Racial Disparities in Prescription Drug Use for Mental Illness among Population in US

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Abstract

Background: Racial minorities are a rapidly growing portion of the US population. Research suggests that racial minorities are more vulnerable to mental illness due to risk factors, such as higher rates of poverty. Given that the burden of mental illnesses is significant, equal likelihood of mental health services utilization is important to reduce such burden. Racial minorities have been known to use mental health services less than Whites. However, it is unclear whether racial disparity in prescription drug use for mental illnesses exists in a nationally representative sample. For a valid estimation of prescription drug use patterns, the characteristic in the distribution of prescription drug use should be accounted for in the estimation model.

Aims of the Study: This study is intended to document whether there was a disparity in psychiatric drug use in both extensive and intensive margins between Whites and three racial minorities: Blacks, Hispanics, and Asian-Indians. The study looked at several specified mental illnesses, controlling for underlying health status and other confounding factors.

Methods: Secondary data analysis was conducted using the multiyear Medical Expenditure Panel Survey (MEPS), a nationally representative panel sample from 1996 through 2000. This analysis provides estimates of the actual expenditure on prescription drug use for people with specified mental illnesses for this study, based on comparison of Whites and other racial minorities. We derived the estimates from the two-part model, a framework that adjusts the likelihood of using prescription drugs for the specified mental illnesses while estimating the total actual expenditures on prescription drugs among the users.

Results: This study found that Blacks, Hispanics, and Asian-Indians were less likely than Whites to use prescription drugs by 8.3, 6.1 and 23.6 percentage points, respectively, holding other factors constant in the sample, with at least one of the specified mental illnesses. The expenditure on prescription drugs for the specified mental illnesses differs between each of racial minorities (Blacks, Hispanics, and Asian-Indians) and Whites even after adjusting for the different likelihood of using those prescription drugs. Blacks, Hispanics, and Asian-Indians with the specified mental illnesses were estimated to spend $606.53, $9.83 and $179.60 less per year, respectively, on their actual prescription drugs than Whites.

Discussion: This study concludes that three racial minorities: Blacks, Hispanics, and Asian-Indians, with the specified mental illnesses are less likely to use psychiatric drugs than Whites. Among users, racial minorities use less psychiatric drugs than Whites in terms of actual spending on those drugs.

Implications for Health Care Provision and Use: There is a need to focus on a program to reach out to racial minorities with a diagnosis of mental illnesses, and this program should consider the cultural specificity of each minority group regarding mental illnesses.

Implications for Health Policies: In the development of mental health policy, it is crucial to understand the underlying non-socioeconomic factors which may significantly determine the access to mental health service. Also, education programs or other outreach programs for racial minorities are necessary to understand the different distribution of mental health services for racial minorities.

Implications for Further Research: Future research should examine the causes for racial disparity in the use of prescription drugs for mental illness both in the extensive and intensive margins. An in-depth analysis is needed to map out the attributes for the observed disparity between Whites and racial minorities in mental health service use.

Introduction

Increasing numbers of studies have been estimating the effect of race on mental health care utilization, and these studies have mainly focused on the extent and type of variation in mental health service utilization patterns by race. For example, Blacks reportedly made more mental health-related office visits to primary care physicians than to psychiatrists, and thus, they were less likely to be provided a psychotropic medication.[1] Similarly, the population-adjusted rate of office-based physician visits with prescription of antidepressant drugs was less than 25% for Hispanics, and less than 50% for Blacks than for Whites.[2] The racial difference also has been found in the type of ambulatory mental health services. Hispanics and Blacks had lower visit rates for drug therapy than Whites, and Blacks also had a lower visit rate for talk therapy than drug therapy.[3]

However, two aspects need more consideration than they are given in the existing literature reporting racial disparity

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for Whites and other minority groups. First, most of the studies used specific outpatient or inpatient claims data from various sources, such as Medicaid or private insurance. Such specific claims data covers only users. Thus, the racial minority populations who have mental illnesses without using the mental health system are not represented in claims data. This implies that the factors deriving from different access to mental health care system are not accounted for in those studies. Second, even for the studies using population-based data with proportionate sampling, few studies accounted for the distributional characteristics of the amount of utilization. Continuous utilization magnitudes are observed only when actual utilization happens, and there are always populations with mental illnesses who do not use mental health services. Therefore, the amount of mental health service use distributes with a mixture of continuous and dichotomous distribution.

This study focuses on prescription drug utilization patterns for mental illnesses. The introduction of psychiatric drugs is a major advance in the treatment of mental illness. Psychiatric medicines have replaced ambulatory care for inpatient specialized therapy, and became a dominant approach for treating with mental illnesses.[4] A two-part model is used to adjust the different probability of accessing prescription drug services for mental illnesses between Whites and other racial minorities including Blacks, Hispanics and Asian-Indians. That is, the prescription drug expenditure for mental illnesses is modeled for the sample persons who received at least a diagnosis of mental illness on a self-report which was retrospectively confirmed by claims. Then, the estimated expenditure is adjusted by multiplying the predicted likelihood of any use of prescription drugs for one of the self-reported mental illnesses of interest for this study.

This study is relevant to health policy for two reasons. First, the prevalence of mental illness is high in general, and the economic burden in terms of direct and indirect cost of mental illness is substantial. About 20 percent of the U.S. population is affected by mental disorders during a given year, according to the Epidemiologic Catchment Area (ECA) study of the early 1980s, and the National Comorbidity Survey (NCS) of the early 1990s. The prevalence of mental illnesses has increased to 30 percent in NCS replication survey of the early 2000s.[3,5,6]. The direct costs of mental health services in the United States in 1996 totaled $69.0 billion, which was 7.3% of total health spending, and the indirect costs of all mental illness imposed a nearly $79 billion loss on the U.S. economy in 1990.[4] Second, racial minority populations, in particular, Hispanics, are growing in the U.S. population, and they are still more likely than non-Hispanics Whites to live in poverty,[7,8] which creates an economic barrier to access to the mental health service system. Other than an economic barrier to access to mental health services, lower socioeconomic status in terms of income, education, and occupation has been reported to be strongly and negatively associated with mental illnesses.[9] Greater stress in the lives of the poor and greater vulnerability to a variety of stressors may lead to some mental disorders, such as depression.[10]

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Background

Most of the previous literature reported a consistent result that there has been a racial disparity regarding the use of mental health services. For example, recent replicative survey of National Comorbidity Survey (NCS-R) found that Blacks were 50 percent less likely to receive psychiatric treatments as Whites when both were diagnosed as the same mental illness of the same severity. In fact, this racial gap in the use of psychiatric treatments has not been changed from the early 1990s NCS. NCS-R also found that a substantial increase in the rate of treatment since NCS (treatment rate for a diagnosed mental illness was 20.3 percent in NCS of the early 1990s, while it was 32.9 percent in NCS-R of the early 2000s). This increase in the rate of psychiatric treatment but almost no change in racial disparity in the use of psychiatric treatment may imply that absolute racial disparity has been even deeper from the 1990s to the 2000s.[5]

