A multilevel decomposition approach to estimate the role of program location and neighborhood disadvantage in racial disparities in alcohol treatment completion

Jerry Owen Jacobsona,*, Paul Robinsonb, Ricky N. Bluthenthala

aDepartment of Psychiatry, Charles R. Drew University of Medicine and Science, Los Angeles, CA, USA
bResearch Centers in Minority Institutions (RCMI), Charles R. Drew University of Medicine and Science, Los Angeles, CA, USA

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Abstract

Large racial disparities in completion rates from substance abuse treatment programs in urban settings remain largely unexplained, although evidence is accumulating that neighborhood conditions may influence individual substance abuse patterns and consequences. Understanding racial disparities in alcohol treatment completion, in particular, is crucial to resolving health disparities because racial/ethnic minorities bear a disproportionate burden of alcohol-related health consequences. Patient records for all non-homeless African American (N = 1677), Hispanic (N = 1635), and white (N = 1216) alcohol outpatients, ages 18 or older, discharged during 1998–2000 from publicly funded treatment programs in Los Angeles County, the second largest system of publicly funded substance abuse treatment in the United States, were combined with census data. We tested the hypothesis that racial differences in treatment completion are related to differences in neighborhood context, particularly neighborhood-level disadvantage. Estimates from multilevel statistical models indicate that treatment neighborhood disadvantage is independently associated with treatment completion after controlling for patient characteristics and facility- and zip code-level random effects. Results of a Oaxaca decomposition of the regression estimates indicate that racial differences in treatment neighborhood disadvantage account for 32.3% of African American–white differences in treatment completion. Hispanic–white differences in completion, and the effect of home neighborhood disadvantage on completion, were non-significant. We conclude that the location of publicly funded alcohol treatment programs is related to racial disparities in treatment completion, but additional research is necessary to understand the mechanism behind this association.

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Introduction

Racial and ethnic disparities in rates of retention in alcohol treatment programs have been documented in several recent studies. In the Project MATCH clinical trial, relatively lower completion rates by African American and Hispanic patients were detected, but lost statistical significance after controlling...
for occupation (Tonigan, 2003). Yet in a random sample of treatment clients from a large California health maintenance organization, significant differences in retention persisted after controlling for addiction severity, self-reported treatment goals, sex, age, income, and employment among African-American women (but not men) compared to whites (Mertens & Weisner, 2000). At public substance abuse treatment programs in Los Angeles, differences in retention between African American and white patients net of patient-level controls have been present at least since the early 1990s (Hser, Joshi, Maglione, Chou, & Anglin, 2001; Jacobson, Robinson, & Bluthenthal, 2006) and have been documented more recently between Hispanic and white patients (Longshore et al., 2004). However, the cause of these disparities remains unclear.

Understanding racial disparities in alcohol treatment outcomes is imperative because historically African Americans and other minority populations generally have experienced up to five times the rate of alcohol morbidity and mortality as whites in the United States, despite similar rates of lifetime heavy drinking (Caetano, 2003; Grant et al., 2004; Group for the Advancement of Psychiatry, 1996). Considering that alcohol consumption is causally related to more than 60 medical conditions (Room, Babor, & Rehm, 2005), reducing racial/ethnic disparities in alcohol-related problems is of special relevance to the national priority of reducing disparities in health (US Department of Health and Human Services, 2000). Disparities in treatment effectiveness could contribute to differences in alcohol-related health outcomes.

Although treatment for alcohol abuse and alcoholism has generally been shown to be an effective intervention to reduce health problems and expenditures (Holder & Blose, 1992; Holder et al., 2000), retention in treatment for alcohol and other classes of substance abuse is widely considered to be “one of the greatest problems interfering with treatment effectiveness” (Stahler, Cohen, & Shipley, 1993). To date, retention studies have examined a broad range of factors including patient demographics, employment, living situation, family background, addiction severity, and treatment program process and components (e.g. Cacciola, Dugosh, Foltz, Leahy, & Stevens, 2005; De Leon, Hawke, Jainchill, & Melnick, 2000; Hser, Evans, & Huang, 2005; Hser et al., 2001; Joe, Simpson, & Broome, 1998; Maglione, Chao, & Anglin, 2000; Mertens & Weisner, 2000; Morrissey et al., 2005; Simpson, Joe, Broome et al., 1997). Research has only recently ventured beyond the patient and program to understand the influence of the larger community context that patients face as they attempt recovery.

