

Receipt of Disease-Modifying Antirheumatic Drugs Among Patients With Rheumatoid Arthritis in Medicare Managed Care Plans

Gabriela Schmajuk, MD, MS

Amal N. Trivedi, MD, MPH

Daniel H. Solomon, MD, MPH

Edward Yelin, PhD

Laura Trupin, MPH

Eliza F. Chakravarty, MD, MS

Jinoos Yazdany, MD, MPH

DESPITE EVIDENCE-BASED GUIDELINES recommending early and aggressive treatment of active rheumatoid arthritis (RA),^{1,2} recent population-based studies of disease-modifying antirheumatic drug (DMARD) use in patients with RA report consistently low rates of DMARD receipt (30%-52%).³⁻⁷ One limitation of the existing literature is that US studies have only examined groups with low socioeconomic status covered by state-funded insurance programs or within a single health plan and geographic area; therefore, these data may not be broadly generalizable.^{4,6}

In 2005, the National Committee for Quality Assurance revised the Healthcare Effectiveness Data and Information Set (HEDIS), a set of performance indicators used by health plans to report on their quality of care, to include a measure assessing whether patients with RA received a prescription for a DMARD. Medicare managed care plans (alternatives to traditional Medicare fee-for-service programs that provide hospital, outpatient, and pharmacy coverage to more than 8 million Medicare beneficiaries) are required to report their performance on all HEDIS measures. There-

Context In 2005, the Healthcare Effectiveness Data and Information Set (HEDIS) introduced a quality measure to assess the receipt of disease-modifying antirheumatic drugs (DMARDs) among patients with rheumatoid arthritis (RA).

Objective To identify sociodemographic, community, and health plan factors associated with DMARD receipt among Medicare managed care enrollees.

Design, Setting, and Participants We analyzed individual-level HEDIS data for 93 143 patients who were at least 65 years old with at least 2 diagnoses of RA within a measurement year (during 2005-2008). Logistic regression models with generalized estimating equations were used to determine factors associated with DMARD receipt and logistic regression was used to adjust health plan performance for case mix.

Main Outcome Measures Receipt or nonreceipt of DMARD.

Results The mean age of patients was 74 years; 75% were women and 82% were white. Overall performance on the HEDIS measure for RA was 59% in 2005, increasing to 67% in 2008 (*P* for trend <.001). The largest difference in performance was based on age: patients aged 85 years and older had a 30 percentage point lower rate of DMARD receipt (95% confidence interval [CI], -29 to -32 points; *P* <.001), compared with patients 65 to 69 years of age, even after adjusting for other factors. Lower percentage point rates were also found for patients who were men (-3 points; 95% CI, -5 to -2 points; *P* <.001), of black race (-4 points; 95% CI, -6 to -2 points; *P* <.001), with low personal income (-6 points; 95% CI, -8 to -5 points; *P* <.001), with the lowest zip code-based socioeconomic status (-4 points; 95% CI, -6 to 2 points; *P* <.001), or enrolled in for-profit health plans (-4 points; 95% CI, -7 to 0 points; *P* <.001); and in the Middle Atlantic region (-7 points; 95% CI, -13 to -2 points; *P* <.001) and South Atlantic regions (-11 points; 95% CI, -20 to -3 points; *P* <.001) as compared with the Pacific region. Performance varied widely by health plan, ranging from 16% to 87%.

Conclusions Among Medicare managed care enrollees carrying a diagnosis of RA between 2005 and 2008, 63% received a DMARD. Receipt of DMARDs varied based on demographic factors, socioeconomic status, geographic location, and health plan.

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fore, HEDIS data from Medicare managed care plans provide a nationally representative sample of the managed care population older than 65 years and avoid the selection bias associated with studies of patients in specialty care or in health plans with voluntary reporting.