Racial disparity can be defined as difference in treatment provided to members of different racial groups not justified by the underlying health conditions or preferences of the treatment of the patient, according to Institute of Medicine (IOM).[9]

Several reasons have been pointed out for the observed racial disparities in previous literature, and those include the following: different perception of mental diseases and the appropriate treatment among racial minorities;[12-14] racial minorities' mistrust against White psychiatrists or general psychiatric system;[15] the cohort effect of the same racial groups in the residential region;[16] the different distribution of available providers for racial minorities and Whites in the area;[17] and poor doctor-patient communication for racial minorities.[18]

If these racial disparities result in different mental health outcomes which were treated, a need for policy intervention for decreasing those disparities will arise. In fact, previous literature has implied a potential adverse effect on mental health outcomes by those disparities. For example, it was found that psychiatrists tended to prescribe medications that are not first-line recommended treatments, which may also carry a greater risk of producing some side effects, to African-Americans than Whites in an experimental situation.[19]

In order to understand racial differences in mental health service utilization in the population with mental illnesses, the term 'cultural identity' is important. '' 'Cultural identity' specifies a reference group, which is an identifiable social entity with whom a person identifies and to whom he or she looks for standards of behavior''. The cultural identity for each race might grant distinct patterns of beliefs and practices that imply the willingness to seek mental health services.[20,21] The racial differences in the use of outpatient mental health services are reported to exist even in an insured and non-poor population.[22,23] This result implies that factors other than socioeconomic status, such as cultural or attitudinal factors, are likely to be attributable for distinct utilization patterns of mental health services across races.

Once the observable factors affecting prescription drug use are controlled in the model, the distinct likelihood of mental health service utilization across races would capture the unobserved cultural or attitudinal factors across races. Meanwhile, if the disparity in the amount of mental health service use is attributable to race for the population who accessed the mental health care system, the cultural or attitudinal factor would not be wholly attributable for the racial disparity.

Methods

Data Analytic Procedures

Utilization is measured by both the extent of access and amount of use by the accessed population. The extent of access can be captured by the probability of using mental health services, in particular, prescription drugs in this study, for the specified mental illnesses.

In the analyzed data, a particular feature exists in the distribution of the prescription drug expenditure for mental illnesses. Among the sample persons who received a diagnosis of mental illness on a self-report, 38.1% did not use prescription drugs for mental illnesses at all during the study period. Moreover, a higher proportion of no prescription drug utilization among the sample persons who received a diagnosis of mental illness on a self-report was observed for three racial minorities, Blacks, Hispanics, and Asian-Indians, than among Whites (40.05%, and 28.56%, respectively). Since the distribution of prescription drug expenditure has a positive mass at zero for both non-Whites and Whites, the distribution of prescription drug expenditure is neither discrete nor continuous. Also, the zeros in the distribution of prescription expenditure are real zeros, neither having the inherent positive values nor being selectively missing. Therefore, the two-part model was used in the analysis of the influence of race on prescription drug expenditure for mental illnesses.

The two-part model is an estimating approach to exploit the fact that the likelihood naturally splits the model into two or more parts. Part one of the two-part model for prescription expenditure deals with the discrete feature of the distribution, i.e., likelihood of having positive values, and part two deals with continuous distribution of expenditure for those individuals who were observed to have more than zero values. Two predictions obtained from each part of the two-part model were multiplied to obtain an overall prediction of prescription drug expenditure for an individual.[24,25]

In the study, the likelihood of using prescription drugs for mental illnesses was estimated on the entire sample with mental illness in the first part of the two-part model. In the second part of the two-part model, the actual prescription drug expenditures for mental illnesses were estimated on the subset with positive prescription expenditure values for mental illnesses. Both the likelihood of prescription drug use and actual prescription drug expenditures are modeled with race and other individual sample characteristics.

The basic equations are the following:

Part 1: Likelihood of using Rx drugs

$$\begin{aligned} \Pr(y > 0 | X) &= \Phi(X\beta, \ \nu) \\ &= \Phi(\beta_1 \ RACE + \beta_2 \ PREDISPOSING + \\ &\quad + \beta_3 \ ENABLING + \beta_4 \ NEED) \end{aligned}$$

Part 2: Rx expenditure for subset of users

$$\begin{aligned} \mathrm{E}[y|y > 0, \ X) &= X\eta + \mathrm{E}[\varepsilon | Rxexpenditure > 0, \ X] \\ &= \eta_1 \ RACE + \eta_2 \ PREDISPOSING + \\ &\quad + \eta_3 \ ENABLING + \eta_4 \ NEED \end{aligned}$$

, where y is the actual prescription drug expenditure for mental illnesses, i indexes individuals, and the β_i's and η_i's are vectors of parameters to estimate. The explanatory variable of interest is a series of dummy variable representing Blacks, Hispanics, and Asian-Indians, with Whites being the reference group. If the respondents in the MEPS claimed themselves as Hispanics, they are placed into Hispanics regardless of their skin color. The expected sign of parameter estimates for β_1 and η_1 are negative. The estimated actual prescription drug expenditure is computed by the following:

$$\begin{aligned} \mathrm{E}[Rx \ expenditure] &= \\ &= \mathrm{E}[Rx \ expenditure | Rx \ expenditure > 0, \ X] \times \\ &\quad \Pr(Rx \ expenditure > 0 | X) \end{aligned}$$

Three sets of individual characteristics are included in the model as covariates following the Anderson and Newman model[26] of the factors explaining health service utilization: (i) predisposing factor: demographics, and social structure; (ii) enabling factor: personal/family resources, community resources, and competing needs; (iii) need factor: perceived physical and mental health status. Controlling possible covariates affecting psychiatric drug use is important so that a series of dummy variables for racial minorities represent racial identity, and to see the effect of racial identity on psychiatric use, ceteris paribus.

The marginal effect of each racial minority on the actual prescription drug expenditure for mental illnesses is obtained by the derivative of the estimated prescription drug expenditure by each racial minority:

$$\begin{aligned} \frac{\partial E[y]}{\partial X_k} &= \frac{\partial (\Phi(\beta X) \times E[y|y > 0])}{\partial X_k} = \\ &\left(\Pr[y > 0] \times \frac{\partial E[y|y > 0]}{\partial X_k} \right) + \\ &\left(E[y|y > 0] \times \frac{\partial \Pr[y > 0]}{\partial X_k} \right) \end{aligned}$$

, where X_k is a vector for a series of dummy variable representing Blacks, Hispanic, and Asian-Indians.

