The Effect of Race-Ethnicity and Geography on Adoption of Innovations in the Treatment of Schizophrenia

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Objective: **This study evaluated the effect of race-ethnicity and geography on the adoption of a pharmacological innovation (long-acting injectable risperidone [LAIR]) among Medicaid beneficiaries with schizophrenia as well as the contribution of geographic location to observed racial-ethnic disparities.** ***Methods:*** **The data source was a claims data set from the Florida Medicaid program for the 2.5-year period that followed the launch of LAIR in the U.S. market. Study participants were beneficiaries with schizophrenia who had filled at least one antipsychotic prescription during the study period. The outcome variable was any use of LAIR; model variables were need indicators and random effects for 11 Medicaid areas, which are multicounty units used by the Medicaid program to administer benefits. Adjusted probability of use of LAIR for blacks and Latinos versus whites was estimated with logistic regression models.** ***Results:*** **The study cohort included 13,992 Medicaid beneficiaries: 25% of the cohort was black, 37% Latino, and 38% white. Unadjusted probability of LAIR use was lower for Latinos than whites, and use varied across the state's geographic areas. Adjustment for need confirmed the unadjusted finding of a disparity between Latinos and whites (odds ratio=.58, 95% confidence interval=.49–.70). The inclusion of geographic location in the model eliminated the Latino-white disparity but confirmed the unadjusted finding of geographic variation in adoption.** ***Conclusions:*** **Within a state Medicaid program, the initial finding of a disparity between Latinos and whites in adopting LAIR was driven by geographic disparities in adoption rates and the geographic concentration of Latinos in a low-adoption area. Possible contributors and implications of these results are discussed. (*Psychiatric Services* 63:1171–1177, 2012; doi: 10.1176/appi.ps.201100408)**

Although schizophrenia affects less than 1% of the U.S. population (1), it has a much larger societal impact because of its early age of onset, its chronicity, and the resultant significant long-term disability and premature mortality (2). Underuse of recommended interventions is widespread (3), and quality of care is modest at best (4–6). Moreover, persons with schizophrenia who are from racial-ethnic minority groups are less likely than whites to receive recommended interventions (7,8). Although much has been learned about factors associated with adoption of health care innovations (9,10), little is known about whether race-ethnicity influences access to innovative treatments for schizophrenia in the period that follows their release to market (11–13).

Several factors are associated with the existence and persistence of racial-ethnic health service disparities in the United States. The Institute of Medicine conceptualized service disparities as the outcome of both direct race-ethnicity effects and effects mediated by socioeconomic status, insurance coverage, and geographic location of minority groups (14). Geography is treated as a mediator of disparities because it is assumed that for minority groups, geographic location is the result of discrimination and lack of opportunities and not a personal choice (15). As demonstrated by Fisher and colleagues (16), the characteristics of the communities where patients live are associated with the volume and quality of care they receive (www.dartmouthatlas.com/index.shtm). Multiple factors are likely to be implicated in these unwarranted geographic variations in care; key among them are differences in clinicians' treatment practices and other characteristics of the health care system (17). Because racial-ethnic minority groups are not homogeneously

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distributed across the United States, geographic disparities can confound the estimation of service disparities when assessed over large and diverse geographic areas (18,19).

We sought to assess the effect of race-ethnicity and geography on the adoption of an evidence-based innovation among Medicaid beneficiaries with schizophrenia who were residing in Florida. In addition, we sought to assess the contribution of geographic location to observed racial-ethnic disparities. We focused on Medicaid because of its primary role as payer of health services for people with schizophrenia (20) and selected Florida because of its size and its diverse population. The evidence-based innovation was the long-acting injectable formulation of the second-generation antipsychotic risperidone, approved by the U.S. Food and Drug Administration (FDA) on October 29, 2003.

