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### Comparing Predictors of Employment in Individual Placement and Support: A Longitudinal Analysis

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#### Highlights

- longitudinal analysis of MHTS Individual Placement and Support competitive employment outcomes
- multiple predictors and predictor domains modeled to assess significance and discrimination
- range of client- and site-level factors significantly associated with employment
- minimal overall prediction
- need to study novel client, environmental, and IPS implementation factors

**Comparing Predictors of Employment in Individual Placement and Support:  
A Longitudinal Analysis**

running title: "Comparing Predictors of Employment in IPS"

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**Conflict of Interest**

None.

## Abstract

Individual Placement and Support (IPS) is an evidence-based model of supported employment for people with serious mental illness. We assessed the effects and relative contributions of predictors of employment among IPS recipients using measures of baseline client characteristics, local economic context, and IPS fidelity. A recent work history, less time on the Social Security rolls, greater cognitive functioning, and a lower local unemployment rate were associated with greater probability of employment. The ability of the model to discriminate between outcomes was limited, and substantial improvements in our understanding of IPS employment outcomes will require the study of novel client, environmental, and IPS implementation factors.

## Keywords

employment, supported; rehabilitation, vocational; social security; employment; mental health; schizophrenia; mood disorders

## 1. Introduction

Individual Placement and Support (IPS) is an evidence-based model of vocational rehabilitation for clients with serious mental illness that has proven effective across a range of populations.(Modini et al., 2016) Despite many prediction studies, a comprehensive picture of the relationships between commonly available client, program, and environmental characteristics and IPS employment outcomes remains elusive.(Bond and Drake, 2008b; Campbell et al., 2010b) Research has demonstrated that factors including duration of enrollment in IPS, client characteristics, local economic conditions, and the quality of a program's implementation, can influence employment outcomes.(Drake et al., 2016) However, the relative contributions of these domains in explaining employment have been explored in piecemeal fashion, and no analysis has yet combined all of them and assessed their effects and relative contributions in a single model.

Findings regarding relatively weak predictors are highly sensitive to study design, analytic technique, and power. Predictors of work outcomes among people with serious mental illness include baseline client characteristics such as cognitive difficulties and symptom severity, (Anthony et al., 2002; Bond and Drake, 2008a; Campbell et al., 2010a; Cook and Razzano, 2000; Green, 1996; Hoffmann and Kupper, 1997; McGurk and Mueser, 2004; Michon et al., 2005; Razzano et al., 2005; Rosenheck et al., 2006; Strauss and Carpenter, 1974; Tsang et al., 2010; Wewiorski and Fabian, 2004) environmental factors such as local unemployment rate(Burns et al., 2007; Cook et al., 2006) and rurality,(Haslett et al., 2011) program factors such as IPS fidelity,(Bond et al., 2011) intensity of IPS services, (Bond and Kukla, 2011) receipt of Social Security Disability Insurance benefits,(Rosenheck et al., 2006) and histories of work.(Metcalf et al., 2017; Strauss and Carpenter, 1974) Furthermore, prior research has suggested that predictors of employment outcomes for those who receive IPS differ from those who do not.(Campbell et al., 2010b) A prior analysis of some of these predictors in the full Mental Health Treatment Study sample did not control for duration of participation, environmental variables, or IPS fidelity.(Metcalf et al., 2017) The straightforward solution to this fragmentary approach is to conduct a single simultaneous analysis of all available predictors using a sufficiently large sample of IPS recipients.

The primary purpose of this analysis was to compare predictors of employment in the presence of effective employment and mental health services. We determined the effects and relative importance of client characteristics, IPS fidelity, and local economic factors in a multivariable model of quarterly competitive employment among IPS recipients. The large sample size and diversity of sites in the Mental Health Treatment Study enabled inclusion of variables specific to both clients and IPS programs in statistical models of quarterly employment status.