In this study, we examined variations in DMARD receipt in a large cohort of managed care patients diag-

Author Affiliations: Department of Medicine, Division of Rheumatology, Stanford University, Stanford, California (Drs Schmajuk and Chakravarty); Department of Community Health and Medicine, Brown University, Providence, Rhode Island (Dr Trivedi); Department of Medicine, Division of Rheumatology, Brigham and Women's Hospital, Harvard University, Boston, Massachusetts (Dr Solomon); and Department of Medicine, Division of Rheumatology, University of California, San Francisco, San Francisco (Dr Yelin, Ms Trupin, and Dr Yazdany).

Corresponding Author: Gabriela Schmajuk, MD, MS, Stanford University, Department of Medicine, Division of Rheumatology, 1000 Welch Rd, Ste 203, Stanford, CA 94304 (schmajuk@gmail.com).

nosed with RA. To our knowledge, this is the first comprehensive study to assess sociodemographic, community, and health plan factors associated with DMARD receipt.

METHODS

Study Population and Data Sources

Individual-level HEDIS data were used for all Medicare managed care plans from the Centers for Medicare & Medicaid Services (CMS) for 4 reporting years (2006-2009), covering clinical care delivered (2005-2008). Each observation included a participant's health identification code, health plan name, and variables indicating eligibility for and receipt of care consistent with the HEDIS RA measure. The study protocol was approved by the institutional review boards of Stanford University and the University of California, San Francisco and by the CMS privacy board; an exemption to informed consent was granted because the data set used was deidentified.

Information about data collection and CMS-sponsored audits has been published previously.^{8,9} Using each participant's identification code, we matched beneficiaries eligible for the HEDIS RA measure with the Medicare denominator file for the corresponding year. This file contains demographic information on race, age, sex, zip code, and county of residence. The file also contains information on whether beneficiaries had received state buy-in assistance for their Medicare Part B premiums or co-payments, a marker of low personal income.¹⁰ We achieved a match rate of 98%. Zip code-based socioeconomic status was calculated using variables from the 2000 US Census and the Agency for Healthcare Research and Quality's socioeconomic status index score.¹¹ Health professional shortage area counties (those with a complete or partial shortage of physicians) were defined using the Area Resource File.¹² We obtained health plan characteristics (model type, plan age, enrollment size, and tax status) from the Interstudy Competitive Edge data set or by contacting the health plans directly.¹³

Inclusion criteria were eligibility for the HEDIS RA measure per the specification, participant age of at least 65 years, residence in the 50 US states, and survival through the measurement year. There were 180 153 observations that met these criteria. We excluded 94 health plans (with 12 862 observations) that appeared to have incomplete reporting, as evidenced by missing data for more than 10% of eligible enrollees or less than 10% performance on the HEDIS RA measure. Because the data set covers multiple years, individuals could have as many as 4 observations; we selected 1 observation at random from each individual to avoid multiple levels of clustering in the statistical analysis. The final study sample included 93 143 observations from 299 health plans.

Measure Specification

The National Committee for Quality Assurance's HEDIS RA measure aimed to assess "whether patients diagnosed with RA have had at least one ambulatory prescription dispensed for a DMARD [during the measurement year]."¹⁴ Patients in the denominator for the measure: (1) were continuously enrolled in a Medicare managed care plan during the measurement year (no more than one 45-day gap in enrollment allowed); (2) had both medical and pharmacy benefits; and (3) had at least 2 face-to-face physician encounters with different dates of service in an ambulatory or nonacute patient setting during the measurement year with any diagnosis of RA (*International Classification of Diseases, Ninth Revision [ICD-9]* codes 714.0, 714.1, 714.2, or 714.81). Patients who were pregnant or carried a diagnosis of human immunodeficiency virus during the measurement year were excluded from the measure. Accepted drugs included traditional and biologic DMARDs: abatacept, adalimumab, anakinra, azathioprine, cyclophosphamide, cyclosporine, etanercept, gold, hydroxychloroquine, infliximab, leflunomide, methotrexate, minocycline, penicillamine, rituximab, staphylococcal protein A, and sulfasalazine. The numerator for the measure was a dichotomous measure of DMARD receipt (yes/no); the names of the specific DMARDs received were not recorded.

receipt (yes/no); the names of the specific DMARDs received were not recorded.