The marginal effect of the interaction terms between

dummy variables for racial minorities and dummy variables for insurance types on the actual prescription drug expenditure for mental illnesses (represented as *IE* in below equation) is obtained by double differencing:

$$IE = [\Phi(X_k = 1, \ Z_i = 0) - \Phi(X_k = 0, \ Z_i = 0)] -$$
$$- [\Phi(X_k = 1, Z_i = 1) - \Phi(X_k = 0, Z_i = 1)],$$

where X_k is a vector for a series of dummy variable representing Blacks, Hispanic, and Asian-Indians, Z_i is a vector for a series of dummy variable representing only having public insurance, and having any private insurance. Prescription drug expenditure is logged in the model, and estimated logged value of prescription drug expenditure was converted into the level following Mullay-Manning protocol as is described in the specification section in detail. The marginal effect across all the observation in the analysis dataset is computed by the average of the probabilities method, i.e. the marginal effect of each observation in the analysis dataset is averaged.

Study Population and Data

The Medical Expenditure Panel Survey (MEPS) data was used for this study. Since the MEPS data is population-based panel data covering U.S. non-institutionalized individuals and/or households, this study does not have a potential threat to external validity. Specifically, the data used in this analysis are derived from the household survey of the 1996 through the 2000 MEPS. The MEPS is composed of three surveys: the Household Component (HC), the Medical Provider Component (MPC), and the Insurance Component (IC). The MEPS HC is the sub-sample of households responding to the National Health Interview Survey (NHIS). The NHIS sample design has three stages of sample selection: an area sample of primary sampling units (PSUs), a sample of segments (single or groups of blocks or block equivalents) within sampled PSUs, and a sample of housing units within segments. Among initially sampled households, those containing Hispanics and Blacks were over-sampled. A person-level weight for MEPS was created, including both an adjustment for non-response over time and post-stratification.[27]

Thus, different observations in the sample had different sampling probabilities and the response rates were different by sample characteristics. In addition, the observations in the sample were drawn using clustering. Therefore, in the analysis, all the estimation models are weighted using the probability weight of each person. Huber/White robust standard errors are produced by adjusting the clustering of the standard errors within primary sample units. Complex survey setting in STATA 8.0 was used for reflecting the survey structure of the MEPS, and the same statistical software was used for other analyses in this study.

We pooled five years of MEPS spanning 1996 to 2000. We also restricted the pooled synthetic panel for the analysis to the adults aged 18-64 years with one or more diagnoses of mental illnesses of interest on a self-report and without having missing values (not zero) in the prescription drug use

for mental illnesses of interest. Mental illnesses of interest included the following: mental retardation; alcohol-related mental disorders; substance-related mental disorders; senility and organic mental disorders; affective disorders; schizophrenia and related disorders; other psychoses; anxiety, somatoform, dissociative, and personality disorders; pre-adult disorders; other mental conditions; personal history of mental disorder, mental and behavioral problems, observation and screening for mental condition. The ICD-9-CM for each of those mental conditions included in this study is displayed in **Appendix A**.

A panel is interviewed in five rounds for two years in the MEPS. Each year has data for two panels. Thus, in the original MEPS data, each panel enters the data twice if data of each year is pooled together. However, as displayed in **Table 1**, this study only used data from one panel in each year. That is, only the data in the first three rounds for each panel was included in this study so that each surveyed sample person enters the final data once.* The information in the first and the second round was used as the lags of the information in the third round. Since each respondent in a panel entered the synthetic panel only once, this study is a cross-sectional study with a synthetic panel data pools repeated cross-sections on different individuals.†

Table 1 presents the distribution of sample persons by cohort and year in the final sample for the analysis. There are 130,938 observations in 1996 through 2000 MEPS Household component, and it reduced to 72,687 observations when the data included only one panel of two panels for each year. Of those 72,687 observations, 60.2 % (n = 43,731) are aged 18 through 64 years. Among those 43,731 adult observations, 9.9 % (n = 4,338) are reported as having one or more mental illnesses of interest. Therefore, in the final analysis, those 4,338 observations are used (hereafter, these 4,338 observations are called the final sample).

Table 2 presents sample means weighted by probability weights and univariate missing rates for the final sample. In the analyzed data, each year contributes almost equally to the final sample: all other years composed around 20% of total observations, except the year 2000 (corresponding to panel 5) which composed 10.8% of the final sample. Proportion of observations with missing values is overall less than 1%. Around one third of the observations (N = 1,591) in the final sample had used prescription drugs for the self-report-based diagnosis of mental illnesses of interest. In the first part

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* From 1997, each year has samples from two panels: round 1 to 3 for panel 1 in 1996; round 4 to 5 for panel 1, and round 1 to 3 for panel 2 in 1997; round 4 to 5 for panel 2, and round 1 to 3 for panel 3 in 1998; round 4 to 5 for panel 3, and round 1 to 3 for panel 4 in 1999; round 4 to 5 for panel 4, and round 1 to 3 for panel 5 in 2000. As we displayed it in **Table 1**, only one panel was used for each year, that is, only starting panel in each year was included in our final data: panel 1 in 1996, panel 2 in 1997, panel 3 in 1998, panel 4 in 1999, and panel 5 in 2000.

† Although MEPS allows a longitudinal study with five rounds of survey for a sample individual, the time distance between each round of survey is too short to have enough variation in prescription drug use. Moreover, the explanatory variable of interest in this study, race, is permanent. Thus, a longitudinal analysis technique, such as fixed effects model, was not used in this study.

Table 1. Sample Size Distribution for Each Panel and Year in the MEPS

year		Panel					
		1	2	3	4	5	Total
1996	A	22691					
	B	13527					
	C	**1229**					
1997	A	20868	13683				
	B		8050				
	C		**916**				
1998	A		12935	11137			
	B			6790			
	C			**671**			
1999	A			10440	14178		
	B				8575		
	C				**779**		
2000	A				13963	11133	
	B					6789	
	C					**680**	
Total							**4338**

Note:
[a] A, B, and C represents total samples, samples aged 18 through 64 years, and samples aged 18 through 64 years with mental illnesses of interest in the MEPS, respectively.
[b] Samples in C are included in the final analysis for this study.

probit model, 3,985 observations were included, and 1,489 observations are used for the second-part regression, respectively.*

Results

Estimation Model

The dependent variables are the likelihood of prescription drug use for mental illnesses of interest in the first probit part of the two-part model, and the expenditure of prescription drug use for mental illness for the second OLS part of the two-part model. Both parts of the model are restricted to the prescription drug use in an ambulatory setting.

Observations of mental illness were identified using CCODEX in the data. ''CCODEX is 259 mutually exclusive medical condition categories which were generated from ICD-9-CM, using Clinical Classification Software''.[28] If a sample individual reported at least one of CCODEX codes representing mental illnesses of interest, the sample person was coded as having mental illnesses of interest in the analysis. Full list of ICD-9 CM corresponding to each CCODEX is displayed in **Appendix A**. In the MEPS data, a

set of constructed variables indicate the rounds in which the condition was first reported, and for subsequent rounds, the rounds in which there was a medical provider visit, prescription medication, or a disability day that occurred due to the condition. Using this information, a dummy variable indicating prescription drug use was created.

