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Utilizing New Prescription Drugs: Disparities among Non-Hispanic Whites, Non-Hispanic Blacks, and Hispanic Whites

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Objective. To examine racial and ethnic disparities in new prescription drug use.
Data Sources/Study Setting. Secondary data analyses of the Medical Expenditure Panel Survey (1996–2001), a national survey representative of U.S. noninstitutionalized civilian population. Drug approval dates were from the GenRx database of Mosby.
Study Design. A negative binomial model was used to compare annual number of times when new drugs were obtained across racial and ethnic groups. Covariates in the model were demographic, economic characteristics, and health status. Drugs were considered new if approved within the past 5 years. We compared non-Hispanic whites with non-Hispanic blacks, and non-Hispanic whites with Hispanic whites, respectively, to examine racial and ethnic disparities separately.
Principal Findings. Descriptive analyses found smaller racial disparities than ethnic disparities: the average annual number of times when new drugs were obtained was higher among non-Hispanic whites than non-Hispanic blacks (1.71 versus 1.36; $p<.01$) and Hispanic whites (1.71 versus 1.11; $p<.01$). Multivariate analyses found smaller ethnic than racial disparities: the number was 22–33 percent lower among non-Hispanic blacks than non-Hispanic whites (significant), and 5–16 percent lower among Hispanic whites than non-Hispanic whites (not always significant), respectively. While the absolute racial disparities decreased over the early years of the life cycles of the products, the reduction in disparities over time was not significant.
Conclusions. There are racial disparities in the use of new medications, which persist during the first 5 years of marketing. Socioeconomic and health characteristics account for a larger share of ethnic disparities than racial disparities.

Key Words. Race, ethnicity, disparities, utilization, new prescription drugs

Race and ethnicity have been shown to be associated with medical diagnosis and treatment (Mayberry, Mili, and Ofili 2000). The contemporary medical

literature uses "race" as a social construct because previous research has accumulated evidence against the biological differences between human races (Stolley 1999). Allocation to a specific racial group is associated with the level of social stress that individuals are subjected to and the medical care they receive (Krieger 2000; Laws 2001). In contrast to race, ethnicity refers to a group that people belong to due to shared languages, cultural traditions, etc. (Bhopal 1997).

According to the Institute of Medicine 2003 report, "Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare," both racial and ethnic minorities tend to receive health care of lower quality and/or quantity than majority populations (Smedley, Stith, and Nelson 2003). These disparities have significant economic and sociological implications. First, racial and ethnic disparities raise concerns about whether health care is being provided in a consistent and appropriate manner (Smedley, Stith, and Nelson 2003).

Additionally, from an economic viewpoint, overall health care expenditures may increase as a result of inconsistent or inappropriate treatment (Smedley, Stith, and Nelson 2003). For example, a study using the Medical Expenditure Panel Survey showed that using newer drugs reduced nondrug medical costs and overall treatment costs (Lichtenberg 2001). Disparities in the use of new prescription drugs may thus be related to increased health care costs.

The aforementioned negative effects of racial and ethnic disparities on quality and health care expenditures may be exacerbated because the proportion of minorities in the United States is increasing (U.S. Census Bureau 2004).

Because of the impact of racial and ethnic disparities in the United States, there has been an intensive effort to document disparities in health services utilization and identify their causes, in preparation for effective interventions.

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Such studies, however, have not addressed the use of prescription drugs in a comprehensive manner. Particularly, the use of new prescription drugs has not been compared across racial and ethnic groups. New drugs are usually priced higher than the older medications, but they may offer the potential benefits of fewer side effects and higher effectiveness (Lichtenberg 2001; Mullins et al. 2001). Therefore, racial and ethnic disparities in the use of new prescription drugs deserve examination. This study was undertaken to examine the question as to whether there are racial and ethnic disparities in new prescription use among non-Hispanic whites, non-Hispanic blacks, and Hispanic whites.

METHODOLOGY

Theoretical Framework

The theoretical framework for this study was the Behavioral Model of Health Services Utilization (Andersen and Davidson 2001). This framework stipulates that the use of health services is influenced by a combination of predisposing, enabling, and need factors. Predisposing factors, including certain demographic and social characteristics such as racial and ethnic groups, age, gender, and education, influence the individual's predisposition to use health care services. In this study, racial and ethnic variables were the key independent variables. Enabling factors, including health insurance and income, facilitate the individual's use of health care services. Need factors refer to medical conditions that require medical treatment as perceived by health care providers or laypersons.