Study Variables

The dependent variable was DMARD receipt among eligible enrollees. Independent variables included age, race (white, black, other), sex, low personal income (as proxied by the state buy-in variable), zip code-based socioeconomic status index score (divided into quintiles), residence in a physician shortage county, geographic region, and health plan variables (model type, plan age, enrollment size, and tax status). Information on race in the Medicare denominator file was derived from Social Security Administration data obtained at the time of an individual's application for a new or replacement Social Security card and has been shown to be reliable for individuals designated as white or black.^{15,16}

Statistical Analysis

We assessed demographic, socioeconomic, and health plan characteristics of participants in the final study sample and used χ^2 or *t* tests to compare participants receiving DMARDs with those who were not. We determined the overall and yearly performance on the HEDIS RA measure. For each subgroup of participants (defined by demographic, socioeconomic, and health plan characteristics), we calculated performance on the HEDIS RA measure and the absolute difference in performance compared with the relevant referent group.

To determine adjusted performance differences among subgroups, we fitted linear models with generalized estimating equations to predict DMARD receipt, adjusted for covariates and accounting for the clustering of individuals within health plans.¹⁷ Variables in the multivariate models were determined a priori based on prior studies of DMARD use and HEDIS measure fulfillment.⁸ All covariates were tested to ensure noncollinearity. We fitted 3 versions of these models: model 1 adjusted for age, race, sex, income, and year; model 2 included all variables in model 1 in addition to zip code-based socioeconomic status, geographic region, and residence in a physician shortage county; and model

3 included all variables in model 2 in addition to health plan variables (model type, plan age, enrollment size, and tax status). Results of the models were reported as percentage point differences. We performed additional sensitivity analyses using the first year of data contributed by a given individual, the last year of data contributed by an individual, and using the “best case” year of data contributed by an individual (ie, if the participant received a DMARD in some years but not others, categorizing the participant as having received a DMARD).

Last, we assessed the variability in the performance of different health plans on the HEDIS RA measure. Health plans with fewer than 20 beneficiaries in the final study sample were excluded, leav-

ing 245 plans. Health plan performance on the measure was calculated by aggregating the individual-level data. We assessed performance on the HEDIS RA measure with logistic regression models to adjust health plan performance for case mix (including variables for age, race, sex, income as proxied by state buy-in, zip code–based socioeconomic status, residence in a physician shortage county, and geographic region). This process has been described at length elsewhere.¹⁸ Briefly, we applied regression coefficients from multivariate logistic regressions to calculate the predicted probability of DMARD receipt in each health plan for every individual in the combined sample. By averaging the predicted probabilities by health plan, we

calculated a directly standardized adjusted performance rate, defined as the predicted performance for each plan if every plan had the same distribution of member characteristics.

Statistical tests were 2-sided with $P < .05$ considered statistically significant. We were able to detect a minimum difference of 2.2 percentage points in the individual subgroup analyses with 80% power. All analyses were performed using SAS statistical software (version 9.2; Cary, North Carolina).

RESULTS

The characteristics of the individual participants and health plans in the study sample are listed in TABLE 1 and TABLE 2. Overall performance on the HEDIS RA measure in the study sample was 63%. In 2005, 59% of the sample received a DMARD; in 2006, 58%; in 2007, 62%; and in 2008, 67% (P for trend $< .001$).

The largest difference in performance on the HEDIS RA measure was based on age: participants aged 85 years and older had a 30 percentage point lower rate of DMARD receipt (95% CI 29–32 points) compared with patients 65 to 69 years old, even after adjusting for other factors (TABLE 3). Other participant categories less likely to receive a DMARD were men, individuals identified by race as black or other, individuals with low personal income, participants in lower socioeconomic status zip codes, and individuals in the Middle and South Atlantic regions. Patients living in a health professional shortage area had slightly lower performance (–3 percentage points; 95% CI, –1 to –5 points). In addition, patients enrolled in a for-profit health plan had a 4 percentage point lower rate of DMARD receipt (95% CI, 0 to –7 points) compared with patients enrolled in a not-for-profit health plan.