The explanatory variable of interest is a series of dummy variables representing Blacks, Hispanics, and Asian-Indians with Whites being the reference group. Those three racial minorities represent around 19.0% of 4,338 persons in the final sample.

The variables representing demographic factors include age, gender, and marital status. The sample population was 34.2% male. The mean age was 41 years in the range from 18 to 64. Around 27.6% of the sample population was reported to have been divorced, separated or widowed at either of the one or two prior rounds which were performed in last 10 months of the third round of the survey.

The education level, family size and employment status were controlled as social structure variables. Thirty three percent of 4,338 persons in the final sample reported to have been unemployed at either of one or two prior rounds of the survey, which is higher than the 27% for total population with or without mental illnesses of interest. Twenty one percent of the final sample had college or higher level education.

Personal/family resources are represented by health insurance status and family income. About 71% of the sample population was covered by some form of private health insurance, and 17.3% were covered only by public insurance. The family income is categorized as poor or near poor, low or middle income, and high income, in reference to the poverty line, and the proportions of each income level are 20.8%, 43.8%, and 35.4%, respectively. Community resources are controlled by regional information: 81.7% of the sample population lives in a metropolitan area; 32.6% lives in the South. Following Gelberg et al.[14] a variable representing competing need is controlled assuming that the individuals can delay to seek mental health services if they have competing medical needs besides mental illness: 33.4% of the sample population reported chronic diseases other than mental illnesses, which included the following: cancer (of any body part), HIV/AIDS, hypertension, ischemic heart disease, stroke, emphysema, transient ischemic attack, high cholesterol, arthritis, back problems of any kind, gall bladder disease, and back and stomach ulcers.[28]

Only about 6% of the sample population who were diagnosed to have at least one mental illness of interest, based on their self-reports, perceived their mental health status as bad. Similarly, around 8.9% of the sample population described their perceived physical health status as bad. The proportion in the final sample who visited office-based physicians related to the self-reported mental illnesses of interest was 27.4%, while it was 33.5% for office-based psychologists.

Specification Tests

The estimated residual of prescription drug expenditure approximately followed normal distribution. Whites NR-

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* In the estimation model, 353 out of 4338 final sample were dropped due to multivariate missings.

Table 2. Summary Statistics

Variables	N	Missing (%)	Estimate	Std. Error	95% confidence interval	
Dependent variable						
Rx use	4338	0.00	0.369	0.010	0.349	0.388
ln(Rx expenditure)	1591	63.32	5.966	0.045	5.877	6.055
Independent variable						
Blacks	4338	0.00	0.084	0.007	0.071	0.097
Hispanic	4338	0.00	0.082	0.006	0.070	0.094
Asian-Indians	4338	0.00	0.024	0.004	0.017	0.032
Other Demographics						
Age	4299	0.90	41.172	0.236	40.709	41.635
Male	4338	0.00	0.342	0.009	0.325	0.360
Marriage failure (ever)	4338	0.00	0.276	0.010	0.257	0.294
Social structure						
Education level						
< = High school	4338	0.00	0.303	0.009	0.286	0.320
> = College	4338	0.00	0.211	0.009	0.193	0.228
Unemployment (ever)	4338	0.00	0.328	0.010	0.309	0.347
Family size	4328	0.23	2.690	0.033	2.625	2.755
Personal/family resources						
Health insurance status						
Public only	4338	0.00	0.173	0.008	0.158	0.188
Any private	4338	0.00	0.709	0.009	0.691	0.727
Family income						
Poor to near poor	4338	0.00	0.208	0.008	0.192	0.224
Low to middle	4338	0.00	0.438	0.010	0.418	0.458
Community resources						
Region						
Northeast	4335	0.07	0.184	0.020	0.145	0.222
West	4335	0.07	0.253	0.026	0.202	0.305
Midwest	4335	0.07	0.237	0.022	0.194	0.279
MSA	4299	0.90	0.817	0.015	0.787	0.847
Competing needs						
Other chronic diseases	4338	0.00	0.334	0.009	0.316	0.352
Needs						
Perceived physical health status						
Excellent or very good	4317	0.48	0.446	0.010	0.427	0.466
Good	4317	0.48	0.298	0.009	0.280	0.316
Fair	4317	0.48	0.167	0.007	0.154	0.181
Perceived mental health status						
Excellent or very good	4314	0.55	0.426	0.011	0.404	0.447
Good	4314	0.55	0.337	0.010	0.318	0.355
Fair	4314	0.55	0.174	0.008	0.159	0.190
Health service providers use						
Office-based physicians	4338	0.00	0.274	0.009	0.257	0.291
Office-based psychologists	4338	0.00	0.335	0.009	0.317	0.354
Year control						
Panel1	4338	0.00	0.209	0.014	0.181	0.237
Panel2	4338	0.00	0.233	0.013	0.207	0.259
Panel3	4338	0.00	0.225	0.015	0.195	0.254
Panel4	4338	0.00	0.225	0.016	0.193	0.256
Panel5	4338	0.00	0.108	0.009	0.091	0.126
Number of Strata						1
Number of PSUs						767
Population size						79770598

squared test rejected the null hypothesis of homoskedasticity of the variance of the error term ($\chi^2 = 43.84$, with twenty five of degrees of freedom). Thus, heteroskedasticity-corrected standard error was estimated in the second part with Huber/White robust standard error.

However, it has been known that Huber/White correction of standard error can not be complete for correcting heteroskedasticity if the dependent variable is in the log form.[29] Thus, the heteroskedasticity consistent variance of error term was estimated as a function of all explanatory variables (represented as X) in the model. To estimate the heteroskedasticity consistent variance of the error terms as a function of X, we have regressed the squared residuals from the second part OLS estimation on the same set of explanatory variables X, and then multiplied the estimated parameter vector $\hat{\alpha}$ by X:

$$\sigma^2(X) = X\alpha$$
$$\hat{\varepsilon} = \ln(y) - X\hat{\beta}$$
$$\hat{\alpha} = (X'X)^{-1}X'(\hat{\varepsilon}^2)$$
$$\hat{\sigma}^2(X) = X\hat{\alpha},$$

where σ^2 is the heteroskedastic variance of the error terms.[30] The estimated mean of prescription drug expenditure, conditional on the set of explanatory variables, X, is the exponentiated predicted value of prescription drug expenditure with a correction for the heteroskedasticity of the normal error term:[27]

$$E[y] = \exp(X\hat{\eta} + 0.5\hat{\sigma}^2).$$

Estimation Results

The main results are: the marginal effect of each minority race (Blacks, Hispanic, and Asian-Indians) on the likelihood of using prescription drug for mental illnesses of interest over Whites in the probit model; and, the marginal effect of each minority race on the actual expenditure of prescription drug use for mental illnesses of interest over Whites when the likelihood of use was adjusted in the two-part model.