Data Sources

The study population for this observational study was the adult population (older than 17 years) who reported use of prescription drugs in the Medical Expenditure Panel Survey (MEPS). New medications were defined as those drugs approved within the past 5 years at the time of utilization (Mullins et al. 2001). For example, a drug that was used by a patient in the 2001 MEPS file was considered new if it was approved in 1996–2001. MEPS provided information on each individual's use of specific medications. Mosby GenRX database (GenRx) provided information on the approval years of medications. We linked these two data sources to determine the use of new medications by each individual. The details of each data source and the functions that each of them served in this study are as follows.

Medical Expenditure Panel Survey. MEPS was the main data source for this study. Started in 1996 and cosponsored by the Agency for Healthcare Research and Quality and the National Center for Health Statistics, the MEPS database has an objective of providing national estimates of health care use, expenses, etc. for the U.S. noninstitutionalized civilian population (Agency for Healthcare Research and Quality 2003).

MEPS has a design with panels overlapping over time. Such design is referred to as a revolving panel design by Menand (Menard 2002). Each subsequent year, a new series of data collection rounds add a new group of households (a new panel) to the sample. Every panel spans 2 years, and each respondent is surveyed for five rounds in these 2 years (Agency for Healthcare Research and Quality 2003).

In this current study, MEPS data from 1996 to 2001 were included. For each year, two files were used: Full Year Consolidated Data File and the Prescribed Medicines File. The Full Year Consolidated Data File contains demographic information, geographic characteristics, health insurance status, and information on health services use. The Prescribed Medicines File includes detailed information for each prescribed medicine event (when a respondent reported purchasing or otherwise obtaining a prescribed medicine, or when a pharmacy had the record of the purchase). It has information on medication names, National Drug Codes (NDC), payment sources, and the amount of payment for each source (Agency for Healthcare Research and Quality 2003). Medication names in MEPS are not standardized and the NDC was used to link MEPS with other data sources in this study. Since the NDC information is not complete in the public use MEPS files, all data analyses were conducted in the MEPS Data Center located in Rockville, MD.

GenRx and FDA Data on Approval Dates of New Chemical Entities. GenRx served as the primary source of FDA approval dates for the "active ingredients" of medicines. We also checked the FDA data on approval years for new chemical entities, to confirm that all new drugs included in the study were indeed new chemical entities.

Multum Lexicon. In order to determine the use of new medications for each individual, MEPS and GenRx had to be linked in this study. However, these two data sources do not have variables in common. The "bridge" used to link these two databases was the electronic Multum Lexicon (Cerner Multum, Inc.

2006), which has information on the NDC, active ingredients, etc. GenRx and Multum Lexicon include information on active ingredients; Multum Lexicon and the MEPS include the NDC (Cerner Multum, Inc. 2006).

Measures and Data Analyses

The use of a new medication was measured as the number of times when new medications were obtained. For example, if five prescriptions were filled in a 1-year period, even if for the same medications, the dependent variable would take the value of "5." We decided to count one medication more than once when necessary because of the importance of refilling prescriptions in achieving optimal health outcomes.

Sensitivity analyses were conducted in order to determine whether the results were sensitive to the definition of a "new" medication. To explore this, "new" medications were defined in 4 alternative ways: those approved less than or equal to 4 years before utilization, 3 years before utilization, 2 years before utilization, and 1 year before utilization. These different criteria are later referred to as the 5-, 4-, 3-, 2-, and 1-year criteria.

In the descriptive analysis, the relationship between patients' characteristics and their use of new prescription medications was analyzed.

Multivariable Analyses on Racial and Ethnic Disparities. A negative binomial model, an extension of a Poisson model, was employed to examine racial and ethnic disparities in the number of times new medications were obtained. The negative binomial model relaxes two strong assumptions of Poisson regression about the distribution of the data: (1) the equality of the variance and mean of the number of the event occurrences, and (2) independence between observations (Kennedy 1998; Greene 2002).

The appropriateness of using the negative binomial model in this analysis was tested using a likelihood-ratio test, which examines the value of the overdispersion parameter α. If the confidence interval of a parameter α does not include zero, the negative binomial model is the appropriate model to use (StataCorp 2005).

Using the negative binomial model, the main multivariate analysis model was as follows:

$$\text{Ln}\,\lambda = b_0 + b_1\text{Race} + b_2\text{Character} + \varepsilon \qquad (1)$$

where "λ" was the expected value of the dependent variable, the annual number of times when new drugs were obtained.

"Race" in model (1) was a vector of dummy variables for racial and ethnic groups, including non-Hispanic blacks and Hispanic whites (non-Hispanic whites as the reference group; black Hispanics and other racial and ethnic groups were excluded due to limited sample size). The difference between non-Hispanic whites and non-Hispanic blacks was considered "racial disparities," and the difference between non-Hispanic whites and Hispanic whites was considered "ethnic disparities."