Three characteristics of the antipsychotic prescribing practices prevalent in the United States during the period that preceded the launch of long-acting injectable risperidone (LAIR) render this drug an interesting case study. First, this form of risperidone is the only second-generation long-acting injectable antipsychotic available in the United States. This is significant because in the early 2000s, second-generation antipsychotics were generally thought to be more effective and safer than first-generation antipsychotics (21). Second, despite the recommendation by key clinical guidelines to consider long-acting injectable antipsychotics for persons with poor medication adherence (22–24), multiple studies conducted before the launch of LAIR showed low use of long-acting injectable antipsychotics in this country (25–27), perhaps because providers perceive these agents as coercive (28,29). Hence, as of its market launch, LAIR held the promise of ensuring greater adherence at a time when second-generation antipsychotics were regarded as a therapeutically superior medication class (30,31). Third, disparities research on these antipsychotic practices (use of second-generation antipsychotics and use of long-acting injectables) suggests the existence of racial disparities working in different directions. Although studies have shown that use of the purportedly superior second-generation drugs is lower among blacks than whites (8,32), some studies (32), but not all (26), conducted before the launch of LAIR showed that use of the purportedly coercive long-acting injectable antipsychotics was higher among blacks than whites.

Methods

We studied racial-ethnic disparities in adoption of LAIR among black, Latino, and non-Latino white Florida Medicaid beneficiaries with comparable need for LAIR. In our primary model, we used the disparities definition proposed by the Institute of Medicine and adjusted only for need variables. We estimated a second model that included geographic location to evaluate whether geographic disparities exist and whether geography affects the racial-ethnic disparity estimates.

Data sources and study population

We used enrollment files and medical and pharmacy claims from the Florida state Medicaid program for the period January 1, 2004, to June 30, 2006. Our study population was a cohort of continuously enrolled adults ages 18–64 years who during the study period had at least two claims recorded on two different dates with a diagnosis of schizophrenia or schizoaffective disorder (*ICD-9* diagnostic code 295.xx) and who had filled at least one antipsychotic prescription. We defined continuous enrollment as having no more than two consecutive months of lapsed Medicaid enrollment and at least 23 months of enrollment over the 30-month study period. We excluded beneficiaries who had less than three months of enrollment before the first filled antipsychotic prescription. We also excluded beneficiaries with Medicare coverage or with more than two months of health maintenance organization coverage during the study period because we could not observe all their care.

Key variables

Outcome variable. Our main outcome variable was any use of LAIR, a binary-valued variable defined as one or more LAIR fills observed during the study period. We identified LAIR prescriptions of all strengths through national drug codes, which are unique product identifiers for all human drugs for commercial use in the United States.

Explanatory variables. Our main explanatory variable was race-ethnicity, defined as black, Latino, and non-Latino white. The Florida Medicaid program uses a racial classification that describes beneficiaries as white, black, Hispanic, Oriental, American Indian, or "other." Because less than 1% of people in our cohort were classified as Oriental or American Indian during the study period, these groups were excluded from the analyses. Although the percentage of people who were classified as black or white varied little during the study period, the percentage of people classified as "other" and Hispanic varied dramatically because of changes in data recording. Analyses of beneficiaries present in the data in fiscal years (FYs) 2005 and 2006 (specifically, between July 1, 2004, and June 30, 2005) showed that 92% of beneficiaries classified as Hispanic in FY 2006 had been classified as "other" in FY 2005. Conversely, analyses of individuals classified as "other" in FY 2005 who were also observed in FY 2006 revealed that 71% were reclassified as Hispanic in FY 2006. Most of the remaining 29% retained the "other" designation, suggesting that they too were Hispanic. Because a majority of those classified as "other" during our study period were classified as Hispanic in previous or subsequent years, we reclassified the "other" group as "ever Hispanic." As a result of this decision, we have some minor misclassification in our racial-ethnic groups. We refer to individuals classified as Hispanic or "ever Hispanic" as Latinos.

Our second primary explanatory variable was geographic location, defined by 11 geographic units used by the Florida Medicaid program to administer benefits (www.fdhc.state.fl.us/Medicaid/Areas). Because of their geographic, cultural, and socioeconomic differences, these geographic units—henceforth referred to as areas—have some latitude to discharge their administrative and quality management functions. Florida Medicaid areas encompass from one to 16 contiguous counties (median=5). Beneficiaries

were assigned to the area in which they resided at the date of the first filled prescription for an antipsychotic drug. [Florida counties are listed by area in an online data supplement to this article.]