A model similar to model 3 in which the separate measures of personal and neighborhood socioeconomic status were replaced by 1 categorical variable representing the 4 possible combinations for personal income (low/not low) and lowest quintile of zip code–based socioeconomic status (yes/no) revealed a stepped relationship. Individuals with

Table 1. Sociodemographic Characteristics of Patients Eligible for the HEDIS Rheumatoid Arthritis Measure and Characteristics of Health Plans^a

Characteristics	No. (%)		
	All Enrollees (N = 93 143)	DMARD	
		Receiving (n = 58 506)	Not Receiving (n = 34 637)
Women	70 186 (75.4)	44 565 (76.2)	25 621 (74.0)
Age, mean (SD), y	74.4 (6.7)	73.4 (6.2)	76.0 (7.1)
65-69	26 440 (28.4)	18 991 (32.5)	7 449 (21.5)
70-74	24 356 (26.2)	16 106 (27.5)	8 250 (23.9)
75-79	20 930 (22.5)	12 722 (21.8)	8 208 (23.7)
80-84	13 609 (14.6)	7 458 (12.7)	6 151 (17.8)
≥85	7 808 (8.4)	3 249 (5.5)	4 559 (13.2)
Race			
White	76 275 (81.9)	48 858 (83.5)	27 417 (79.2)
Black	10 229 (11.0)	5 806 (9.9)	4 423 (12.8)
Other	6 639 (7.1)	3 862 (6.6)	2 777 (8.0)
Low personal income	12 297 (13.2)	6 762 (11.6)	5 535 (16.0)
SES indicator (zip code), mean (SD) ^b	50.9 (3.8)	51.0 (3.8)	50.6 (3.9)
Health professional shortage area (part or whole)	79 201 (85.1)	49 129 (84.0)	30 072 (86.9)
Geographic division			
New England	4 087 (4.4)	2 734 (4.7)	1 353 (3.9)
Middle Atlantic	17 746 (19.0)	10 461 (17.8)	7 285 (21.1)
East North Central Midwest	7 838 (8.4)	5 423 (9.3)	2 415 (7.0)
West North Central Midwest	5 719 (6.1)	4 067 (7.0)	1 652 (4.8)
South Atlantic	16 035 (17.2)	8 280 (14.2)	7 755 (22.4)
East South Central	3 626 (3.9)	2 212 (3.8)	1 414 (4.1)
West South Central	6 712 (7.2)	4 134 (7.1)	2 578 (7.4)
Mountain	8 015 (8.6)	5 584 (9.5)	2 431 (7.0)
Pacific	23 365 (25.1)	15 631 (26.7)	7 734 (22.3)

Abbreviations: DMARD, disease-modifying antirheumatic drug; HEDIS, Healthcare Effectiveness Data and Information Set; SES, socioeconomic status.

^aThe χ^2 or t test was performed to compare the characteristics of individuals who received DMARDs with those who did not; all tests resulted in P values of less than .001.

^bValues refer to the Agency for Healthcare Research and Quality's SES indicator variable based on zip code.¹¹ This is an indexed value based on US Census variables. Higher values indicate higher SES (US mean, 50).

both personal and neighborhood poverty had the lowest performance on the HEDIS RA measure (−7.1 percentage points; 95% CI, −9.8 to −4.4 points) compared with those without low personal income and living in any of the top 4 quintiles of socioeconomic status zip codes, individuals with only 1 type of poverty—a slightly better living standard (low personal income only, −6.9 percentage points; 95% CI, −8.9 to −5.0 points), and lowest socioeconomic status zip codes only (−2.4 percentage points; 95% CI, −4.1 to −0.8 points).

Sensitivity analyses in which the first or the most recent year of data contributed by an individual did not change the results of the multivariate models. Similarly, using the best case year of data showed that 66% of patients received a DMARD overall. Again, the results of the multivariate models remained unchanged.