Table 3 displays the analyses results for two-part model. In the first-part probit model, the effects of being Blacks, Hispanic, and Asian-Indians were all statistically significant at the 1% significance level, and all negative. These results imply that racial minorities (Blacks, Hispanic, and Asian-Indians) who were diagnosed with mental illnesses of interest based on their self-reports are less likely to use prescription drugs for those mental illnesses of interest than Whites. However, only being Blacks was statistically significant among three racial minorities in the second-part regression model. A negative coefficient for Blacks in the regression model implies that Blacks spent less on prescription drugs for mental illnesses of interest than Whites.

Other individual characteristics had the expected effect on the likelihood of prescription drug use and prescription drug expenditure for mental illnesses of interest. Sample persons who had access to either of public or private health insurance were more likely to use prescription drugs than persons who did not have access to health insurance. As expected, persons who perceived their mental health status as good or excellent were less likely to use prescription drugs for mental illnesses. Office-based physician visits were more likely to lead to prescription drug use for mental illnesses of interest, while office-based psychologist visits were less likely to lead to prescription drug use.

For prescription drug users, however, only access to public health insurance had statistically positive effect on prescription drug expenditure for mental illnesses of interest. The OLS analysis for prescription drug users also resulted in no statistically significant effect of office-based physician visits on prescription drug expenditure. While it did show a statistically significant positive effect of office-based psychologist visits on that expenditure. This implies no positive effect of physician visits on the magnitude of prescription drug use once a sample individual spent more than zero dollars on it. The positive effect of psychologist visits on prescription drug expenditure may imply an underlying positive correlation of severity of mental illnesses of interest to the psychotherapy use and prescription drug use for those prescription drugs users.

Table 4 presents the marginal effect of three minority races (Blacks, Hispanics, and Asian-Indians) on the likelihood of prescription drug use for mental illnesses of interest, and the estimated actual expenditure on those drugs. Asian-Indians were about 50% less likely to use those prescription drugs at the margin than Whites relative to Blacks and Hispanics (the marginal effect of Blacks, Hispanic, and Asian-Indians was 8.3 percentage point, 6.1 percentage point, and 23.6 percentage point lower than Whites on average, respectively).

Blacks were estimated to spend $723.57 less on average than Whites in the sample persons with positive prescription drug expenditure for mental illnesses of interest. However, this amount decreases to $606.53 when the probability of positive prescription drug expenditure, i.e. the probability of any use of prescription drugs for mental illnesses of interest, is adjusted. Hispanics showed a different pattern: although they were estimated to spend $86.48 more than Whites on average in the samples with positive spending on prescription drugs, after adjustment of likelihood of use, it turned out that they spent $9.83 less on average than Whites for prescription drugs for mental illnesses of interest. For Asian-Indians, their actual estimated spending on prescription drugs was $179.50 less than Whites on average, which is a slight increase from the likelihood-of-use unadjusted marginal difference of $143.9 less than Whites.

Previous research has shown a different effect of race on mental health service use by insurance group.[31] Thus, the marginal effect of three minority races (Blacks, Hispanics, and Asian-Indians) on both the likelihood of use and spending were separately calculated by two insurance groups (sample persons with only public health insurance, and sample persons with any private health insurance) in a model with interaction terms of race dummies and dummies representing insurance types. We used the average of the probabilities method: we replaced the value of each of race dummies and health insurance dummies while all other

Table 3. Estimation Results[a]

First-part: Probability of Rx		Second-part: Expenditure of Rx	
Constant	−2.284**	Constant	3.962**
	(0.404)		(0.548)
Blacks	−0.345**	Blacks	−0.758**
	(0.103)		(0.198)
Hispanic	−0.320**	Hispanic	−0.206
	(0.088)		(0.118)
Asian_Indian	−0.687**	Asian_Indian	0.160
	(0.220)		(0.270)
Demographics		Demographics	
Age	0.057**	Age	0.059**
	(0.017)		(0.022)
Age squared	−0.001*	Age squared	−0.001**
	(0.001)		(0.001)
Male	−0.043	Male	0.034
	(0.055)		(0.078)
Marriage failure (ever)	−0.076	Marriage failure (ever)	0.001
	(0.077)		(0.093)
Social structure		Social structure	
Education level		Education level	
<= High school	0.002	<= High school	0.079
	(0.086)		(0.113)
>= College	−0.062	>= College	0.117
	(0.089)		(0.119)
Unemployment (ever)	0.163	Unemployment (ever)	0.221*
	(0.083)		(0.104)
Family size	−0.006	Family size	−0.034
	(0.020)		(0.024)
Personal/family resources		Personal/family resources	
Health insurance status		Health insurance status	
Public only	0.394**	Public only	0.511**
	(0.128)		(0.158)
Any private	0.365**	Any private	0.172
	(0.111)		(0.148)
Log of family income	−0.010	Log of family income	−0.001
	(0.013)		(0.013)
Competing needs		Competing needs	
Other chronic diseases	0.100	Other chronic diseases	0.345**
	(0.063)		(0.074)
Community resources		Community resources	
Region		Region	
Northeast3	−0.239**	Northeast3	−0.009
	(0.089)		(0.092)
Midwest3	−0.056	Midwest3	0.115
	(0.077)		(0.100)
West3	−0.208*	West3	−0.250
	(0.088)		(0.128)
MSA	−0.182*	MSA	0.034
	(0.072)		(0.094)
Needs		Needs	
Perceived physical health status		Perceived physical health status	
Not bad	−0.313**	Excellent to very good	0.209
	(0.116)		(0.114)
		Fair	−0.177
			(0.119)

→

First-part: Probability of Rx		Second-part: Expenditure of Rx	
Medical service use		Medical service use	
Office-based physicians	2.231**	Office-based physicians	0.161
	(0.090)		(0.103)
Psychologists	−0.192*	Psychologists	0.427**
	(0.081)		(0.118)
			(0.119)
Panel variables		Panel variables	
Panel2	0.189*	Panel2	0.150
	(0.088)		(0.109)
Panel3	0.109	Panel3	0.345**
	(0.092)		(0.114)
Panel4	0.147**	Panel4	0.337**
	(0.082)		(0.107)
Panel5	0.336**	Panel5	0.682**
	(0.093)		(0.115)
Log likelihood	−1597.44	R^2	0.153
N	3985	N	1489

[a] Notes: standard errors are in parenthesis.
* statistically significant at the 5% level.
** statistically significant at the 1% level.

variables in the model fixed. As displayed in **Table 4**, the marginal difference in the likelihood of prescription drug use between each of three racial minorities and Whites was slightly smaller in the sample persons only with public insurance than the sample persons with any private insurance. For Asian-Indians, the results were opposite to Blacks or Hispanics.

Blacks with only public health insurance were estimated to have $951.87 less actual spending on prescription drugs than Whites, while it was $475.34 for Blacks with any private health insurance. For Asian-Indians, the estimated actual spending on prescription drugs was $260.12 less than Whites within the only publicly insured, while it was $149.42 within the insured by any private health insurance.