Our model included several variables found to be associated with adherence to antipsychotic medication, the main indicator of need for LAIR (33–36): age (continuous), sex, substance use disorder comorbidity, and three measures of illness severity (psychiatric comorbidity, intensity of use of inpatient services for schizophrenia, and benefit mechanism). Benefit mechanism is considered an indicator of illness severity because receipt of Supplemental Security Income (SSI) suggests a more chronic and disabling illness. Because patients' general health status may influence the decision to prescribe LAIR, we also included two measures of medical comorbidity: metabolic comorbidity and other general medical comorbidity.

Race-ethnicity, age, sex, and geographic location were assessed at the date of the first filled antipsychotic prescription. All other variables were constructed with data observed during the three-month period before the first filled antipsychotic prescription. The comorbidity measures required the observation of one or more claims with selected *ICD-9* diagnoses. Diagnoses used to construct the psychiatric comorbidity variable were major depression, dysthymia, panic disorder, obsessive-compulsive disorder, and specific personality disorders, among others. Diagnoses used to construct the substance use disorder comorbidity variable were abuse or dependence on drugs or alcohol. Diagnoses used to construct the metabolic comorbidity variable were diabetes, dyslipidemias, and obesity. Diagnoses used to construct the other medical comorbidity variable included cardiovascular and cerebrovascular disorders, neurologic disorders, and hypertension, among others. *ICD-9* codes used are available from the authors on request. Intensity of inpatient service use was defined as the total number of inpatient days for schizophrenia. Benefit mechanism was a categorical variable reflecting the mechanism most frequently observed (SSI versus Temporary Assistance for Needy Families).

Statistical analyses

The unit of observation for our analyses was the beneficiary. We used logistic regression to model the log-odds of the probability of LAIR use as a function of race-ethnicity (blacks and Latinos versus non-Latino whites) and explanatory variables. The primary model included age, sex, all the comorbidity variables, intensity of inpatient service utilization, and benefit mechanism. The secondary model included all primary model variables as well as random effects for each geographic region to account for within-region correlation. This strategy reflected our assumption that, all else being equal, the probability of use of LAIR for two beneficiaries living in the same area would be more alike than the probability for two beneficiaries living in two different areas. We assumed that the random effects arose from a normal distribution. To assess for racial-ethnic effects that were uncorrelated with geographic effects, we also ran the secondary model and included geographic region as a fixed effect.

Data were analyzed with SAS version 9.1 (20). We fit a random effects model with Proc NLMixed and used a critical value of .05 to evaluate statistical significance of the p values. We report our adjusted findings as odds ratios (ORs) and 95% confidence intervals (CIs).

Our study was granted exempt status by the University of Pittsburgh Institutional Review Board because we used previously collected data that had no personal identifiers (the study was initiated when MH-L was at the University of Pittsburgh).

Results

Study sample characteristics

We observed the care received by 13,992 Medicaid beneficiaries during the study period. Our sample included 25% blacks, 37% Latinos, and 38% whites. The mean±SD age was 44±11.4 years, and 52% of the beneficiaries were female. Three percent and 11% had any substance use disorder and any psychiatric comorbidity, respectively, and the mean number of schizophrenia-related inpatient days was .6±3.4, with a range of 0–67 days. Eight percent and 18% had any metabolic and any other medical comorbidity, respectively. Medicaid eligibility was mediated by SSI for 89% of the sample. As shown in Table 1, the racial-ethnic groups

Table 1

Sample characteristics of Florida Medicaid beneficiaries with schizophrenia, by racial-ethnic group[a]

	All (N=13,992)		Blacks (N=3,523)		Latinos (N=5,126)		Whites (N=5,343)	
Variable[b]	N	%	N	%	N	%	N	%
Age (mean±SD)	44±11.4		42±11.2		45±11.2		45±11.4	
Female	7,320	52.3	1,748	49.6	2,919	56.9	2,653	49.7
Psychiatric comorbidity	1,546	11.1	346	9.8	640	12.5	560	10.5
Substance use disorder comorbidity	466	3.3	182	5.2	114	2.2	170	3.2
Inpatient days (mean±SD)	.6±3.4		.9±4.0		.6±3.5		.5±2.9	
Metabolic comorbidity	1,178	8.4	277	7.9	522	10.2	379	7.1
Other medical comorbidity	2,443	17.5	662	18.8	992	19.4	789	14.8
Social Security Disability Insurance	12,428	88.8	3,275	93.0	4,753	93.0	4,400	82.4

[a] All between-group comparisons were significant at $p<.001$.