"Character" in model (1) includes all other predisposing variables besides racial and ethnic groups, enabling factors and need factors. The other predisposing factors were age in years, gender, dummy variable for marital status (married; not married as reference group), dummy variables for education (high school, bachelor, and master and higher; lower than high school as reference group), dummy variables for census region (Midwest, South, and West; Northeast as reference group), and dummy variable for metropolitan statistical area (yes = 1). Enabling factors we included were dummy variables for poverty status (near poor, low income, middle income, and high income; "poor" as reference group), and generosity of prescription drug benefit (percentages of annual drug costs paid by health insurance). Need factors we included were dummy variables for self-perceived health status (very good, good, fair, poor; "excellent" as reference group), the number of medical conditions in the observation year, the number of other prescription drugs obtained in the observation year, and the number of office-based physician visits in the observation year. The ε in model (1) is the error term.

The coefficients of the dummy variables for racial and ethnic groups ("Race") in model (1) are the measure of racial and ethnic differences in the use of new drugs. Because of the functional form of the negative binomial regression, the effect size of a factor is the antilog of its coefficient. This value is a rate ratio. A rate ratio less than one for a minority population would suggest lower new medication use among them than non-Hispanic whites.

Multivariable Analyses on the Trend of Racial and Ethnic Disparities. After examining the racial and ethnic disparities in new medication use, we explored whether the disparities in the use of new medications decrease in the early years of the drug products' life cycles. This question was examined using the following model:

$$\text{Ln}\,\lambda = b_0 + b_1\text{Race} + b_2\text{Character} + b_3\text{Years} + b_4\text{Race} \times \text{Years} + \varepsilon \quad (2)$$

The model (2) was similar to model (1), but included additional variables "Years" and "Race × Years." "Years" was a group of dummy variables for

each criterion for defining new drugs (5-year criterion as reference group). "Race × Years" was a group of interaction terms between racial and ethnic groups and the criteria for defining new drugs. These interaction terms were included to test the trend of racial and ethnic disparities and their coefficients were the measures of the trend. If the coefficients for the interaction terms are significant, racial and ethnic disparities change significantly over the first years of products' life cycles. Otherwise, the disparities persist over time.

In addition to the aforementioned analyses, additional analyses were performed to test the robustness of the findings surrounding racial and ethnic disparities in new medication use. In these analyses, additional variables were included in the models. These variables were the type of health insurance (public insurance only, any private insurance, and no insurance), and the utilization of other health services, including the total number of hospital outpatient visits, emergency room visits and hospitalization, the total number of hospital discharges, the total number of nights associated with these discharges, and the total number of days when home health care was received. The type of health insurance was included due to potential limitation of the "generosity of prescription drug benefit" as the measure of health insurance. Note that the "generosity of prescription drug benefit" was constructed as the percentage of drug costs paid by health insurance, and the premiums or total charges were not taken into account. As the use of prescription drugs may be associated with the use of other health services, additional use measures were included in these analyses.

The complex sampling structure of the MEPS survey, including sampling weights, stratum, and primary sampling units, was accounted for in all analyses. Observations with any missing values were excluded from the analyses. This study was deemed exempt from Institutional Review Board (IRB) review by the University of Maryland Baltimore Office for Research Subjects (Approval number H-25934). The data analysis of this study was conducted using the software *SAS*® 9 and *STATA*® 9. The level of significance was set a priori at $p = .01$.

RESULTS

In the study population, a total of 41,928 adult prescription users were included from MEPS (1996–2001). Among them, 28,924 were non-Hispanic whites, 5,232 were non-Hispanic blacks, and 6,245 were Hispanic whites. Black Hispanics and other racial and ethnic groups represented less than

4 percent (1,527; 3.64 percent) of the study population and were excluded from the study sample.

According to the descriptive statistics, the use of new drugs differed across patient demographic characteristics as shown in Table 1. The number of times when new drugs were obtained differed across racial and ethnic groups (Table 1). The number of times was higher among non-Hispanic whites than non-Hispanic blacks, who in turn had a higher number than Hispanic whites. The difference between non-Hispanic whites and non-Hispanic blacks was 0.35 ($p<.01$; Table 1). This means that the size of racial disparity was almost one quarter of the average number of times when non-Hispanic blacks obtained new drugs (1.36). The difference between non-Hispanic whites and Hispanic whites was 0.6 ($p<.01$). This shows that non-Hispanic whites used more than 50 percent more new drugs than Hispanic whites (1.71 versus 1.11).