Performance varied widely by health plan (FIGURE) with rates ranging from 16% to 87%, even after adjusting for case mix. The range of adjustment due to case mix was −16% to +21% (mean, −1%; interquartile range, −4% to 1%). The case mix adjustments were smaller than the standard error of the rates for the majority of plans; in other words, the variation introduced into the performance rates by case mix was smaller than the sampling variability, but not negligible. A sensitivity analysis using the best case year of data only changed adjusted health plan performance slightly (range, 15%-89%).

COMMENT

In this nationally representative sample of patients in Medicare managed care with a diagnosis of RA, we found wide variations in DMARD receipt based on sociodemographics, geographic location, and health plan. Prior research has found that disparities in outcomes for patients with RA exist on the basis of race and socioeconomic status.¹⁹⁻²² Although RA was once an inevitably deforming and disabling condition, the development of new DMARDs and support for their early use has dramatically improved clinical outcomes for many

Table 2. Characteristics of Health Plans and Patients Eligible for the HEDIS Rheumatoid Arthritis Measure^a

Characteristics	Health Plans (n = 245) ^b	All Enrollees (N = 93 143)	No. (%)	
			Receiving (n = 58 506)	Not Receiving (n = 34 637)
Model type				
Group/staff	131 (53.5)	45 373 (48.7)	28 146 (48.1)	17 227 (49.7)
Independent practice association	79 (32.2)	41 810 (44.9)	26 428 (45.1)	15 382 (44.5)
Mixed/network/other	35 (14.3)	5960 (6.4)	3952 (6.8)	2008 (5.8)
Year HMO started operation				
After 2000	71 (29.0)	13 968 (15.0)	8892 (15.2)	5076 (14.7)
1980-1999	136 (55.5)	48 894 (52.5)	29 211 (49.9)	19 683 (56.9)
Before 1980	38 (15.5)	30 281 (32.5)	20 423 (34.9)	9858 (28.4)
Plan size				
0-24 999	155 (63.3)	16 955 (18.2)	10 835 (18.5)	6120 (17.7)
25 000-99 999	77 (31.4)	41 107 (44.1)	25 972 (44.4)	15 135 (43.7)
≥100 000	13 (5.3)	35 081 (37.7)	21 719 (37.1)	13 362 (38.6)
Profit status				
Not for profit	70 (28.6)	31 508 (33.8)	21 185 (36.2)	10 323 (29.8)
For profit	175 (71.4)	61 635 (66.2)	37 341 (63.8)	24 294 (70.2)

Abbreviations: DMARD, disease-modifying antirheumatic drug; HEDIS, Healthcare Effectiveness Data and Information Set; HMO, health maintenance organization.

^aThe χ^2 or *t* test was performed to compare the characteristics of individuals who received DMARDs with those who did not; all tests resulted in *P* values of less than .001.

^bRefers to health plans used in health plan analysis (see Figure).

patients.^{1,23-25} This study suggests that 1 mechanism for the sociodemographic disparities in RA outcomes in the United States may relate to differences in DMARD receipt.

Although we found that more than one-third of patients in this cohort were not receiving a DMARD, the optimal rate of DMARD receipt for this cohort is difficult to estimate. Some patients in the HEDIS denominator for this measure may have declined treatment, had quiescent disease, or had contraindications to all 17 eligible drugs. In a recent study using the German Biologic Register, Ziegler et al²⁶ report that as many as 19% of patients did not receive a DMARD within a calendar year and that as many as 11% had quiescent disease or relative contraindications to available drugs. In our study, the proportion of patients in these categories may be even higher because of an older mean age and possibly a higher rate of RA misdiagnosis (because RA diagnoses were drawn from administrative sources).

We found that DMARD receipt varied significantly with sex and age; the

oldest patients had the lowest rate of DMARD receipt and men had slightly lower DMARD receipt compared with women. Although there are conflicting data around disparities based on sex, recent studies have shown that older individuals are less likely to receive DMARDs.^{3,4,7,27-29} Age differences may be due to age bias,²⁷ increased prevalence of comorbidities that may represent contraindications to DMARD use,⁴ patient preferences against DMARD receipt, or a milder or different clinical course among older patients. Future studies using a large clinical data set could further elucidate these issues.