Discussion

Consistent with previous studies, this study found that race is a powerful independent predictor of mental health service use, in particular prescription drugs.[32,33] Derived from the two-part model, all of three racial minorities (Blacks, Hispanics, and Asian-Indians) with reported mental illnesses of interest were estimated to be less likely to use mental health services in the form of prescription drugs, and less likely to have actual spending on prescription drugs for mental illnesses of interest than Whites at the margin. Therefore, race by itself influences both the access to the prescription drug use for mental illnesses, and the amount of prescription drug use for the accessed persons.

Given previous literature and current study results, the follow-up question of interest would be whether racial minorities with mental illnesses inappropriately under-utilize prescription drugs for mental illnesses. Even though this question cannot be directly answered through the current study, several previous studies imply the amount of mental health service use for racial minorities may be less than the clinically appropriate level. It has been reported that the current U.S. mental health system is built on a biomedical model of treating diseases, and thus, it is more attuned to treating individuals who accept this etiological point of view.[34] This may put up a structural barrier against access to the current mental health care system for racial minorities. Therefore, eliminating the systematic access barrier might be an important policy measure to improve mental health conditions for growing populations of racial minorities.

Disparity can be defined as a difference in treatment provided to members of different racial groups that is not justified by the underlying health conditions or treatment preferences of patients.[35] The marginal effect of three minority races over Whites in this study was estimated after adjusting the underlying physical and mental health status. Physical health status was measured by both perceived subjective ratings and diagnosis of the chronic diseases other than mental illnesses based on patients' self-reports. Thus, the differentials in both extensive and intensive margin between three racial minorities and Whites which are the primary results of this study may be called as disparity, according to the definition of Institute of Medicine.

Several aspects of this study would merit comments. First, unobserved individual heterogeneity of prescription drug use

Table 4. Marginal Effect of Blacks, Hispanic, Asian-Indians over Whites on the Likelihood and the Expenditure of Prescription Drug Use.

Dependent variable	Variable	Marginal effect					
		Total		Public insurance only		Any private insurance	
		Number of obs.	Mean (S.D.)	Number of obs.	Mean (S.D.)	Number of obs.	Mean (S.D.)
Likelihood of Rx drug use							
	Blacks	3985	−0.083 (0.036)	822	−0.085 (0.040)	2626	−0.086 (0.033)
	Hispanic	3985	−0.061 (0.026)	822	−0.061 (0.030)	2626	−0.063 (0.024)
	Asian-Indians	3985	−0.236 (0.129)	822	−0.281 (0.118)	2626	−0.235 (0.126)
Rx drug expenditure for users							
	Blacks	1489	−723.57 (540.90)	439	−1076.84 (764.55)	933	−588.74 (320.01)
	Hispanic	1489	86.48 (64.65)	439	128.70 (91.38)	933	70.36 (38.25)
	Asian-Indians	1489	−143.99 (107.64)	439	−214.29 (152.14)	933	−117.16 (63.68)
Actual Rx drug expenditure							
	Blacks	1489	−606.53 (530.92)	439	−951.87 (723.10)	933	−475.34 (339.72)
	Hispanic	1489	−9.83 (66.67)	439	14.95 (97.97)	933	−19.82 (45.01)
	Asian-Indians	1489	−179.60 (121.51)	439	−260.12 (159.34)	933	−149.42 (80.99)

is not accounted for in the likelihood and the magnitude of prescription drug use, although the estimation model in the study controlled for observed characteristics, which theoretically affect the likelihood and the magnitude of prescription drug use. If the unobserved individual heterogeneity is uncorrelated with other observed individual characteristics in the model, the estimated parameters would be unbiased.[36] We also controlled for the type of mental health provider (either office-based physicians or psychologists) visited for the self-reported mental illnesses. This control may proxy for the individual preference for the mental health care system. However, we acknowledge that the unaccounted unobserved individual heterogeneity, such as tastes for mental health care or illness severity etc. may be correlated with some of the observed characteristics in the model such as type of physician visited or insurance type. This potential correlation would bias our results.

Second, some observed individual characteristics in the model may not be given, but chosen. For example, taking prescription drugs for mental illnesses may affect the way individuals perceive their physical and/or mental health status.[37] The employment status may also be endogenous, if workers with mental illness are at earlier risk of unemployment than workers without mental illness.[38-40] It also may be that the impairments associated with mental

disorders lead to lower socioeconomic status.[41,42] Regardless of those potentially endogenous explanatory variables in the model, this study did not try to control for those endogeneity problems. The foremost reason for not controlling for possible endogeneity of some covariates is that the key variable of interest in this study is race which is obviously exogenous.* Controlling for the endogeneity in all of covariates would require an estimation of a system of structural equation, which is beyond the purpose of this study. Also, previous literature in economics has warned of the possibility of obtaining unwanted results caused by weak instruments for identifying endogenous regressors, including efficiency loss, or bias toward OLS.[18,43,44]

Third, provider characteristics may influence the likelihood or the magnitude of prescription drug use for mental illnesses, since diagnosis and prescription by physicians should come before psychiatric drug utilization. It has been reported that the likelihood of being diagnosed with mental illnesses is significantly associated with a patients' race.[45]

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* It may be pointed out that race is not truly orthogonal in the econometric sense since it may be correlated with the unobserved individual heterogeneity in the error term. That potential correlation would result in biased estimation results, which will put a limitation on our results.

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Also, a physician's specialty or gender has been reported as a predictor of the likelihood of prescribing psychiatric medication for patients with psychiatric diagnoses.[46-48] However, those physician characteristics are factors mediating race and prescription drug use. Thus, omitting those variables in the model does not affect the validity of the parameter estimates as long as the interest is the total effect of race on prescription use. Our model is a reduced form equation since we only measure the total effects of race including indirect effect of race on prescription drug use through physician prescription. We acknowledge a caveat of reduced form equation that the proximate (or direct) effects are not measured. Besides physician characteristics, variation in the supply of mental health providers may also put up a barrier against access to mental health services. Such variables in supply side were omitted in our model due to the constraint of the data, which may result in biased parameter estimates.

The findings of this study have an important implication for mental health policy and health education measures in the US. Even when socioeconomic conditions were controlled for, racial minorities accessed prescription drugs for mental illnesses of interest less than Whites. This finding seems to reinforce the significant role of non-socioeconomic factors which are specific for each minority to mental health care which are not necessarily associated with socioeconomic factors. Among socioeconomic factors, insurance coverage status also appeared to be an important factor affecting the magnitude of the differential to the access to prescription drug for mental illnesses: racial minorities who were insured only under public insurance showed a larger differential to the access to prescription drugs for mental illnesses of interest compared to Whites than other racial minorities who were insured by any private health insurance.