## 2. Methods

### 2.1. Overview

We conducted a secondary analysis of participants in the intervention arm of the Mental Health Treatment Study, a multisite randomized controlled trial comparing the effectiveness of an intervention

group receiving comprehensive services that included IPS, systematic medication management (evidence-based pharmacological management guidelines), and other behavioral services to a treatment-as-usual control group at 23 sites.(Drake et al., 2013) We assessed the effect size, significance, and coefficient of discrimination (Tjur's pseudo  $R^2$ ) for each of 21 client, program, and environmental characteristics in a longitudinal model of competitive work status among IPS recipients.

## 2.2. Participants

Participants in the Mental Health Treatment Study were Social Security Disability Insurance beneficiaries between 18 and 55 years of age who had not worked competitively in the previous 30 days, with a primary psychiatric diagnosis of schizophrenia or mood disorder, residing within postal zip codes served by the study sites. Of the 2,238 participants enrolled, those who died during follow-up (N=24), did not complete at least two post-baseline interviews (N=159), or whose data were corrupted due to a computer malfunction (N=5) were excluded from analyses. We restricted our analyses to the participants in the intervention arm, resulting in an overall analytic sample of 1,004 beneficiaries.(Drake et al., 2013)

## 2.3. Measures

Characteristics included 16 baseline measures (six baseline demographic variables, seven scales measuring client health and functioning, and three variables describing previous income sources and knowledge of social security), IPS fidelity, and four measures of the local environment (change in gross domestic product from the previous year, population density, county unemployment rate, and local unionization rate).

### 2.3.1. Data Collection

Quarterly interviews over a two-year period of enrollment yielded longitudinal employment outcomes. Client-specific baseline measures were based on Social Security data and self-reported responses to computer-assisted personal interviews conducted prior to randomization, and measures of local unemployment rate and population density are drawn from the Bureau of Labor Statistics and United States Census surveys. A team of independent, experienced fidelity reviewers unaffiliated with the study sites conducted three annual fidelity reviews of participating sites.

### 2.3.2. Baseline Client Measures

- *Demographics* included age, gender, race (white/African-American/other), Hispanic ethnicity, educational attainment (high school graduate/not), and marital status (married/not).
- *Cognitive functioning.* The Brief Assessment of Cognition in Schizophrenia (BACS) composite score is a reliable measure of cognitive functioning and impairment in subjects with schizophrenia.(Keefe et al., 2004) The overall score is the mean of the standardized motor speed and general cognitive function, memory and working memory, and executive function section scores.
- *Alcohol and drug use* were measured by the Addiction Severity Index.(McLellan et al., 1992) A 6-item "alcohol composite score" is calculated based on frequency of alcohol use, frequency of intoxication, and perceived alcohol-related problems over the previous 30 days. A 13-item drug

composite score” is calculated based on frequency of use of 11 types of drugs and perceived overall drug-related problems over the previous 30 days.(McLellan et al., 1980)

- *Quality of life.* The overall life satisfaction item from the Quality of Life Interview(Lehman, 1988) consists of the question, “How do you feel about your life in general?” Valid responses ranged from 1 (“terrible”) to 7 (“delighted”).
- *Health status.* The Short Form Health Survey (SF-12) is a brief, 12-item self-reported health assessment. In our analysis, we used two subscales from the SF-12 measuring physical and mental components of functional well-being.(Ware et al., 1996) The physical component of the SF-12 comprises the following domains: physical functioning, physical role limitations, bodily pain, and general health. The mental component of the SF-12 includes the following domains: vitality, social functioning, social role limitation, and mental health.
- *Clinical measures.* We used the psychiatric diagnosis (schizophrenia/affective disorder) identified by the Social Security Administration. This diagnosis was concordant in 88% of the cases with the diagnosis obtained from a standardized clinical interview conducted with beneficiaries in the intervention group.(Frey et al., 2011) We used the Social Security Administration diagnosis instead of that provided by the Structured Clinical Interview for Diagnostic and Statistical Manual disorders to maintain consistency with other Mental Health Treatment Study analyses.
- *Misconceptions about Social Security benefits.* Drawing on an earlier checklist,(MacDonald-Wilson et al., 2003) we developed a 7-item checklist assessing beliefs about the impact of working on Social Security Disability Insurance (e.g., “As soon as people start working they stop getting their benefit checks.”) The total score was calculated as the sum of the endorsed items. The baseline scores on this measure had an internal consistency reliability coefficient (Cronbach’s alpha) of 0.54.
- *Work history.* At baseline, beneficiaries indicated whether they had worked in a paid job in the last two years.
- *Years on Social Security Disability Insurance rolls.* Years receiving disability benefits was obtained from Social Security records.