[b] All nondemographic variables were assessed in the 3 months before the first antipsychotic prescription fill.

Table 2

Racial-ethnic distribution of adult Medicaid beneficiaries with schizophrenia across 11 Florida Medicaid areas, by unadjusted probability (Pr) of LAIR use[a]

Group	Medicaid area																	
	2 (Pr=3.1%)		11 (Pr=3.7%)		8 (Pr=6.5%)		7 (Pr=6.8%)		4 (Pr=6.8%)		6 (Pr=7.8%)		10 (Pr=8.7%)		5 (Pr=9.4%)		3 (Pr=9.8%)		1 (Pr=12.3%)		9 (Pr=14.2%)	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All	605	4.3	6,037	43.2	372	2.7	753	5.4	1,283	9.2	606	4.3	1,180	8.4	945	6.8	1,088	7.8	325	2.3	798	5.7
Blacks	273	7.8	1,052	29.9[b]	5.7	1.6	209	5.9	486	13.8[b]	137	3.9	427	12.1[b]	168	4.8	331	9.4	91	2.6	292	8.3
Latinos	69	1.4	3,749	73.1[c]	86	1.7	197	3.8	178	3.5	135	2.6	269	5.3	123	2.4	157	3.1	33	.6	130	2.5
Whites	263	4.9	1,236	23.1[b]	229	4.3	347	6.5	619	11.6[b]	334	6.3	484	9.1	654	12.2[b]	600	11.2[b]	201	3.8	376	7.0

[a] Medicaid areas are listed in ascending order of unadjusted probabilities of using long-acting injectable risperidone (LAIR); these probabilities have not been fitted with a random-effects model.

[b] ≥10% of racial-ethnic group in area

[c] ≥50% of racial-ethnic group in area

differed with regard to all need variables.

Probability of LAIR use

Unadjusted analyses. The overall unadjusted probability of LAIR use was 6.5%. Probability of LAIR use was comparable for blacks and whites (8.2% versus 7.2%; OR=1.66, CI=.99–1.36). Latinos, however, had a lower probability of LAIR use than whites (4.6% versus 7.2%; OR=.62, CI=.53–.73).

The unadjusted probability of LAIR use varied across the Medicaid areas. Probability of LAIR use was lowest in areas 2 and 11 (3.1% and 3.7%, respectively) and highest in areas 1 and 9 (12.3% and 14.2%, respectively) (Table 2). Whereas all racial-ethnic groups were unequally distributed across the state (Table 2), Latinos were the most concentrated, with 73% of Latino beneficiaries residing in area 11 (Miami Dade and Monroe counties). Although blacks were as likely as whites to reside in the two areas with the highest rates of LAIR use (10.9% and 10.8%, respectively), a higher proportion of them resided in the two areas with the lowest rates of LAIR use (38% and 28%, blacks and whites, respectively).

Multivariate analyses with the primary model. Adjustment for need variables did not fundamentally change our unadjusted findings (Table 3). Blacks did not differ significantly from whites in their probability of LAIR use (OR=.98, CI=.82–1.16), yet Latinos' probability of LAIR use was lower than that of whites (OR=.58, CI=.49–.70).

Multivariate analyses with the secondary model. Inclusion of the geographic random effects in the model eliminated the Latino-white disparity (Table 3), a result that remained unchanged when area was included as a fixed effect (results not shown). Further, the odds of LAIR use varied substantially across areas, ranging from a low of .44 in area 11, to a high of 1.91 in area 1. Compared with the state average, odds of LAIR use were significantly lower for areas 2 and 11 and significantly higher for areas 1 and 9.

