.¹¹ Likewise, the use of intermediate outcome (control) measures is a major advance over the exclusive use of process measures, such as test ordering or screening, and more closely reflects the benefit portion of the value equation.

Our study illustrates the ability to create a useful value classification approach that places health plans into quadrants of high and low quality and high and low resource use and may be applicable to other care delivery systems (eg, accountable care organizations). Furthermore, improvement in risk-adjustment methods may allow reliable reporting of a larger proportion of health plans or entities (eg, those with smaller populations). The finding of a negative relationship between combined

medical care services resource use and related inpatient sub-components—composite quality of care in diabetes and no clear correlation in cardiovascular disease—indicates a complex relationship between cost components and quality that needs to be explored on a disease-by-disease basis. That each of the 2 major components of the combined medical care services (inpatient facility services and procedure and surgery services) is negatively related to composite quality of care in diabetes suggests the need for a more detailed examination of specific procedures and services that might indicate opportunities for reducing resource use without negatively affecting quality or for improving quality and reducing specific resource use.

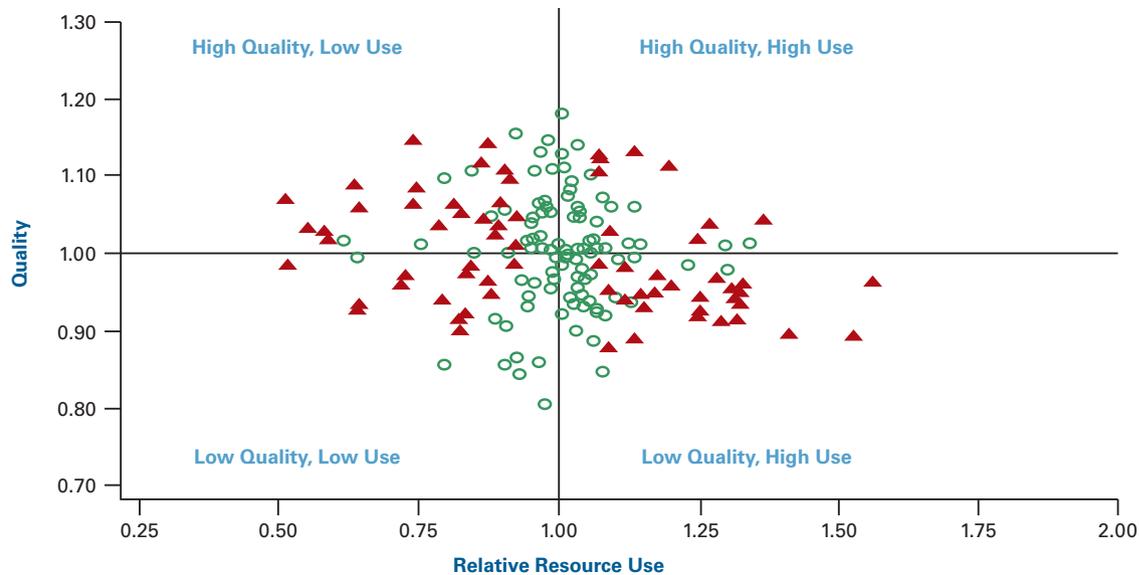
A critical question going forward is whether there are definable and replicable practices and interventions that relate to how some health plans seem to achieve higher value, as denoted by higher quality for the same or lower resource use. While additional factors must be considered, the present results imply that overall resource use and quality are independent characteristics of care, at least as now measured, but that certain sub-components of resource use or cost may be negatively or positively associated with quality for specific diseases. This suggests that purchasers and health plans should use information from both quality and resource use measures to benchmark their performance; furthermore, specific interventions may be required related to controlling and rationalizing resource utilization, as well as efforts that focus on quality improvement. Information on resource use along with data on premiums or expenditures can promote better understanding of the forces driving medical costs.

This analysis is limited to commercial HMO plans that submitted HEDIS data to the NCQA and may not apply to other types of health plans or in other settings. However, the