The number of times new drugs were obtained was higher among individuals with the following characteristics relative to the reference group (Table 1): older respondents, female respondents, unmarried individuals, respondents with less education, respondents that reside in the census regions of midwest or south, respondents that resided in nonmetropolitan statistical areas, poorer individuals, respondents with more generous prescription drug benefits, those with self-perceived worse health status, those with a greater number of medical conditions, higher number of other prescription medications, and a higher number of office-based physician visits. All associations were significant at the 0.01 level, with the exception of the census regions with a p-value of .089, and marital status with a p-value of .019.

According to the multivariable analysis, racial disparities were still significant after controlling for confounding factors (Table 2). In Table 2, the rate ratios are reported for five different criteria, i.e., the 5- to 1-year criteria for defining new drugs. According to the 5-year criterion, non-Hispanic blacks obtained 22 percent fewer new drugs per year than non-Hispanic whites. Similarly, according to other criteria, the average number of times when new medications were obtained among non-Hispanic blacks was 26–33 percent lower than non-Hispanic whites. The rate ratios were all significant ($p<.01$).

Ethnic disparities are shown by the rate ratios between non-Hispanic whites and Hispanic whites, which compare the relative number of times when new medications were obtained between them. These rate ratios were in the range from 0.84 to 0.95, but only two of five rate ratios were significant (Table 2).

Of the confounding factors, the variables that had consistently significant effects on the use of new drugs regardless of the criterion for defining new

Table 1: Associations between Characteristics of Patients and the Number of Times When New Medications Were Obtained*

Characteristics	*Groups*	*Number*	*Mean*	*Standard Error of the Mean*
Racial and ethnic groups	Non-Hispanic whites	28,924	1.71	0.03
	Non-Hispanic blacks	5,232	1.36	0.06
	Hispanic whites	6,245	1.11	0.05
Age group (years)	18–29	6,897	0.47	0.02
	30–39	7,842	0.86	0.04
	40–49	8,369	1.41	0.05
	50–59	7,043	2.12	0.07
	60–69	5,275	2.54	0.08
	70–79	4,280	2.73	0.09
	≥ 80	2,222	2.81	0.13
Gender	Female	25,258	1.67	0.03
	Male	16,670	1.52	0.04
Marital status	Unmarried	16,615	1.64	0.04
	Married	25,313	1.58	0.03
Education	Lower than high school	11,182	1.94	0.06
	High school	19,404	1.53	0.03
	Bachelor's	5,692	1.44	0.06
	Master's and higher	2,850	1.54	0.08
Census regions	Northeast	7,473	1.61	0.07
	Midwest	9,346	1.75	0.05
	South	15,701	1.75	0.04
	West	9,408	1.18	0.05
Metropolitan statistical area	No	9,653	1.84	0.05
	Yes	32,275	1.55	0.03
Poverty status[†]	Negative or poor	5,632	1.86	0.07
	Near poor	2,031	1.81	0.13
	Low income	5,888	1.74	0.07
	Middle income	12,929	1.59	0.05
	High income	15,448	1.50	0.04
Generosity of drug benefit[‡]	≤ 0.2	14,360	1.11	0.03
	>0.20–0.40	4,055	1.47	0.08
	>0.40–0.60	5,618	1.61	0.06
	>0.60–0.80	8,950	2.01	0.06
	>0.80	8,945	2.03	0.06
Perceived health status	Excellent	8,389	0.77	0.03
	Very good	12,795	1.20	0.03
	Good	12,512	1.80	0.04
	Fair	5,639	2.84	0.09
	Poor	2,275	4.07	0.16
Number of medical conditions	1	5,646	0.40	0.03
	2–4	20,359	0.94	0.02
	5–9	13,294	2.45	0.05
	≥ 10	2,629	5.31	0.16

continued

Table 1. *Continued*

Characteristics	*Groups*	*Number*	*Mean*	*Standard Error of the Mean*
Number of other prescription medications	1	7,181	0.67	0.03
	2–4	10,374	0.53	0.02
	5–9	7,843	1.03	0.03
	≥ 10	16,530	3.02	0.06
Number of office-based physician visits	1	10,458	0.51	0.02
	2–4	12,986	1.16	0.03
	5–9	9,512	1.95	0.05
	≥ 10	8,972	3.14	0.07

*$p < .01$ for every variable except census regions, which had a $p = .089$, and marital status, which had a $p = .019$.

†Categories of poverty status: negative income or poor: < 100% of poverty line; near poor: 100 to < 125% of poverty line; low income: 125 to < 200%; middle income: 200 to < 400%; wealthy: 400% and greater.

‡Generosity of drug benefit: share of annual drug cost paid by insurance.

drugs were age, generosity of prescription drug benefits, number of medical conditions, other prescription medications, and number of office-based physician visits (Table 2). The rate ratios of age were always 1.02 for the five criteria for defining new drugs. The rate ratios for the generosity of prescription drug were between 2.09 and 2.37 ($p < .01$). The number of medical conditions had a rate ratio of 1.02. The number of other prescription medications had rate ratios between 1.07 and 1.11. The rate ratios for the number of office-based physician visits were in the range from 1.01 to 1.03.