The results of this study might imply that there is a need to focus on a program to reach out to racial minorities with a diagnosis of mental illnesses, and this program should consider the cultural specificity of each race regarding mental illnesses. Also, in the development of mental health policy, it is crucial to understand the underlying non-socioeconomic factors which may significantly determine the access to mental health service use.

References

1. Snowden LR. Barriers to effective mental health services for African Americans. *Health Serv Res* 2001; **3**(4): 181-187.
2. Skaer TL, Sclar DA, Robison LM and Galin RS. Trends in the rate of depressive illness and use of antidepressant pharmacotherapy by ethnicity/race: an assessment of office-based visits in the United States, 1992-1997. *Clin Ther* 2000; **22**(12): 1575-1589.
3. Cooper-Patrick L, Gallo JJ, Powe NR, Steinwachs DM, Eaton WW and Ford DE. Mental health service utilization by African Americans and Whites: the Baltimore Epidemiologic Catchment Area Follow-up. *Med Care* 1999; **37**(10): 1034-1045.
4. Freiman MP, and Zuvekas SH. Determinants of ambulatory treatment mode for mental illness. *J Health Econ* 2000; **9**: 423-434.
5. Mental health - A report of the surgeon general. Accessed in March 1, 2003. http://www.surgeongeneral.gov/library/mentalHealth/ chapter2/sec8.html.
6. Kessler RC, Demler O, Frank RG, Olfson M, Pincus HA, Walters EE, Wang P, Wells KB and Zaslavsky AM. Prevalence and treatment of mental disorders. *NEJM* 2005; **352**(24): 2515-2523.
7. Vega W and Rumbaut RG.. Ethnic minorities and mental health. *Annu Rev Sociol* 1991; **17**: 351-383.
8. Sturm R and Gresenz CR. Relations of income inequality and family income to chronic medical conditions and mental health disorders: national survey. *BMJ* 2002; **324**(7328): 20-23.
9. Regier DA, Narrow WE, Rae DS, Manderscheid RW, Locke BZ and Goodwin FK. The de facto US mental and addictive disorders service system. Epidemiologic Catchment Area prospective 1-year prevalence rates of disorders and services. *Arch Gen Psychiatry* 1993; **50**: 85–94.
10. Belle D. Poverty and women's mental health. *Am Psychol* 1990; **45**: 385–389.
11. Institute of Medicine. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. 2002
12. Millet PE, Sullivan BF, Schwebel AI and Myers LJ. Black Americans' and White Americans' views of the etiology and treatment of mental health problems. *Community Ment Health J* 1996; **32**(3): 235-242.
13. Carter JH. Religion/spirituality in African-American culture: an essential aspect of psychiatric care. *J Natl Med Assoc* 2002; **94**(5): 371-375.
14. Carter JH. Psychosocial/cultural issues in medicine and psychiatry: treating African Americans. *J Natl Med Assoc* 1995; **87**(12): 857-860.
15. Whaley AL. Cultural mistrust of white mental health clinicians among African Americans with severe mental illness. *Am J Orthopsychiatry* 2001; **71**(2): 252-256.
16. Haas JS, Phillips KA, Sonneborn D, McCulloch CE, Baker LC, Kaplan CP, Perez-Stable EJ and Liang SY. Variation in access to health care for different racial/ethnic groups by the racial/ethnic composition of an individual's county of residence. *Med Care* 2004; **42**(7): 707-714.
17. Bach PB, Pham HH, Schrag D, Tate RC and Hargraves JL. Primary care physicians who treat blacks and whites. *N Engl J Med* 2004; **351**(6): 575-584.
18. Balsa AI, McGuire TG, and Meredith LS. Testing for statistical discrimination in health care. *Health Serv Res* 2005; **40**(1): 227-252.
19. Herbeck DM, West JC, Ruditis I, Duffy FF, Fitek DJ, Bell CC and Snowden LR. Variations in use of second-generation antipsychotic medication by race among adult psychiatric patients. *Psychiatr Serv* 2004; **55**(6): 677-84.
20. Cooper CR and Denner J. Theories linking culture and psychology: universal and community-specific process. *Annu Rev Psychol* 1998; **49**: 559-584.
21. Diala CC, Muntaner C, Walrath C, Nickerson K, LaVeist T and Leaf P. Racial/ethnic differences in attitudes toward seeking professional mental health services. *Am J Public Health* 2001; **91**(5): 805-807.
22. Lasser KE, Himmelstein DU, Woolhandler SJ, McCormick D and Bor DH. Do minorities in the US receive fewer mental health service than whites? *Int J Health Serv* 2002; **32**(3): 567-578.
23. Padgett DK, Patrick C, Burns BJ and Schlesinger HJ. Ethnic difference in use of inpatient mental health services by blacks, whites, and hispanics in a national insured population. *Health Serv Res* 1994; **29**(2): 135-153.
24. Blough DK, Madden CW and Hornbrook MC. Modeling risk using generalized linear models. *J Health Econ* 1999; **18**: 153-171.
25. Manning WG, Newhouse JP, Duan N, Keeler EB, Leibowitz A, and Marquis MS. Health insurance and the demand for medical care: evidence from a randomized experiment 1987. *Am Econ Rev* 1987; **77**: 251-277.
26. Alegria M, Canino G, Rios R, Vera M, Calderon J, Rusch D and Ortega AN. Inequalities in use of specialty mental health services among Latinos, African Americans, and non-Latino whites. *Psychiatr Serv* 2002; **53**(12): 1547-1555.
27. MEPS HC-050: 2000 Full year consolidated data file. Accessed in Oct 12, 2002. http://www.meps.ahrq.gov/PufFiles/H50/H50doc.pdf
28. MEPS HC-050: MEPS HC-027 1998 Medical Conditions. Accessed in Oct 12, 2002. http://www.meps.ahrq.gov/Pubdoc/HC027/h27doc.pdf
29. Manning WG and Mullahy J. Estimating Log Models: To Transform or Not to Transform? *J Health Econ* 2001; **20**(4): 461-94.
30. Woodridge JM. Introductory *Econometrics: A modern Approach*. South-Western College Publishing. 1st edition. 2000.
31. Thomas KC and Snowden LR. Minority Response to Health Insurance Coverage for Mental Health Services. *J Ment Health Policy Econ* 2001; **4**(1): 35-41.

32. Kuno E and Rothbard AB. Racial disparities in antipsychotic prescription patterns for patients with schizophrenia. *Am J Psychiatry* 2002; **159**(4): 567-572.

33. McAlpine DD and Mechanic D. Utilization of specialty mental health care among persons with severe mental illness: the roles of demographics, need, insurance, and risk, *Health Serv Res* 2000: **35**(1); 277-292.

34. Takeuchi DT and Kim KF. Enhancing mental health services delivery for diverse populations. *Contemp Sociol* 2000: **29**; 74-83.