Other findings. In both models, odds of LAIR use were higher for

Table 3

Adjusted estimated probabilities of using long-acting injectable risperidone among Florida Medicaid beneficiaries with schizophrenia, January 1, 2004, through June 30, 2006

Beneficiary characteristic	Primary model					Secondary model[a]				
	Log-OR	SE	p	OR	95% CI	Log-OR	SE	p	OR	95% CI
Black (reference: white)	–.023	.087	ns	.98	.82–1.16	.084	.089	ns	1.09	.89–1.33
Latino (reference: white)	–.542	.092	<.001	.58	.49–.70	–.108	.101	ns	.90	.72–1.12
Age	–.027	.003	<.001	.97	.97–.98	–.022	.003	<.001	.98	.97–.99
Female (reference: male)	–.083	.075	ns	.92	.80–1.07	–.126	.076	ns	.88	.74–1.04
Substance use disorder comorbidity (reference: none)	.081	.158	ns	1.08	.80–1.48	.023	.160	ns	1.02	.72–1.46
Psychiatric comorbidity (reference: none)	.202	.105	ns	1.22	.99–1.50	.214	.107	ns	1.24	.98–1.57
Intensity of inpatient service use	.131	.007	<.001	1.14	1.12–1.16	.142	.008	<.001	1.15	1.13–1.17
TANF (reference: SSI)[b]	−1.275	.373	.001	.27	.13–.58	−1.234	.379	.009	.29	.13–.68
Metabolic comorbidity (reference: none)	.632	.109	<.001	1.88	1.52–2.33	.625	.111	<.001	1.87	1.46–2.39
Other medical comorbidity (reference: none)	.706	.087	<.001	2.03	1.71–2.40	.771	.088	<.001	2.16	1.78–2.63
Medicaid area										
1						.649	.217	.014	1.91	1.18–3.10
2						–.777	.248	.011	.46	.26–.80
3						.377	.179	ns	1.46	.98–2.17
4						–.146	.182	ns	.86	.58–1.30
5						.258	.185	ns	1.29	.86–1.95
6						.009	.207	ns	1.01	.64–1.60
7						–.132	.201	ns	.88	.56–1.37
8						.067	.234	ns	1.07	.64–1.80
9						.633	.181	.006	1.88	1.26–2.82
10						–.025	.181	ns	.98	.65–1.46
11						–.830	.170	.001	.44	.30–.64

[a] Between-area variance component estimated as .23 (p=.056)

[b] TANF, Temporary Assistance for Needy Families; SSI, Supplemental Security Income

younger beneficiaries or those with SSI benefits and for those with heavier use of inpatient services for treatment of schizophrenia or general medical comorbidities (Table 3).

Discussion

Our Florida-wide study of LAIR use among Medicaid beneficiaries during the 30-month period that followed its FDA approval offers a unique window into the process of adoption of mental health treatment innovations within a large and diverse state Medicaid program. Whether racial-ethnic disparities exist in the adoption of LAIR depends on whether geographic effects are accounted for. When we assessed for adoption disparities within the entire Florida Medicaid program, we found that Latinos had a lower probability of LAIR use than whites. Once we accounted for beneficiaries' geographic location, the Latino-white adoption disparity evaporated. The explanation for the powerful effect of geography on the estimation of ethnic disparities lies in two phenomena: the geographic concentration of Latino Medicaid beneficiaries and geographic disparities in LAIR adoption within the state of Florida. Because choice of geographic area of residence depends on unobserved subject and geographic factors that may be related to medication use, our results are only associative and not causative.

We are aware of only three previous studies that have produced evidence of disparities in the adoption of antipsychotic medications in the United States. A study conducted in the Veterans Health Administration (VHA) found that black and Latino veterans with schizophrenia were less likely than whites to use ziprasidone immediately after its launch into the U.S. market (11). However, the authors found little evidence of disparities across administrative VHA regions. Opolka and colleagues (13) assessed for racial-ethnic disparities in receipt of olanzapine versus a first-generation oral antipsychotic among Texas Medicaid adult beneficiaries with schizophrenia during a 20-month period that covered the market launch of olanzapine. After adjusting for health status and geographic region, the investigators found that blacks but not Mexican-Americans were less likely than whites to receive olanzapine. The authors also found geographic variation in adjusted probability of olanzapine use. In a similarly designed study, Opolka and colleagues (12) assessed for racial differences in receipt of olanzapine versus an established second-generation antipsychotic; they did not find racial disparities but found geographic variations.

Our study differs from these studies in two respects. First, we framed our study both conceptually and methodologically as an investigation of disparities in the adoption of a new medical technology. Because policy remedies differ depending on whether the main issue is racial-ethnic versus geographic variations (37), we explicitly sought to disentangle the effects of race-ethnicity

and geography in the estimation of racial-ethnic disparities. Second, we contrasted probability of use of the innovation versus use of all other antipsychotics and systematically assessed for geographic disparities through a random-effects approach that accounted for within-region correlation.