### 2.3.3. Environmental Measures

- *County population density, 2010.* County population density per square mile is based on the results of the 2010 United States Census ([www.census.gov/support/USACdataDownloads.html](http://www.census.gov/support/USACdataDownloads.html)). Population density is used in this analysis as a measure of the relative rurality of the various study sites. Due to a highly skewed distribution, we converted this continuous measure into an indicator of high or low population density based on the median density.
- *Local past-year change in Gross Domestic Product.* The Bureau of Economic Analysis provides data describing change in gross domestic product in real chained dollars from the previous year for metropolitan statistical regions based on US Census Bureau data (<http://www.bea.gov/itable>).
- *Unemployment rate in county of study site at time of recruitment.* The Bureau of Labor Statistics generates unemployment estimates at the national, state, and local levels based on data from the

Current Population Survey and several other sources ([www.bls.gov/lau/lauov.htm](http://www.bls.gov/lau/lauov.htm)). The unemployment rate is defined as the proportion of the workforce that is actively seeking employment and is able to work but does not have a job. The workforce consists of the employed and the unemployed.

- *Local unionization rate.* The proportion of each metropolitan statistical area's workforce with union membership is based on the Current Population Survey.(Hirsch and Macpherson, 2003) We posit that the local unionization rate is a proxy measure of the extent to which a collective approach to protecting the rights of existing workers may constitute a barrier to employment for job applicants, such as people with psychiatric disabilities, who are not union members.(Bertola et al., 2002)

#### 2.3.4. *IPS Program Measure*

- *IPS program fidelity.* The 15-item IPS fidelity scale(Bond et al., 1997) was used to measure the degree to which IPS programs adhered to the IPS model. Each item is rated on a 5-point scale, and any score greater than or equal to 65 indicates a program consistent with IPS. Interrater reliability and internal consistency have proven excellent across numerous studies.

#### 2.3.5. *Outcome*

The outcome measure was the quarterly competitive employment rate, defined as at least one day of competitive employment during each three-month period of follow-up. We chose this measure of employment outcome because of its simplicity and because of greater accuracy of measurement (with fewer missing observations) compared to other employment measures. Employment rate is moderately correlated with measures of job duration, total earnings and other common employment outcomes,(Bond et al., 2012) and a recent analysis of cognitive predictors of employment using Mental Health Treatment Study data found little difference between a dichotomous work outcome and weeks worked.(McGurk et al., 2018)

A job is defined as competitive if it is open to all jobseekers, pays at least minimum wage, and is subject to regular supervision in an integrated work setting. IPS studies examine competitive employment as the primary outcome because it represents beneficiaries' participation in the mainstream job market.

#### 2.4. *Statistical Analyses*

Participants who completed at least two quarterly post-baseline interviews were subject to imputation of missing quarterly employment outcome data. The imputations used a combination of hot-deck methods, in which missing data are replaced by observed values from similar participants, and chained parametric procedures, in which missing values are based on models using known values.(Krenzke and Judkins, 2008) To aid in interpretation of logistic regression models, we zeroed self-report scales, site fidelity, and county unemployment rate at their means or medians and scaled age and time as a Social Security Disability Insurance beneficiary from years to decades. Using descriptive statistics, we examined data distributions for skew and identifying outliers, and standard logistic regression diagnostic procedures, including predicted probability plots, leverage plots, and Pearson and deviance residuals, to identify



potential outliers and to assess fit.