35. Institute of Medicine. Unequal Treatment: Confronting *Racial and Ethnic Disparities in Health Care*. 2002.

36. Green WH. 2000. *Econometric analysis*. Upper Saddle River, NJ: Prentice Hall, 652-707.

37. Katz SJ, Kessler RC, Frank RG, Leaf P, Lin E and Edlund M. The use of outpatient health services in the United States and Ontario: the impact of mental morbidity and perceived need for care. *Am J Public Health* 1997; **87**: 1136-1143.

38. Catalano R, Drake RE, Becker DR and Clark RE. Labor market conditions and employment of the mentally ill. *J Ment Health Policy Econ* 1999; **2**(2): 51-54.

39. Fiscella K, Franks P, Doescher MP and Saver BG.. Disparities in health care by race, ethnicity, and language among the insured. *Med Care* 2002; **40**(1): 52-59.

40. Ettner SL, Frank RG. and Kessler RC. The impact of psychiatric disorders on labor market outcomes. *Ind Labor Relat Rev* 1997; **51**: 64-81.

41. McLeod JD and Kessler RC. Socioeconomic status differences in vulnerability to undesirable life events. *J Health Soc Behav* 1990; **31**: 162-172.

42. Dohrenwend BP, Levav I, Shrout PE, Schwartz S, Naveh G, Link BG, Skodol AE and Stueve A. Socioeconomic status and psychiatric disorders: The causation-selection issue. *Science* 1992; **255**: 946-952.

43. Bollen KA, Guilkey DK and Mroz TA. Binary outcomes and endogenous explanatory variables: tests and solutions with an application to the demand for contraceptive use in Tunisia. *Demography* 1995; **32**(1): 111-131.

44. Staiger D and Stock J. Instrumental variables regression with weak instruments. *Econometrica* 1997; **65**(3): 557-586.

45. Kosch SG, Burg MA, Podikuju S. Patient ethnicity and diagnosis of emotional disorders in women. *Fam Med* 1998; **30**(3): 215-219.

46. Morabia A, Fabre J and Dunand JP. The influence of patient and physician gender on prescription of psychotropic drugs. *J Clin Epidemiol* 1992; **45**(2): 111-116.

47. Nichol MB, Stimmel GL and Lange SC. Factors predicting the use of multiple psychotropic medications. *J Clin Psychiatry* 1995; **56**(2): 60-66.

48. Hermann RC, Yang D, Ettner SL, Marcus SC, Yoon C and Abraham M. Prescription of antipsychotic drugs by office-based physicians in the United States, 1989-1997. *Psychiatr Serv* 2002; **53**(4): 425-430.

Appendix A. CCCODEX (Clinical Classification Software - Diagnoses) and Matching ICD-9-CM Codes

CCCODEX	Diagnosis Category	ICD-9-CM codes
65	Mental retardation	317 3180 3181 3182 319
66	Alcohol-related mental disorders	2910 2911 2912 2913 2914 2915 2918 29181 29189 2919 30300 30301 30302 30303 30390 30391 30392 30393 30500 30501 30502 30503
67	Substance-related mental disorders	V1582 2920 29211 29212 2922 29281 29282 29283 29284 29289 2929 30400 30401 30402 30403 30410 30411 30412 30413 30420 30421 30422 30423 30430 30431 30432 30433 30440 30441 30442 30443 30450 30451 30452 30453 30460 30461 30462 30463 30470 30471 30472 30473 30480 30481 30482 30483 30490 30491 30492 30493 3051 30510 30511 30512 30513 30520 30521 30522 30523 30530 30531 30532 30533 30540 30541 30542 30543 30550 30551 30552 30553 30560 30561 30562 30563 30570 30571 30572 30573 30580 30581 30582 30583 30590 30591 30592 30593
68	Senility and organic mental disorders	2900 29010 29011 29012 29013 29020 29021 2903 29040 29041 29042 29043 2908 2909 2930 2931 29381 29382 29383 29384 29389 2939 2940 2941 2948 2949 3100 3101 3102 3108 3109 3310 3311 3312 797
69	Affective disorders	29600 29601 29602 29603 29604 29605 29606 29610 29611 29612 29613 29614 29615 29616 29620 29621 29622 29623 29624 29625 29626 29630 29631 29632 29633 29634 29635 29636 29640 29641 29642 29643 29644 29645 29646 29650 29651 29652 29653 29654 29655 29656 29660 29661 29662 29663 29664 29665 29666 2967 29680 29681 29682 29689 29690 29699 2980 3004 30111 30113
70	Schizophrenia and related disorders	29500 29501 29502 29503 29504 29505 29510 29511 29512 29513 29514 29515 29520 29521 29522 29523 29524 29525 29530 29531 29532 29533 29534 29535 29540 29541 29542 29543 29544 29545 29550 29551 29552 29553 29554 29555 29560 29561 29562 29563 29564 29565 29570 29571 29572 29573 29574 29575 29580 29581 29582 29583 29584 29585 29590 29591 29592 29593 29594 29595 29900 29901 29910 29911 29980 29981 29990 29991
71	Other psychoses	2970 2971 2972 2973 2978 2979 2981 2982 2983 2984 2988 2989
72	Anxiety, somatoform, dissociative, and personality disorders	30000 30001 30002 30009 30010 30011 30012 30013 30014 30015 30016 30019 30020 30021 30022 30023 30029 3003 3005 3006 3007 30081 30082 3010 30110 30112 30120 30121 30122 3013 3014 30150 30151 30159 3016 3017 30181 30182 30183 30184 30189 3019 30740 30741 30742 30743 30744 30745 30747 30748 30749 30780 30781 30789 3079 3080 3081 3082 3083 3084 3089 30981 31230 31231 31232 31233 31234 31235 31239
73	Pre-adult disorders	30921 31200 31201 31202 31203 31210 31211 31212 31213 31220 31221 31222 31223 3124 3128 31281 31282 31289 3129 3130 31321 31400 31401 3141 3142 3148 3149
74	Other mental conditions	30089 3009 3021 3022 3023 3024 30250 30251 30252 30253 3026 30270 30271 30272 30273 30274 30275 30276 30279 30281 30282 30283 30284 30285 30289 3029 3060 3061 3062 3063 3064 30650 30651 30652 30653 30659 3066 3067 3068 3069 3070 3071 30720 30721 30722 30723 3073 30746 30750 30751 30752 30753 30754 30759 3076 3077 3090 3091 30922 30923 30924 30928 30929 3093 3094 30982 30983 30989 3099 311 3131 31322 31323 3133 31381 31382 31383 31389 3139 31500 31501 31502 31509 3151 3152 31531 31532 31539 3154 3155 3158 3159 316 7801
75	Personal history of mental disorder, mental and behavioral problems, observation and screening for mental Condition	V110 V111 V112 V113 V118 V119 V154 V1541 V1542 V1549 V400 V401 V402 V403 V409 V663 V673 V701 V702 V7101 V7102 V7109 V790 V791 V792 V793 V798 V799