Our finding that the Florida Medicaid areas differed in their LAIR adoption rates adds to a small body of research suggesting geographic variation in adoption of mental health innovations within state Medicaid programs (12,13,38,39). Why would geographic variations exist for fee-for-service Medicaid beneficiaries subject to the same drug coverage and utilization management policies and unaffected by potential differences in managed care contracts? Although we were unable to generate evidence on the drivers of these variations, the literature points to possible explanations. The rate at which an innovation spreads through the health care system is associated with factors related to patients (race-ethnicity, socioeconomic status, and preferences), clinicians (knowledge and attitudes), the system of care (policies, organizational structure, and culture), and private-sector initiatives (advocacy and pharmaceutical promotion) (3,9,10,40–46). Evidence of differences in use of long-acting injectable antipsychotics across U.S. facilities subject to the same regulatory and financial constraints (47,48) suggests that the culture and the organizational structure in which prescribers operate may have played an important role in the observed geographic variations in adoption of LAIR. Although cultural factors of relevance include opinion leaders and attitudes toward and exposure to pharmaceutical promotion, a key structural factor is the availability of nursing staff to administer injections (10,49).

Our finding that geographic disparities confounded the estimation of racial-ethnic disparities when these were assessed for the entire state is in keeping with studies of other populations (19,50). However, as far as we are aware, ours is the first such finding for a Medicaid population with schizophrenia.

In the absence of extraneous dynamics, rate of adoption of new health care technologies should be similar for all those who stand to benefit from their use. Although the field no longer regards second-generation antipsychotics as the standard of care (51) and recent studies have produced mixed evidence on the effectiveness of long-acting injectable antipsychotics and LAIR (52,53), our study peers into a time when LAIR held the promise of delivering the advantages of both second-generation antipsychotics and long-acting injectable antipsychotics.

Our study had some limitations. First, because of the observational nature of our design, our study may not have compared racial-ethnic groups that were entirely balanced with regard to history of poor medication adherence and other factors affecting need for long-acting injectable antipsychotics. Second, the generalizability of our study may be limited because of our focus on Florida, a state that differs from many others because of its racial-ethnic diversity and its restrictive requirements for Medicaid eligibility.

Conclusions

Our results indicate that within a state Medicaid program, the initial finding of a Latino-white disparity in the adoption of a novel treatment for schizophrenia was driven by geographic disparities in adoption rates and the geographic concentration of Latinos in a low-adoption area. When we accounted for place of residence, the ethnic disparity disappeared. Our study adds to an expanding body of evidence suggesting that as a result of the heterogeneous distribution of racial-ethnic groups, racial-ethnic disparity estimates that represent average effects over large geographic areas may be confounded by the unaccounted effects of geographic variations. This evidence has important implications for efforts to eradicate disparities and improve quality of care for all.