For each of eight quarters we defined two groups, *the competitively employed group* (beneficiaries who held a competitive job during that quarter) and *the unemployed group* (those who did not). We assessed the significance of bivariate correlations between each variable and the total number of quarters employed. Then, we selected a best-fitting model of quarterly employment using only time as an independent variable in mixed effects logistic regression models of quarterly employment status. We parameterized time as first through sixth degree functions of quarter of follow-up, and furthermore as linear, quadratic, and cubic spline functions with knots at the first through seventh quarters, for a total of 27 potential models with a maximum of six parameters. All spline functions of degree  $n$  had equal values and  $(n-1)$  derivatives at the knot to ensure smooth transitions.(Rothman et al., 2008) Inclusion of higher degree polynomials provided for estimation of the limits on the possible fit of employment models based solely on time. We gauged overall fit with the Akaike Information Criteria, a likelihood-based measure which represents better fitting models with a lower score.(Rothman et al., 2008) We used Pearson residuals to assess consistency of fit over the two-year follow-up period.

We then constructed a mixed effects logistic regression model of quarterly employment status using PROC GLIMMIX (SAS 9.4),(SAS, 2011) compensating for within-subject correlation by generating random intercepts for each subject and controlling for time with the previously chosen parameterization. In this model we included all potential factors drawn from the domains of baseline client characteristics, local economic context, and IPS implementation. We added second-degree parameters to all continuous predictors to confirm the linearity of the relationships and interactions with time to all significant main effects to test for the consistency of the effects throughout follow-up. We also removed the insignificant parameters to assess the stability of the parameters found to be significant in the full model. We assessed individual parameters' effects using corresponding parameter estimates and standard errors, and we assessed the relative importance of individual parameters and parameter domains using Tjur's pseudo- $R^2$ .(Tjur, 2009) Various equivalents of  $R^2$ , as commonly used in linear regression, have been proposed to describe the proportion of observed variance explained by a given logistic regression model. Tjur's  $R^2$ , also known as the coefficient of discrimination (D), is the difference between the mean predicted probabilities of each of two potential outcomes, in this case employment and unemployment. Like  $R^2$ , Tjur's  $R^2$  has a range of zero to one; lower values indicate a less discriminating model.(Tjur, 2009) A perfect model would predict the probabilities of employment during every employed and unemployed quarter to be 1.0 and 0.0, respectively, implying  $D = 1.0 - 0.0 = 1.0$ . Similarly, if a model predicts the mean quarterly probabilities of employment, among those quarters during which subjects were employed and unemployed, to be 0.3 and 0.2, then  $D = 0.3 - 0.2 = 0.1$ . In this analysis, we computed the coefficients of discrimination for the complete marginal model and for marginal models containing only the specific variable or domain in question. For purposes of comparison with the primary analysis, we also conducted a secondary analysis based on a zero-inflated negative binomial regression model of total months worked. For all hypothesis tests, we used the Bonferroni correction to compensate for Type II error inflation due to

multiple tests based on 26 tests and a desired  $\alpha=.05$ , yielding  $\alpha=.002$ .

### 3. Results

Table 1 contains correlations of baseline client- and site-specific covariates, as well as site-specific process measures, with total number of quarters worked during eight quarters of follow-up. Competitive employment correlated significantly ( $\alpha=.002$ ) with having worked within two years of baseline, having spent less time as a Social Security beneficiary, being Hispanic, and having higher cognitive function.

Figure 1 shows the competitive employment status over eight quarters of follow-up among those who received the IPS-based intervention. We selected a cubic spline with a cut-point at the second quarter to represent the relationship between time and quarterly competitive employment. The Akaike Information Criteria (AIC) of the 27 models tested ranged from 6658 (cubic spline with cut-point at the first quarter) to 7143 (linear). As the complexity of the models increased, their AICs appeared to be converging on a value close to the observed minimum. The selected model had an AIC of 6660.