In addition, we found that individuals with low personal income and those living in low socioeconomic status neighborhoods had reduced DMARD receipt. Lacaille et al²⁸ report similar findings in a population-based study from Canada. Low neighborhood socioeconomic status exerted an independent negative effect on DMARD receipt beyond that of personal low income; this finding has been described previously in studies of physi-

cal and mental health outcomes and access to care in patients with other chronic conditions.^{30,31}

This study found significant variation in performance on the HEDIS RA measure based on geography, with pa-

tients in the Middle and South Atlantic regions using DMARDs at rates 10 percentage points lower than patients in

Table 3. Observed and Adjusted Performance Rates on the HEDIS Rheumatoid Arthritis Measure

Characteristics	No. of Patients	Observed Rate, %	Difference, Percentage Points			
			Unadjusted	Adjusted (95% CI), by Model ^a		
				1	2	3
Sex						
Men	22 957	60.9	-2.6	-4.0 (-5.6 to -2.4)	-3.5 (-4.9 to -2.0)	-3.3 (-4.7 to -1.9)
Women	70 186	63.5	Reference	Reference	Reference	Reference
Patient age, y						
65-69	26 449	71.8	Reference	Reference	Reference	Reference
70-74	24 359	66.0	-5.8	-5.2 (-6.2 to -4.2)	-5.2 (-6.1 to -4.2)	-5.0 (-5.9 to -4.2)
75-79	20 923	60.8	-11.0	-10.3 (-11.7 to -9.0)	-10.5 (-11.7 to -9.4)	-10.4 (-11.4 to -9.3)
80-84	13 607	54.8	-17.0	-16.3 (-18.2 to -14.4)	-16.7 (-18.2 to -15.1)	-16.6 (-18.0 to -15.0)
≥85	7805	41.5	-30.3	-29.6 (-31.3 to -27.9)	-30.3 (-31.8 to -28.9)	-30.3 (-31.7 to -28.7)
Race						
White	76 275	64.0	Reference	Reference	Reference	Reference
Black	10 229	56.6	-7.4	-7.5 (-9.2 to -5.8)	-4.1 (-6.5 to -2.7)	-4.3 (-6.1 to -2.5)
Other	6639	58.2	-5.8	-4.2 (-6.8 to -1.6)	-4.6 (-6.5 to -2.7)	-5.0 (-7.2 to -2.7)
Personal income						
Not low	80 851	64.0	Reference	Reference	Reference	Reference
Low	12 292	55.0	-9.0	-7.8 (-9.3 to -6.4)	-6.6 (-8.3 to -4.9)	-6.3 (-7.9 to -4.8)
Zip code-based socioeconomic status						
Quintile 1 (low)	19 696	59.8	-7.2		-4.5 (-6.4 to -2.6)	-4.0 (-5.8 to -2.3)
Quintile 2	19 205	60.5	-6.5		-4.2 (-5.7 to -2.6)	-3.7 (-5.2 to -2.2)
Quintile 3	18 236	62.9	-4.1		-2.4 (-3.8 to -0.9)	-2.0 (-3.5 to -0.6)
Quintile 4	17 862	64.3	-2.7		-1.8 (-3.1 to -0.1)	-1.6 (-2.7 to 0.0)
Quintile 5 (high)	18 144	67.0	Reference		Reference	Reference
Geographic division						
New England	4086	67.0	0.1		0.0 (-3.8 to 4.7)	0.0 (-4.8 to 5.8)
Middle Atlantic	17 744	58.8	-8.1		-9.4 (-14.0 to -4.7)	-7.6 (-12.9 to -2.2)
East North Central Midwest	7839	69.2	2.3		0.2 (-4.1 to 4.5)	2.6 (-1.6 to 6.9)
West North Central Midwest	5719	71.1	4.2		2.2 (-3.3 to 7.6)	2.5 (-4.1 to 9.0)
South Atlantic	16 037	51.6	-15.3		-15.1 (-26.0 to -4.2)	-11.3 (-19.7 to -2.8)
East South Central	3626	61.0	-5.9		-8.3 (-17.0 to 0.4)	-5.3 (-14.3 to 3.8)
West South Central	6713	61.6	-5.3		-6.3 (-10.7 to -1.9)	-2.6 (-7.6 to 2.3)
Mountain	8015	69.7	2.8		0.1 (-3.2 to 5.8)	2.9 (-1.3 to 7.1)
Pacific	23 364	66.9	Reference		Reference	Reference
Health professional shortage area						
No shortage	13 873	67.4	Reference		Reference	Reference
Shortage	79 203	62.0	-5.4		-3.4 (-5.2 to -1.6)	-2.8 (-4.6 to -1.2)
Model type						
Group/staff	45 373	62.0	Reference			Reference
Independent practice association	41 814	63.2	1.2			2.7 (-1.6 to 7.1)
Mixed/network/other	5956	66.3	4.3			1.4 (-2.2 to 5.0)
Year HMO started operation						
After 2000	13 969	63.4	-4.1			-1.2 (-6.6 to 4.3)
1980-1999	48 893	59.7	-7.8			-4.2 (-8.4 to 0.0)
Before 1980	30 281	67.5	Reference			Reference
Plan size						
0-24 999	16 958	63.9	2.0			1.0 (-4.2 to 6.2)
25 000-99 999	41 104	63.1	1.2			1.4 (-3.3 to 6.1)
≥100 000	35 081	61.9	Reference			Reference
Profit status						
Not for profit	31 506	67.2	Reference			Reference
For profit	61 637	60.6	-6.6			-3.7 (-7.2 to -0.2)