The effects of self-perceived health status were almost always significant, the exception being self-perceived very good health status according to the 1-year criterion. Compared with persons with self-perceived excellent health status, the rate ratios for a person with other health status were between 1.18 and 2.15 (almost all $p < .01$).

When examining the trend of racial and ethnic disparities in the use of new drugs, none of the coefficients of the interaction terms between racial and ethnic variables and criteria for defining new drugs was found to be significant (Table 3). The inclusion of additional variables in the models, such as the types of health insurance as measure of insurance (instead of generosity of drug benefit) and the amount of utilization of other health services, did not change the patterns of the findings significantly. Racial disparities were always significant according to the multivariable analyses and the ethnic disparities were not always significant (results not shown). The dispersion parameter alphas are

Table 2: Racial and Ethnic Disparities in the Use of New Drugs According to Different Criteria for Defining New Drugs*

	Five-Year Criterion		*Four-Year Criterion*		*Three-Year Criterion*		*Two-Year Criterion*		*One-Year Criterion*	
	RR†	*p*	*RR*†	*p*	*RR*†	*p*	*RR*†	*p*	*RR*†	*p*
Constant	N/A	.000	N/A	.000	N/A	.000	N/A	.000	N/A	.000
Non-Hispanic whites										
Non-Hispanic blacks	0.78	.000	0.74	.000	0.73	.000	0.72	.000	0.67	.000
Hispanic whites	0.88	.002	0.87	.012	0.84	.006	0.95	.500	0.93	.500
Age (years)	1.02	.000	1.02	.000	1.02	.000	1.02	.000	1.02	.000
Female										
Male	1.06	.032	1.03	.306	0.99	.747	0.99	.801	1.03	.692
Unmarried										
Married	0.94	.034	0.90	.002	0.92	.033	0.93	.121	0.90	.117
Lower than high school education										
High school diploma	1.08	.018	1.09	.044	1.09	.074	1.12	.040	1.07	.442
Bachelor's degree	1.22	.000	1.22	.001	1.18	.016	1.11	.187	1.09	.518
Master's degree or higher	1.21	.000	1.17	.010	1.17	.034	1.35	.002	1.49	.003
Census region "Northeast"										
Census region "Midwest"	1.01	.800	1.00	.932	1.02	.769	0.96	.563	0.89	.221
Census region "South"	1.14	.000	1.18	.000	1.18	.000	1.19	.003	1.17	.071
Census region "West"	0.74	.000	0.67	.000	0.70	.000	0.67	.000	0.77	.013
Nonmetropolitan statistical area										
Metropolitan statistical area	0.97	.389	0.94	.102	0.89	.012	0.85	.005	0.87	.068
Negative income or poor‡										
Near poor	0.90	.142	0.91	.263	0.90	.329	0.93	.538	0.89	.427
Low income	1.08	.133	1.04	.583	1.06	.446	1.13	.201	1.06	.657
Middle income	1.04	.372	1.01	.889	0.99	.884	1.07	.359	1.15	.200
High income	1.11	.011	1.07	.226	1.07	.304	1.17	.057	1.22	.099

continued

Table 2. *Continued*

	Five-Year Criterion		*Four-Year Criterion*		*Three-Year Criterion*		*Two-Year Criterion*		*One-Year Criterion*	
	RR[†]	*p*	*RR*[†]	*p*	*RR*[†]	*p*	*RR*[†]	*p*	*RR*[†]	*p*
Generosity of drug benefit[§]	2.37	.000	2.28	.000	2.35	.000	2.22	.000	2.09	.000
Self-perceived excellent health status										
Self-perceived very good health status	1.28	.000	1.23	.000	1.18	.009	1.28	.004	1.23	.061
Self-perceived good health status	1.50	.000	1.44	.000	1.48	.000	1.68	.000	1.75	.000
Self-perceived fair health status	1.72	.000	1.68	.000	1.73	.000	1.98	.000	2.12	.000
Self-perceived poor health status	1.73	.000	1.64	.000	1.70	.000	2.04	.000	2.15	.000
Number of medical conditions	1.02	.000	1.02	.000	1.02	.000	1.02	.000	1.02	.000
Number of other prescription medications	1.11	.000	1.10	.000	1.09	.000	1.08	.000	1.07	.000
Number of office-based physician visits	1.01	.000	1.01	.000	1.02	.000	1.02	.000	1.03	.000

*Point estimates and 99% confidence intervals for dispersion parameter α for the models are 4.70 [4.54–4.87], 7.02 [6.71–7.35], 9.46 [8.99–9.95], 13.67 [12.86–14.52], and 26.15 [23.99, 28.51], respectively; 5-year criterion: when new drugs were defined as those approved within the past 5 years; 4-year criterion: when new drugs were defined as those approved within the past 4 years, etc.