Table 2 shows odds ratios, 95% confidence intervals, and Type 3 tests of significance for fixed effects across three random effects logistic regression models. Having a previous work history (OR=3.43 (2.29, 5.14)) and years as a Social Security Disability Insurance beneficiary were significant (OR=.48 (.34, .68) per 10 years), the latter result indicating that increased time receiving disability benefits recipients was associated with a reduced likelihood of finding employment. The effect of the BACS overall composite score (OR=1.69 (1.26, 2.28)) indicates that an increase of one standard deviation from the overall mean score of the study group (meaning a higher level of cognitive functioning) is associated with a 70% increase in the odds of employment. Every one percent increase in local unemployment rate (OR=.71 (.59, .86)) was associated with a 29% reduction in the odds of employment. The high p-value of the age parameter ( $p=.76$ ) is largely due to co-linearity with both years as an SS beneficiary and self-reported physical health (SF-12 Physical); the significance of age in the model was .068 when these variables were removed. None of the second-degree parameters of significant continuous covariates added to this model were significant, indicating that our assumptions of linear relationships between continuous independent variables and quarterly competitive employment were reasonable. Interactions of time with each of the baseline predictors significant in the previous model were not significant, indicating that the effects of the included covariates were consistent throughout follow-up. Tests of significant parameters' stability did not reveal sensitivities to time parameterization and removal of insignificant covariates sufficient to call the results into question. Our secondary analysis of total months worked confirmed the results of the primary analysis and also identified the IPS fidelity and SF-12 mental subscale scores to be significant predictors of employment.

Table 2 also shows domain- and predictor-specific coefficients of discrimination (D) for the models' marginal predictions. The complete model, client domain, site domain, and time domain had coefficients of discrimination of .090, .043, .006, and .018, respectively. Recent work history was the most discriminating of the significant variables ( $D=.021$ ), followed by overall years as a Social Security

beneficiary (.009), cognitive functioning (.004), and local unemployment rate (.002). Despite the significance of factors such as recent work history and years as an SSDI beneficiary observed in this and previous studies, knowledge of any of these parameters does not enable confident predictions regarding a given IPS recipient's likelihood of finding employment.

#### 4. Discussion

In this analysis of Social Security Disability Income beneficiaries receiving IPS supported employment, work history, years as a beneficiary, and neurocognitive function were the best predictors of employment outcomes, and their effects were consistent throughout follow-up. As these results make clear, a model containing statistically significant factors, even those corresponding to apparently large effect sizes, did not explain a large fraction of the observed outcome variance and enable useful prediction.

Mental Health Treatment Study participants were of late middle age with concomitant work histories and high benefits payments relative to those typical of participants in most IPS trials, who typically received less generous or negligible payments from Supplemental Security Income, welfare, or other programs. The restriction of predictor variance to the limited ranges that follow from these sample characteristics may have reduced the ability of factors such as recent work history and years receiving disability benefits to predict employment outcomes. Yet the results of this analysis align with previous research indicating both that known client predictors are modestly predictive of IPS employment outcomes, and presumably relevant economic, cultural, and regulatory factors are largely unmeasured. (Bond and Drake, 2008a) Significant client factors, including work history, years as an SS beneficiary, and level of cognitive functioning, are prominent in previous research. (Bond et al., 2007; McGurk and Mueser, 2004; Rosenheck et al., 2006; Strauss and Carpenter, 1974) Local unemployment rate, the only significant environmental characteristic, also has some association with a jobseeker's success, and its effect is weak enough to explain its inconsistent significance in previous research. (Burns et al., 2007; Cook et al., 2006) Notable predictors that nearly met our significance threshold included Hispanic ethnicity, self-reported physical health, and IPS fidelity, the latter two of which have previously been identified as predictors. (Bond et al., 2011; Razzano et al., 2005) All of these characteristics have more predictive utility, as described by the coefficient of discrimination, when aggregated.