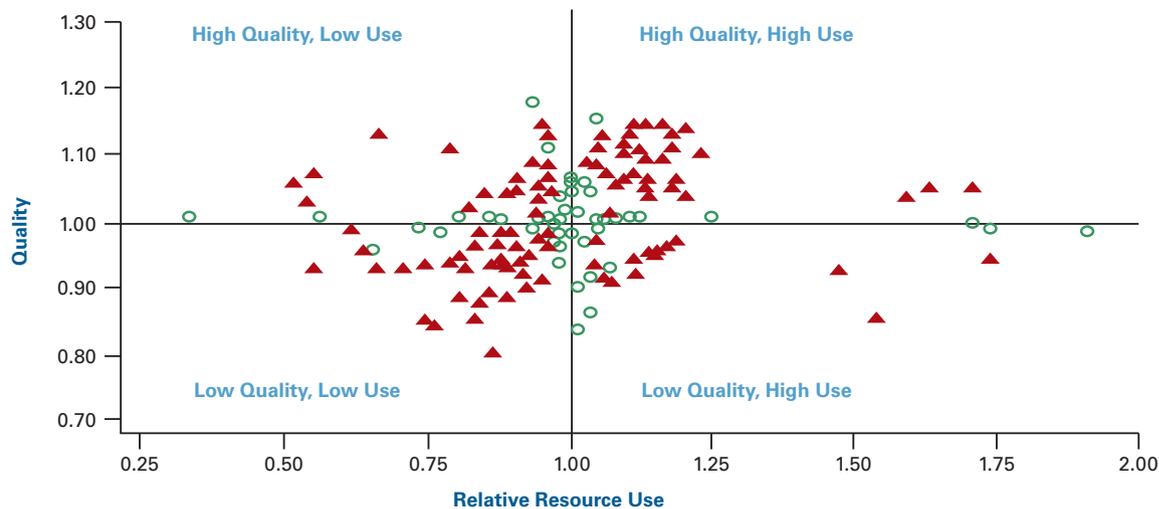
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■ **Figure 3.** Scatterplots of Diabetes Mellitus Quality and Relative Resource Use, 2008^a

A. Diabetes Mellitus Quality and Combined Medical Care Services



B. Diabetes Mellitus Quality and Ambulatory Pharmacy Services



^aRed triangles indicate health plans for which 90% confidence intervals do not include either axis (1.00). Green circles indicate health plans for which 90% confidence intervals include 1 axis (1.00).

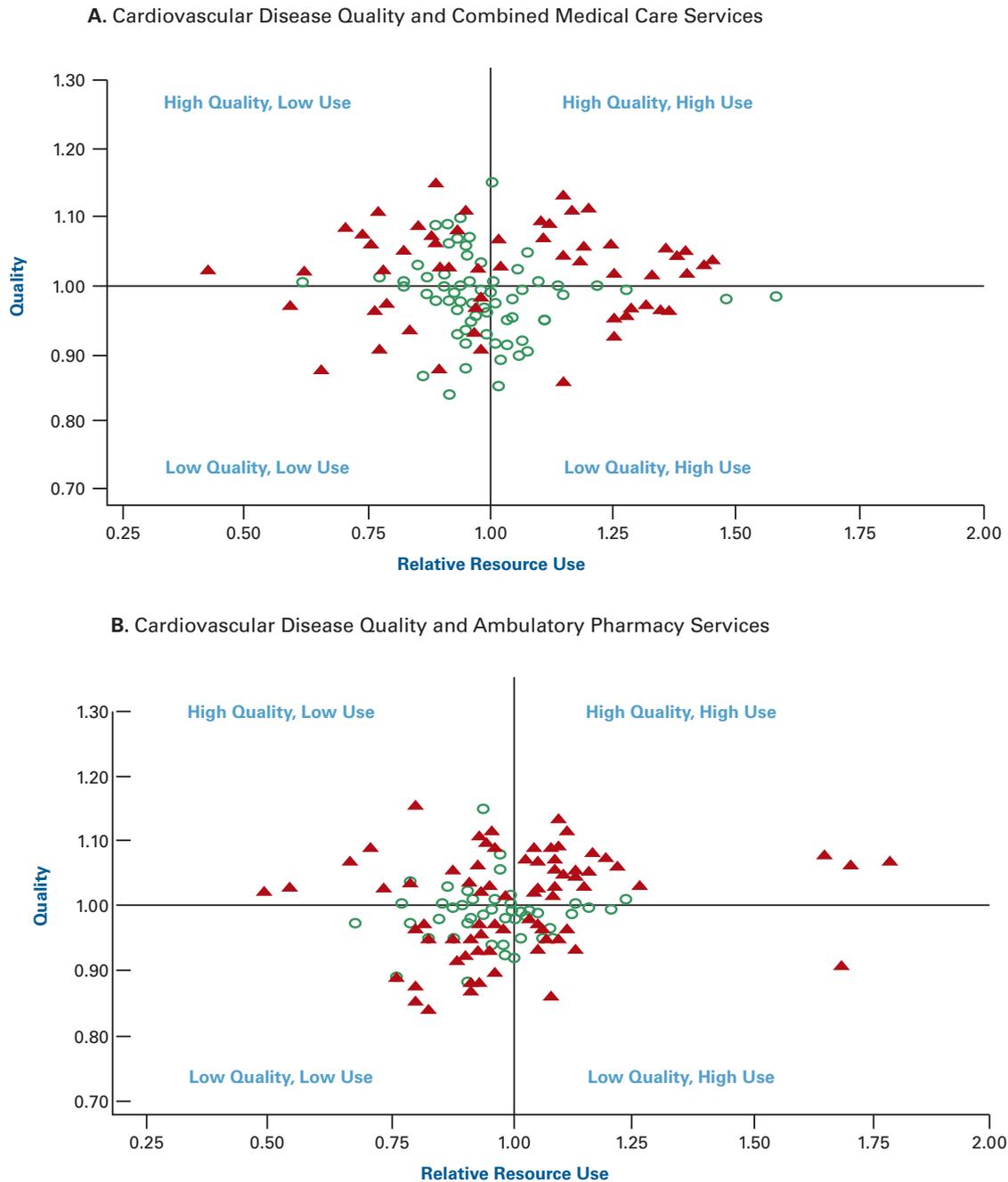
health plans included represent a substantial proportion of the commercial HMO plans and are an important market segment. Moreover, the results tend to support the conclusions by Wennberg et al¹² related to expenditures in the Medicare program, suggesting that the findings are robust. The definition of value used in his study is limited to the HEDIS measures, which included clinical process and intermediate outcome measures but did not include measures of patient experience of care or