[†]Rate ratio.

[‡]Categories of poverty status: negative income or poor: <100% of poverty line; near poor: 100 to <125% of poverty line; low income: 125 to <200%; middle income: 200 to <400%; wealthy: 400% and greater.

[§]Generosity of drug benefit: share of annual drug cost paid by insurance.

reported for the models in Tables 2 and 3. None of the confidence intervals included zero.

DISCUSSION

This study analyzed racial and ethnic disparities in the use of all new medications using MEPS data and the negative binomial model. None of the confidence intervals for the dispersion parameter alphas included zero, indicating that it is appropriate to use the negative binomial model in this study.

Both the descriptive and multivariable analyses revealed significant racial disparities: the number of times when new medications were obtained was higher among non-Hispanic whites than non-Hispanic blacks. These findings are consistent with previous studies on racial disparities in the use of prescription drugs at the aggregate level (Hanlon et al. 1992; Hahn 1995; Khandker and Simoni-Wastila 1998; Chen and Chang 2002; Philips and Atherly 2002). Our study extends the prior results regarding racial disparities. The fact that racial disparities were still significant after we adjusted for the total number of other prescription medications in the model suggests that the racial disparities in the use of new medications might be greater than racial disparities in older medications.

This study also found ethnic disparities between non-Hispanic whites and Hispanic whites in new medication use based on descriptive analysis. These disparities were not evident in the multivariable analysis. Most previous studies found that Hispanics have lower utilization of prescription drugs in general compared with their white or non-Hispanic white counterparts (Smith and Kirking 1999; Chen and Chang 2002).

Previous drug category-specific and disease-specific studies reported inconsistent patterns of racial and ethnic disparities (Moore et al. 1994; Simon, Sorvillo, and Lapin 1994; Khandker and Simoni-Wastila 1998; Sirey et al. 1999; Smith and Kirking 1999; Blazer et al. 2000; Chen and Chang 2002; Palacio et al. 2002; Daumit et al. 2003; Zito et al. 2005). Future studies on the racial and ethnic disparities in drug class-specific use of new drugs would shed more light on the causes for the inconsistency.

When comparing racial and ethnic disparities, this study found that ethnic disparities were smaller (5–16 percent) than racial disparities (22–33 percent) after adjusting for confounding factors. However, it was the opposite before adjusting for confounding factors. In addition to the fact that ethnic disparities were not always significant in the multivariate analysis but racial

Table 3: Trend of Racial and Ethnic Disparities in the Use of New Drugs in First 5 Years of Marketing*

Variables	*Coefficient*	*RR*†	*Robust Standard Error*	*t*	$p>\|t\|$
Constant	−2.47	N/A	0.09	−27.48	.000
Non-Hispanic whites					
Non-Hispanic blacks	−0.27	0.76	0.04	−6.72	.000
Hispanic whites	−0.14	0.87	0.05	−3.02	.003
Five-year criterion					
Four-year criterion	−0.48	0.62	0.01	−44.30	.000
Three-year criterion	−0.91	0.40	0.02	−52.27	.000
Two-year criterion	−1.49	0.23	0.02	−64.69	.000
One-year criterion	−2.38	0.09	0.03	−68.36	.000
Non-Hispanic blacks × 4-year criterion	−0.02	0.98	0.03	−0.66	.511
Non-Hispanic blacks × 3-year criterion	−0.03	0.97	0.05	−0.67	.501
Non-Hispanic blacks × 2-year criterion	−0.03	0.97	0.06	−0.53	.597
Non-Hispanic blacks × 1-year criterion	−0.08	0.92	0.09	−0.90	.371
Hispanic whites × 4-year criterion	−0.01	0.99	0.03	−0.32	.751
Hispanic whites × 3-year criterion	−0.04	0.96	0.04	−0.87	.387
Hispanic whites × 2-year criterion	0.08	1.08	0.06	1.31	.190
Hispanic whites × 1-year criterion	0.10	1.10	0.09	1.10	.271
Age (years)	0.02	1.02	0.00	23.64	.000
Female					
Male	0.01	1.01	0.03	0.49	.624
Unmarried					
Married	−0.08	0.92	0.03	−2.52	.012
Lower than high school education					
High school diploma	0.09	1.09	0.04	2.24	.025
Bachelor's degree	0.16	1.17	0.06	2.84	.005
Master's degree or higher	0.22	1.25	0.06	3.56	.000
Census region "Northeast"					
Census region "Midwest"	−0.01	0.99	0.04	−0.34	.731
Census region "South"	0.15	1.16	0.04	3.88	.000
Census region "West"	−0.36	0.70	0.05	−6.63	.000
Nonmetropolitan statistical area					
Metropolitan statistical area	−0.09	0.91	0.04	−2.47	.013
Negative income or poor‡					
Near poor	−0.10	0.91	0.08	−1.31	.190
Low income	0.06	1.06	0.06	1.01	.314
Middle income	0.04	1.04	0.05	0.83	.406
High income	0.11	1.11	0.05	2.14	.033
Generosity of prescription drug benefit§	0.82	2.27	0.04	18.49	.000
Self-perceived excellent health status					
Self-perceived very good health status	0.21	1.24	0.05	4.29	.000
Self-perceived good health status	0.43	1.54	0.05	8.16	.000
Self-perceived fair health status	0.59	1.81	0.06	9.69	.000
Self-perceived poor health status	0.58	1.79	0.07	8.14	.000
Number of other medical conditions	0.02	1.02	0.00	19.92	.000