As this analysis suggests, our ability to predict employment outcomes among people with serious mental illness receiving high-quality vocational services is limited because commonly measured client and environmental characteristics provide an incomplete description of the complexity of the employment process. Significant predictors describe associated constructs with either categorical variables that obscure underlying complexity (any work history in previous two years) or continuous measures that precisely describe facets of the whole (unemployment rate), and the importance of such factors indicates the possibility that a more complete characterization and measurement of the relevant construct may yield additional insight into the job-finding process. However, the variance in IPS employment outcomes will remain largely unexplained until we assess a wider range of predictors. A more comprehensive list might

include: local economic conditions, such as the needs of local employers; social and cultural influences, such as ethno-racial factors and stigma; IPS service intensity and the competence of individual IPS employment specialists; and unmeasured client characteristics, such as motivation, perseverance, and social skills.

#### *4.1 Limitations*

Limitations relate primarily to generalizability, the ranges and characteristics of the utilized measures, and choice of outcomes, as well as the absence of any assumption that the statistical associations described demonstrate causal relationships. Only 14% of invited Social Security Disability Insurance beneficiaries participated in the Mental Health Treatment Study. These participants had expressed a desire to work, were older, and had more work experience than samples from community mental health centers, and our constrained ability to differentiate between those who participated and those who declined to participate limits the study's generalizability. Our behavioral, health, and environmental measures were subject to the biases associated with recall and self-assessment, the characteristics of the specific instruments, and the survey methodologies. This study only examined competitive employment status during each quarter, and therefore did not account for differences in amount or type of work.

#### *4.2 Conclusion*

Competitive employment in IPS is primarily associated with the individual characteristics of the recipient; site-level characteristics, such as local unemployment rate, also impact the likelihood of employment. Nevertheless, our ability to predict the employment outcomes of IPS recipients is minimal, and future research should focus both on deconstructing prominent client-specific characteristics such as work history and on measuring client and environmental factors that have yet to be studied.

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Figure 1. Quarterly competitive employment rate among recipients of IPS (N=1004).

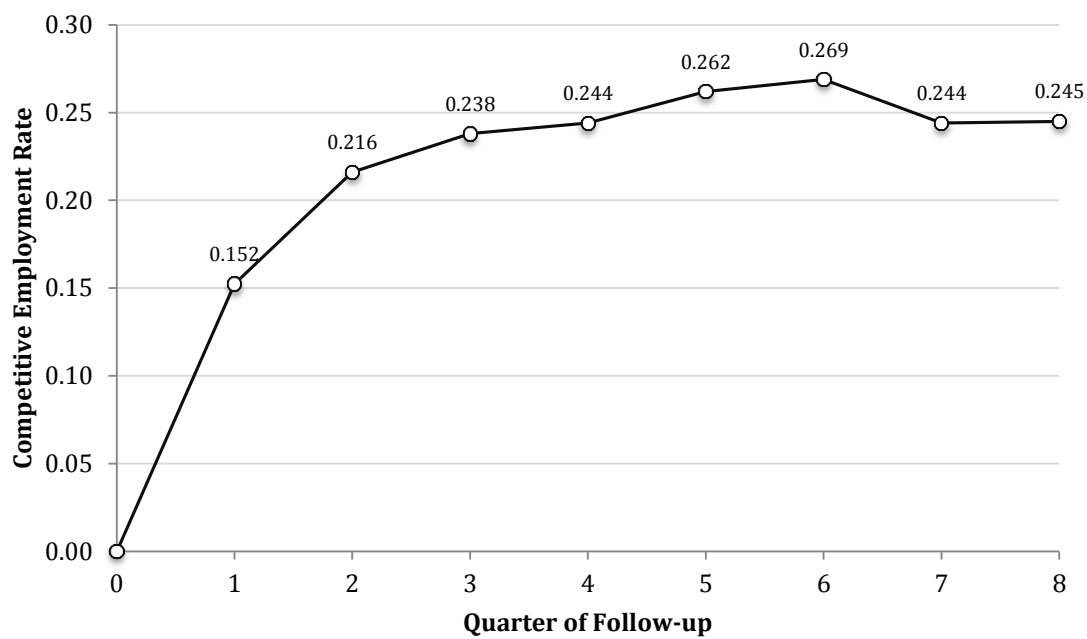


Table 1. Pearson product-moment correlations ( $r$ ) of quarters worked vs. baseline predictors and process measures ( $N=1004$ ).