hospital-related quality. Data are limited to patients with diabetes or cardiovascular disease; while these are highly prevalent and costly diseases, it is unclear if our findings apply to other diseases. Similar analyses are needed for preferred provider organizations and for Medicaid and Medicare health plans.

The HEDIS RRU measures reflect the use of all services received by patients with diabetes or cardiovascular disease. While this inclusiveness of services avoids the issue of exces-

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■ **Figure 4.** Scatterplots of Cardiovascular Disease Quality and Relative Resource Use, 2008^a



^aRed triangles indicate health plans for which 90% confidence intervals do not include either axis (1.00). Green circles indicate health plans for which 90% confidence intervals include 1 axis (1.00).

sive partitioning of cost found in episode-of-care cost measures, it also leads to inclusion of costs that may not be directly related to the measured condition. The resource use measures are adjusted for age, sex, major chronic condition, and the presence of chronic comorbid conditions. These represent the most important predictors of cost identified in the literature. Indirect standardization ensures that the health plans are treated equal-

ly with respect to these attributes, but it is possible that health plans differ on an unobserved variable. However, because these data are cross-sectional, we do not believe that there was an opportunity for health plans to game the measure by selecting on unobservables with an intention to bias these measures. There may be residual bias in the unobservables for other purposes (eg, selection of more compliant patients), and this represents a

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■ **Table 4.** Distribution of Health Plans According to Quality and Resource Use^a

Low Resource Use	High Resource Use
Relative High Quality	
High Quality and Low Resource Use	
Combined medical care services	Combined medical care services
13.9% Of plans for diabetes mellitus	5.2% Of plans for diabetes mellitus
15.2% Of plans for cardiovascular disease	14.4% Of plans for cardiovascular disease
Ambulatory pharmacy services	
11.0% Of plans for diabetes mellitus	19.1% Of plans for diabetes mellitus
14.4% Of plans for cardiovascular disease	21.6% Of plans for cardiovascular disease
Relative Low Quality	
Low Quality and Low Resource Use	
Combined medical care services	Combined medical care services
8.1% Of plans for diabetes mellitus	9.6% Of plans for diabetes mellitus
14.5% Of plans for cardiovascular disease	5.6% Of plans for cardiovascular disease
Ambulatory pharmacy services	
23.1% Of plans for diabetes mellitus	8.7% Of plans for diabetes mellitus
18.4% Of plans for cardiovascular disease	8.8% Of plans for cardiovascular disease
^a For combined medical care services, 58% and 55% of plans are not significantly different from the mean at the 90% confidence level on both dimensions for diabetes mellitus and cardiovascular disease, respectively. For ambulatory pharmacy services, 38% and 37% of plans are not significantly different from the mean at the 90% confidence level on both dimensions for diabetes mellitus and cardiovascular disease, respectively.	

possible limitation. In addition, these data reflect only a cross-sectional analysis of the relationship between quality and resource use and do not directly prove whether improving quality would lead to changes in resource use or vice versa.

In conclusion, measures of resource use along with measures of quality of care provide objective information that can help define the value of a health plan or delivery system. Although this study did not determine causality, the findings suggest that health plans and practices can create higher value by improving quality of care without large increases in resource use or by maintaining the same quality of care with decreased resource use.

Author Affiliations: From National Quality Forum (SET), Washington, DC; National Committee for Quality Assurance (RCS, MAT, SHS, LGP), Washington, DC.

Funding Source: This study was funded by grant 20070496 from The Commonwealth Fund.

Author Disclosures: The authors (RCS, MAT, SHS, LGP) report their employment with the National Committee for Quality Assurance, which owns the copyright to the measures presented in the study. Ms Turbyville reports previous employment with the National Committee for Quality Assurance.

Authorship Information: Concept and design (SET, RCS, SHS, LGP); acquisition of data (SET, SHS); analysis and interpretation of data (SET, RCS, SHS, LGP); drafting of the manuscript (SET, RCS, MAT, SHS, LGP); critical revision of the manuscript for important intellectual content (SET, RCS, MAT, SHS, LGP); statistical analysis (RCS); obtaining funding (SHS, LGP); administrative, technical, or logistic support (SET, MAT, SHS, LGP); and supervision (SHS, LGP).

Address correspondence to: Sally E. Turbyville, MS, National Quality Forum, 601 13th St NW, Ste 500 N, Washington, DC 20005. E-mail: sturbyville@qualityforum.org.

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