Table 3. *Continued*

Variables	*Coefficient*	*RR*[†]	*Robust Standard Error*	*t*	$p > \|t\|$
Number of other prescription medications	0.09	1.09	0.01	13.54	.000
Number of office-based physician visits	0.02	1.02	0.00	9.85	.000

*The point estimate and the 99% confidence interval for dispersion parameter α are 2.05 [2.01–2.09].

[†]Rate ratio.

[‡]Categories of poverty status: negative income or poor: < 100% of poverty line; near poor: 100 to < 125% of poverty line; low income: 125 to < 200%; middle income: 200 to < 400%; wealthy: 400% and greater.

[§]Generosity of drug benefit: share of annual drug cost paid by insurance.

disparities were, these findings suggest that ethnic disparities can be explained by confounding factors, including demographic characteristics, economic characteristics, and health status, to a greater degree than racial disparities. As Mayberry et al. have summarized, although access to health care for racial and ethnic minorities in general is poorer than the majority population, it is more problematic for the individuals with skin color different from the majority population (Mayberry, Mili, and Ofili 2000). Part of this might be due to historical discrimination and maltreatment toward "blacks" and this might impact health care in a subtle way (Mayberry, Mili, and Ofili 2000).

Since none of the coefficients of interaction terms between racial and ethnic variables and criteria for new drugs were significant, there is no evidence of decreasing racial or ethnic disparities in the early years of drug products' life cycles. This is consistent with the limited empirical literature. Previous studies have examined a longer time period when looking at the trend of racial and ethnic disparities without a specific focus on the early period of drugs' life cycles. These studies have not found a statistically significant time trend of racial or ethnic disparities in the use of medications (Blazer et al. 2000; Daumit et al. 2003). The test of the trends in this study may be confounded with period effects including industry effects, which were not specifically examined in the analyses. However, as the approval years of the new medications examined in this study spanned a long period of time and we found that disparities did not decrease over time in early years of drug products' life cycles, the racial disparities in new medication use are concerning.

A discussion of possible sources of racial and ethnic disparities in the use of new medications is warranted in order to inform policy-making process. This can be done following the Behavioral Model of Health Services Utilization (Andersen and Davidson 2001). The predisposing variable of age was a

significant determinant for the use of new prescription drugs. Significant enabling factors included the generosity of prescription drug benefits. Need factors, including the number of medical conditions, the number of other prescription medications, and the number of office-based physician visits, were also significant; self-perceived health status was almost always significant.

Age and the generosity of prescription drug benefits had positive effects on the use of new prescription drugs. The rate ratios of age were always 1.02. This suggests that as age increased by 1 year, the number of times a person obtained new drugs would increase by 2 percent. The rate ratios for the generosity of prescription drug benefit were always greater than two. This suggests that if a person's health insurance covered 100 percent of the drug cost, the number of times this person obtained new drugs would at least double compared with an individual with no drug benefit. As the number of medical conditions was increased by one, the number of times that a person obtained new medications increased by 2 percent. When the number of other prescription medications was increased by one, the number of times that a person obtained new medications would increase by 7–11 percent. When the number of office-based physician visits increased by one, an individual used 1–3 percent more new medications. Compared to a person with self-perceived excellent health status, the number of times when new drugs were obtained could be 18–115 percent higher among individuals with self-perceived very good, good, fair, or poor health status.