domain	variable	$r$	p-value
Client-Specific	male vs. female	-0.01	0.746
	HS graduate vs. not HS graduate	<.01	0.905
	Hispanic vs. not Hispanic	0.14	<.001
	married vs. not married	0.01	0.836
	race: white	-0.01	0.636
	race: black	-0.02	0.610
	race: other	0.05	0.116
	age	-0.09	0.003
	BACS Overall	0.12	<.001
	ASI Alcohol	-0.01	0.805
	ASI Drug	-0.04	0.193
	quality of life (1-7)	0.02	0.510
	SF-12 mental subscale	0.02	0.435
	SF-12 physical subscale	0.04	0.167
	affective disorder vs. schizophrenia	-0.06	0.043
	knowledge of social security	-0.03	0.367
	work history (past 2 yrs) vs. no work history	0.23	<.001
	Years as SS beneficiary	-0.17	<.001
Site-Specific	site IPS fidelity	0.06	0.058
	local past year GDP change	0.02	0.480
	low vs. high population density	-0.06	0.053
	local unemployment rate	-0.09	0.006
	local unionization rate	-0.02	0.609

Higher  $r$  indicates increasingly positive correlation between either higher values of numeric measure or the first referenced category of each dichotomous variable. Negative  $r$  indicates a negative correlation between higher values of numeric measures or the first reference category and employment.



Table 2. Random effects logistic regression model (Odds Ratios, 95% confidence intervals, and Type III tests of fixed effects) and coefficients of discrimination (D) of marginal predictions based on models containing individual variables and variable domains.

domain	variable	Model (N=8415)				full model = 0.091	
		OR	95% CI		p-val	Tjur's R <sup>2</sup>	D
			low	high		variable	
Client	female	0.786	0.536	1.152	0.216	<.001	0.043
	high school graduate	0.651	0.374	1.131	0.128	<.001	
	Hispanic	2.127	1.069	4.233	0.032	0.008	
	married or living as married	0.814	0.504	1.314	0.399	<.001	
	race: other (vs. white)	1.184	0.570	2.461	0.650	0.001	
	race: African-American (vs. white)	1.514	0.965	2.376	0.071	0.001	
	age	0.938	0.734	1.198	0.607	0.004	
	BACS composite score	1.678	1.245	2.260	0.001	0.004	
	ASI alcohol	0.958	0.794	1.157	0.658	<.001	
	ASI drug	0.864	0.620	1.202	0.385	0.001	
	Quality of Life (1-7)	1.044	0.906	1.203	0.549	<.001	
	SF-12 Mental subscale	1.127	0.947	1.342	0.180	<.001	
	SF-12 Physical subscale	1.134	0.958	1.342	0.145	0.001	
	affective disorder (vs. schizophrenia)	1.268	0.806	1.994	0.304	0.001	
	knowledge of social security (1-7)	0.939	0.850	1.038	0.219	<.001	
	work history (past 2 years)	3.546	2.372	5.301	<.001	0.021	
	years as SS beneficiary	0.477	0.339	0.673	<.001	0.009	
Site	Site IPS Fidelity	1.085	1.013	1.161	0.020	0.001	0.006
	local GDP change, previous year (%)	0.991	0.883	1.111	0.872	<.001	
	population density (high vs. low)	0.662	0.452	0.968	0.034	0.001	
	local unemployment rate (%)	0.711	0.587	0.862	0.001	0.002	
	local unionization rate (%)	0.997	0.963	1.033	0.883	<.001	
Time							0.018

Note: Odds Ratios and parameter effects for age and years on disability rolls based on 10-unit increase. Complete model parameterization, including that of time, is available in the online supplement. All time parameters had  $p < .001$ . N=8415 is out of a maximum of 9036 possible observations, based on 9 observations per subject.