Abbreviations: CI, confidence interval; HEDIS, Healthcare Effectiveness Data and Information Set; HMO, health maintenance organization.
^aAdjusted for all listed variables in addition to calendar year (see Methods for specifications of models).

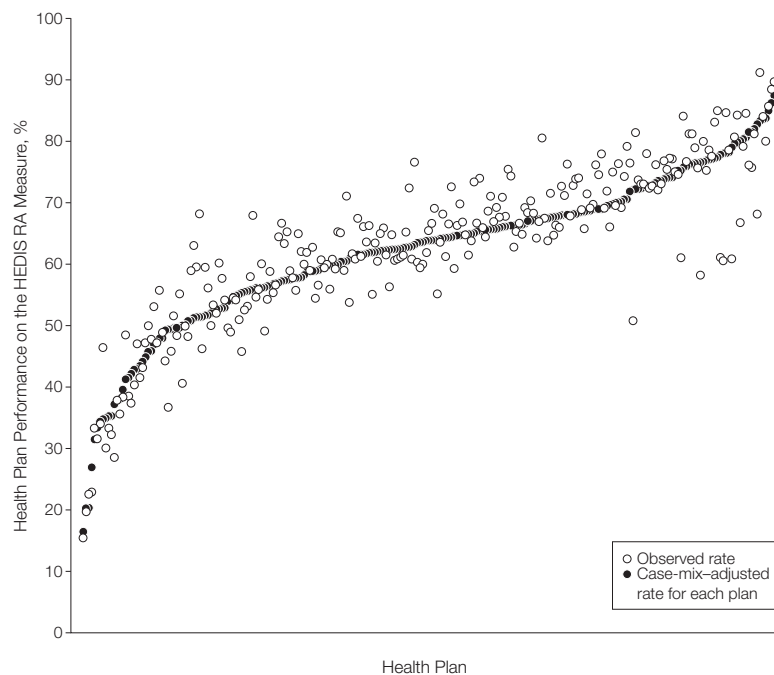
other areas of the United States, even after adjusting for characteristics of individual patients. Such geographic disparities have been noted in other analyses of Medicare quality and spending.³²⁻³⁴ This study also found a small but significant increase in DMARD receipt in enrollees of not-for-profit health plans compared with enrollees of for-profit health plans, which has also been reported for other HEDIS measures.³⁵

The dramatic variations in performance on the HEDIS RA measure among different health plans are concerning. This study found a 70 percentage point spread between the best and worst performing plans. Possible explanations for these differences include variations in the availability or accessibility of specialty care within a health plan or differences in the ability of the health plan to appropriately identify patients in the numerator and denominator for the measure. At least 1 other study has found that health plans can influence quality of care independent of the selection of physician organizations with which they contract.³⁶

The primary strength of this study is that it provides the first examination of DMARD receipt in a nationally representative sample of patients in managed care plans. Because we enhanced data obtained from HEDIS with multiple other data sources, we were able to investigate the influence of individual, community, and health care system factors on DMARD receipt.