The significant effects of these factors suggest that individual factors conceptualized in the Behavioral Model of Health Services Utilization are associated with new prescription drug use and are modifiers of racial and ethnic disparities in new prescription drug use. However, racial disparities were still significant after controlling for these factors, so these factors do not account for all racial disparities. This inference is in keeping with previous studies that have shown that confounding factors did not account for all racial disparities (Smith and Kirking 1999; Blazer et al. 2000; Chen and Chang 2002; Daumit et al. 2003).

What might be sources of significant racial disparities after adjusting for confounding factors? Racial disparities may be related in part to individual behaviors. Members of a minority population might engage in risky health behaviors, such as failing to fill or refill prescriptions (Daumit et al. 2003). However, this study examined only prescription users, so the role of failing to fill or refill prescriptions is likely to be less important as a source for racial disparities.

Other individual characteristics might have also contributed to the observed racial disparities in the use of new medications. For example, mistrust of the health care system serves as barriers to health care use by a minority population (LaVeist, Nickerson, and Bowie 2000; Mayberry, Mili, and Ofili 2000). Minorities might be less likely to try new drugs or may delay seeking health care (Blazer et al. 2000). There is a growing literature that suggests that minority neighborhood may have fewer pharmacies and some pharmacies in these neighborhoods might not carry certain categories of medications (Morrison et al. 2000; Spernak et al. 2005). This would have an impact on the use of drugs.

It has been reported that the incidence and prevalence rates of various disease and medical conditions vary across racial and ethnic groups (Daumit et al. 2003). However, the variation across racial and ethnic groups should not be overemphasized: the list of genetic characteristics much more common in African Americans than other racial and ethnic groups is small (Stolley 1999).

Causes of racial disparities in the use of new medications might also come from the health care providers (Jones 2000, 2001). In the event of differential prescribing patterns by physicians, minorities may not be prescribed new drugs at the same rate (Shaya et al. 2005). These factors could not be explored in this study.

The study strengths included the following aspects. The first strength lies in the data source. MEPS is the first national expenditure survey that has taken measures to address the issue of underreporting of prescription drug use by obtaining computerized printouts from respondents' pharmacy providers (Agency for Healthcare Research and Quality 2003). Moreover, the study sample covered a cross-section of U.S. citizens who were prescription users, which makes the results more generalizable compared with most previous research on the racial and ethnic disparities in the use of prescription drugs. Additionally, MEPS oversampled Hispanics to make possible reliable estimates for this population. Most previous household surveys did not have the statistical power to adequately compare Hispanics with other racial and ethnic groups.

Some of the limitations include the fact that nonusers of prescription drugs were excluded from the study; thus, the results cannot be generalized to nonusers of prescribed medications. However, we have examined this research question in a national sample and this study addresses an important research question: whether there are racial and ethnic disparities in the use of new prescription medications even among prescription users. Additionally, members of racial and ethnic minority groups may be less likely than

non-Hispanic whites to purchase prescription drugs in the first place. Therefore, based on these considerations, the findings from this study may understate the disparities. This study used drug approval dates in the criteria for new drugs as a proxy for marketing dates. Although marketing dates would be a more accurate measure, these were unavailable. Moreover, there has not been a unanimous definition of new prescription medication, but an acceptable way of defining them is the 5-year criterion that we used (Barents Group LLC 1999; Express Scripts 2000; Mullins et al. 2001). One additional limitation lies in the measure of new medication use. If a patient was prescribed a new medication in December of a year, he or she would not have the same opportunity to refill the prescription as a patient received the prescription in January of the year. The fact that a patient could stay in the sample for 2 years might help to alleviate this problem.

The generalizability of this study is also limited by the inclusion of only new chemical entities. New chemical entities had been in the market for up to 5 years before the utilization. The study results do not generalize to generic drugs. However, racial disparities in the use of new medications were still significant when the number of other prescription medications was included in the model. This suggests that the racial disparities in the use of the new prescription medications may be even greater than the racial disparities in the use of older medications. Finally, differential patterns of new drug use were examined in this study but not the appropriateness of the patterns. However, disparities in the use of new drugs across racial groups are not reassuring since previous literature has reported the benefits of new drugs in general (Lichtenberg 2001).

CONCLUSIONS

This study found that there are racial disparities in the use of new medications even after controlling for confounding factors. Ethnic disparities can be accounted for by socioeconomic and health factors to a greater extent than racial disparities. Future research is needed to determine whether these disparities have contributed to health disparities across racial groups and if so, by how much. However, the potential benefits of new medications reported by previous studies make racial disparities in the use of these medications a concern.

Socioeconomic and health factors represent significant causes for racial disparities in the use of new drugs. Differential health behaviors across racial groups might play a role as well, but their role is likely to be small. Further research is

needed to determine the roles of differential treatment patterns by health care providers in explaining racial disparities in the use of new medications.

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