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References

1. Saha S, Chant D, Welham J, et al: A systematic review of the prevalence of schizophrenia. PLoS Medicine 2:e141, 2005
2. Mental Health: A Report of the Surgeon General. Washington, DC, US Department of Health and Human Services, US Public Health Service, 1999
3. Horvitz-Lennon M, Donohue JM, Domino ME, et al: Improving quality and diffusing best practices: the case of schizophrenia. Health Affairs 28:701–712, 2009
4. Young AS, Sullivan G, Burnam MA, et al: Measuring the quality of outpatient treatment for schizophrenia. Archives of General Psychiatry 55:611–617, 1998
5. Lehman AF, Steinwachs DM: Patterns of usual care for schizophrenia: initial results from the Schizophrenia Patient Outcomes Research Team (PORT) Client Survey. Schizophrenia Bulletin 24:11–32, 1998
6. Busch AB, Lehman AF, Goldman H, et al: Changes over time and disparities in schizophrenia treatment quality. Medical Care 47:199–207, 2009
7. Wang PS, Demler O, Kessler RC: Adequacy of treatment for serious mental illness in the United States. American Journal of Public Health 92:92–98, 2002
8. Kuno E, Rothbard AB: Racial disparities in antipsychotic prescription patterns for patients with schizophrenia. American Journal of Psychiatry 159:567–572, 2002
9. Cabana MD, Rand CS, Powe NR, et al: Why don't physicians follow clinical practice guidelines? A framework for improvement. JAMA 282:1458–1465, 1999
10. Greenhalgh T, Robert G, Macfarlane F, et al: Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Quarterly 82: 581–629, 2004
11. Valenstein M, McCarthy JF, Ignacio RV, et al: Patient- and facility-level factors associated with diffusion of a new antipsychotic in the VA health system. Psychiatric Services 57:70–76, 2006
12. Opolka JL, Rascati KL, Brown CM, et al: Ethnicity and prescription patterns for haloperidol, risperidone, and olanzapine. Psychiatric Services 55:151–156, 2004
13. Opolka JL, Rascati KL, Brown CM, et al: Ethnic differences in use of antipsychotic medication among Texas Medicaid clients with schizophrenia. Journal of Clinical Psychiatry 64:635–639, 2003
14. Smedley BD, Stith AY, Nelson AR (eds): Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care. Washington, DC, National Academy Press, 2003
15. McGuire TG, Alegría M, Cook BL, et al: Implementing the Institute of Medicine definition of disparities: an application to mental health care. Health Services Research 41:1979–2005, 2006
16. Fisher ES, Wennberg DE, Stukel TA, et al: The implications of regional variations in

Medicare spending: part 1: the content, quality, and accessibility of care. Annals of Internal Medicine 138:273–287, 2003