However, the study has several limitations. RA diagnoses were obtained from administrative sources. Gabriel's population-based study measuring the accuracy of administrative diagnoses for RA showed only moderate (57%) positive predictive value of a single diagnostic code for RA compared with a criterion standard that included medical record review.³⁷ Identification of RA patients in this study were based on 2 RA diagnosis codes from 2 face-to-face physician encounters with different dates of service; still, some patients in this study may have been misclassified as having RA when in fact they carried an

Figure. Observed and Case Mix–Adjusted Rate of Performance by Health Plans on the Healthcare Effectiveness Data and Information Set (HEDIS) Rheumatoid Arthritis Measure (n=245)



Plans with fewer than 20 observations were excluded.

alternate diagnosis or had quiescent disease that might not require DMARDs.

In addition, we lacked detailed clinical information on factors such as disease activity, comorbidities, contraindications to DMARD use, or patient preferences. However, the number of patients with contraindications or intolerance to all 17 available DMARDs (including hydroxychloroquine and sulfasalazine) was likely to be small, as demonstrated by very high rates of DMARD receipt reported for patients seen in specialty clinics.²⁶ We did not have information on the treating physician's specialty for each individual patient or the number of rheumatology specialists serving a particular health plan. Because physician specialty has been identified as an important predictor of quality care in other studies,^{4,5,28} this represents a possible explanation for the disparities we observed in this study's population. However, we did include a variable (health professional shortage areas) that assessed the den-

sity of physicians, including specialists, in a patient's county and found that patients residing in a physician shortage county were significantly less likely to receive a DMARD.

Finally, we were not able to assess the allowances on prescription drug benefits for each health plan, which may be an important factor associated with DMARD receipt. Although annual out-of-pocket costs among patients in Medicare managed care plans for biologic DMARDs can exceed \$4000,³⁸ drugs such as hydroxychloroquine or methotrexate cost less than \$1000 per year. Still, patients with state buy in or living in lower socioeconomic status neighborhoods might be less likely to receive a DMARD because they are unable to afford copayments or other forms of cost sharing for a DMARD.³⁹ If patients with lowest socioeconomic status were clustered within a few health plans, cost burden may also be a mechanism for the variation found in health plan performance.

In summary, we found significant differences in DMARD receipt based on individual, community, and health plan characteristics. Given the enormous individual and societal costs associated with RA, and increasing substantial evidence that DMARDs can reduce these costs, variations in DMARD receipt based on demographics, socioeconomic status, and geography are unacceptable. Because optimizing DMARD use is the primary mechanism for decreasing the significant public health impact of RA in the United States, targeting educational and quality improvement interventions to patients who are underusing DMARDs and their clinicians will be important to eliminate these disparities. Additional studies of population-wide cohorts that include clinical data and disease activity measures are needed to validate our findings.

Author Contributions: Dr Schmajuk had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Schmajuk, Trivedi, Yelin, Yazdany.

Acquisition of data: Schmajuk, Yazdany.

Analysis and interpretation of data: Schmajuk, Trivedi, Solomon, Chakravarty, Trupin, Yazdany.

Drafting of the manuscript: Schmajuk, Yelin, Yazdany.

Critical revision of the manuscript for important intellectual content: Schmajuk, Trivedi, Solomon, Yelin, Chakravarty, Trupin, Yazdany.

Statistical analysis: Schmajuk, Yelin, Trupin, Yazdany.

Obtained funding: Schmajuk, Yelin, Yazdany.

Administrative, technical, or material support: Trivedi, Yazdany.

Study supervision: Solomon, Chakravarty, Yazdany.

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