17. Wennberg JE: Time to tackle unwarranted variations in practice. British Medical Journal 342:d1513, 2011
18. Baicker K, Chandra A, Skinner JS: Geographic variation in health care and the problem of measuring racial disparities. Perspectives in Biology and Medicine 48(suppl):S42–S53, 2005
19. Chandra A, Skinner JS: Geography and Racial Health Disparities. Cambridge, Mass, Social Science Research Network, 2003
20. Frank RG, Glied SA: Better but Not Well: Mental Health Policy in the US Since 1950. Baltimore, Johns Hopkins University Press, 2006
21. Kane JM, Leucht S, Carpenter D, et al: Optimizing pharmacologic treatment of psychotic disorders: introduction: methods, commentary, and summary. Journal of Clinical Psychiatry 64(suppl 12):5–19, 2003
22. Lehman AF, Kreyenbuhl J, Buchanan RW, et al: The Schizophrenia Patient Outcomes Research Team (PORT): updated treatment recommendations 2003. Schizophrenia Bulletin 30:193–217, 2004
23. Lehman AF, Lieberman JA, Dixon LB, et al: Practice guideline for the treatment of patients with schizophrenia, second edition. American Journal of Psychiatry 161(suppl 2):1–56, 2004
24. Lehman AF, Steinwachs DM: Translating research into practice: the Schizophrenia Patient Outcomes Research Team (PORT) treatment recommendations. Schizophrenia Bulletin 24:1–10, 1998
25. Rosenheck RA, Desai R, Steinwachs D, et al: Benchmarking treatment of schizophrenia: a comparison of service delivery by the national government and by state and local providers. Journal of Nervous and Mental Disease 188:209–216, 2000
26. West JC, Marcus SC, Wilk J, et al: Use of depot antipsychotic medications for medication nonadherence in schizophrenia. Schizophrenia Bulletin 34:995–1001, 2008
27. Fayek M, Flowers C, Signorelli D, et al: Underuse of evidence-based treatments in psychiatry. Psychiatric Services 54:1453–1454; 1456, 2003
28. Glazer WM: Who receives long-acting antipsychotic medications? Psychiatric Services 58:437, 2007
29. Heres S, Hamann J, Kissling W, et al: Attitudes of psychiatrists toward antipsychotic depot medication. Journal of Clinical Psychiatry 67:1948–1953, 2006
30. Burton SC: Strategies for improving adherence to second-generation antipsychotics in patients with schizophrenia by increasing ease of use. Journal of Psychiatric Practice 11:369–378, 2005
31. Chue P: Risperidone long-acting injection. Expert Review of Neurotherapeutics 3: 435–446, 2003
32. Kreyenbuhl J, Zito JM, Buchanan RW, et al: Racial disparity in the pharmacological management of schizophrenia. Schizophrenia Bulletin 29:183–193, 2003
33. Fenton WS, Blyler CR, Heinssen RK: Determinants of medication compliance in schizophrenia: empirical and clinical findings. Schizophrenia Bulletin 23:637–651, 1997
34. Valenstein M, Blow FC, Copeland LA, et al: Poor antipsychotic adherence among patients with schizophrenia: medication and patient factors. Schizophrenia Bulletin 30:255–264, 2004
35. Lacro JP, Dunn LB, Dolder CR, et al: Prevalence of and risk factors for medication nonadherence in patients with schizophrenia: a comprehensive review of recent literature. Journal of Clinical Psychiatry 63: 892–909, 2002
36. Gilmer TP, Dolder CR, Lacro JP, et al: Adherence to treatment with antipsychotic medication and health care costs among Medicaid beneficiaries with schizophrenia. American Journal of Psychiatry 161: 692–699, 2004
37. Fisher ES, Goodman DC, Chandra A: Regional and Racial Variation in Health Care Among Medicare Beneficiaries. A Brief Report of the Dartmouth Atlas Project. Lebanon, NH, Dartmouth Institute for Health Policy and Clinical Practice/Robert Wood Johnson Foundation, 2008. Available at www.rwjf.org/qualityequality/product.jsp?id=36729
38. Liu GG, Sun SX, Christensen DB, et al: Choice of atypical antipsychotic therapy for patients with schizophrenia: an analysis of a Medicaid population. Current Therapeutic Research 66:463–474, 2005
39. Rascati KL, Johnsrud MT, Crismon ML, et al: Olanzapine versus risperidone in the treatment of schizophrenia: a comparison of costs among Texas Medicaid recipients. PharmacoEconomics 21:683–697, 2003
40. Landon BE, Wilson IB, Cleary PD: A conceptual model of the effects of health care organizations on the quality of medical care. JAMA 279:1377–1382, 1998
41. Drake R, Skinner J, Goldman HH: What explains the diffusion of treatments for mental illness? American Journal of Psychiatry 165:1385–1392, 2008
42. Domino ME, Frank RG, Rosenheck R: The diffusion of new antipsychotic medications and formulary policy. Schizophrenia Bulletin 29:95–104, 2003
43. Smedley BD: Moving beyond access: achieving equity in state health care reform. Health Affairs 27:447–455, 2008
44. Zuvekas SH, Taliaferro GS: Pathways to access: health insurance, the health care delivery system, and racial/ethnic disparities, 1996–1999. Health Affairs 22 (2):139–153, 2003
45. Alegría M, Pérez DJ, Williams S: The role of public policies in reducing mental health status disparities for people of color. Health Affairs 22(5):51–64, 2003
46. Figueiras A, Caamaño F, Gestal-Otero JJ: Influence of physician's education, drug information and medical-care settings on the quality of drugs prescribed. European Journal of Clinical Pharmacology 56: 747–753, 2000
47. Valenstein M, Copeland LA, Owen R, et al: Adherence assessments and the use of depot antipsychotics in patients with schizophrenia. Journal of Clinical Psychiatry 62:545–551, 2001
48. Citrome L, Levine J, Allingham B: Utilization of depot neuroleptic medication in psychiatric inpatients. Psychopharmacology Bulletin 32:321–326, 1996
49. Arbuckle MR, Gameroff MJ, Marcus SC, et al: Psychiatric opinion and antipsychotic selection in the management of schizophrenia. Psychiatric Services 59:561–565, 2008
50. Skinner J, Weinstein JN, Sporer SM, et al: Racial, ethnic, and geographic disparities in rates of knee arthroplasty among Medicare patients. New England Journal of Medicine 349:1350–1359, 2003
51. Carpenter WT, Buchanan RW: Lessons to take home from CATIE. Psychiatric Services 59:523–525, 2008
52. Rosenheck RA, Krystal JH, Lew R, et al; CSP555 Research Group: Long-acting risperidone and oral antipsychotics in unstable schizophrenia. New England Journal of Medicine 364:842–851, 2011
53. Tiihonen J, Haukka J, Taylor M, et al: A nationwide cohort study of oral and depot antipsychotics after first hospitalization for schizophrenia. American Journal of Psychiatry 168:603–609, 2011