But in attempts to do so, attention has focused on the important, though narrow issues of distance-to-treatment and proximity to primary health and mental health services (Beardsley, Wish, Fitzelle, O’Grady, & Arria, 2003; Friedmann, D’Aunno, Jin, & Alexander, 2000; Friedmann, Lemon, Stein, Etheridge, & D’Aunno, 2001; Marsh, D’Aunno, & Smith, 2000; Umbricht-Schneiter, Ginn, Pabst, & Bigelow, 1994).

This paper examines whether broader differences in community context experienced by racial and ethnic minorities could be one factor contributing to lower rates of alcohol treatment completion among minority patients. With respect to drug use behavior, Lillicie-Blanton, Anthony, and Schuster (1993) found that racial/ethnic differences in crack cocaine use lose their statistical significance when controlling for neighborhood clustering, although the specific neighborhood characteristics that underlie this result were not investigated. More recent studies have shown that drinking and illicit substance abuse in several urban contexts are related to neighborhood levels of poverty and disorganization (i.e. disadvantage) net of individual-level controls (Boardman, Finch, Ellison, Williams, & Jackson, 2001; Hill & Angel, 2005; Saxe et al., 2001). These studies have drawn on social ecology theory (Bronfenbrenner, 1996; Kelly, 1966; Moos, 1973) and strain and social disorganization theories (Agnew, 1992; Merton, 1938) to argue that substance abuse can be explained in part as a response to neighborhood environments that cause stress or strain and lack the community-level organization or collective efficacy to sanction substance abuse behavior.

However, it is questionable whether racial disparities in neighborhood context in the general population (Kasarda, 1993) are mirrored in sub-populations accessing publicly funded alcohol treatment programs. Furthermore, while neighborhood conditions associated with patterns of substance abuse could conceivably influence rates of treatment entry, it is not necessarily the case that they also influence patterns of treatment completion in the same way. This issue was recently examined by Jacobson (2004), who suggested a number of causal mechanisms that could link neighborhood disadvantage to treatment completion based on a review of related literature. We briefly summarize
the principal hypotheses forwarded in this review below. For a more detailed discussion, readers are referred to the full article.

First, it is argued that because psychological stress is independently associated with dropout at the individual level (Brown et al., 1998; Hiller, Knight, & Simpson, 1999), the same neighborhood-level psychological stressors thought to be associated with substance abuse—less access to reliable employment, higher levels of criminal victimization, harsher living conditions, and social stigmatization from living in a disadvantaged area (Boardman et al., 2001)—may impede treatment completion. Second, Tucker, Vuchinich, and Gladsjo (1990–1991) argue that the relative paucity in disadvantaged areas of establishments that facilitate everyday tasks—grocery stores and other retail establishments, financial institutions, and health care facilities—may contribute to relapse by increasing the burden of “daily hassles” on residents. Relapse, in turn, is inversely related to treatment completion (Simpson, Joe, Rowan-Szal, & Greener, 1997). Additionally, lower expected education and earnings in disadvantaged areas (Borjas, 1995; Cutler & Glaeser, 1997; Massey, 1990) could affect patients’ self-efficacy and expected benefit from treatment, and thus their willingness to stay on when attendance becomes difficult (Hiller et al., 1999). Finally, greater physical availability of alcohol in disadvantaged areas (Alaniz, 1998; Storr, Chen, & Anthony, 2004) may expose patients in these areas to more environmental triggers for relapse to the extent that it increases actual availability, audiovisual cues for use, or the expectation of consumption (Rosenhow, Niaura, Childress, Abrams, & Monti, 1991).

These arguments provide a theoretical basis for expecting an inverse association between neighborhood disadvantage and alcohol treatment completion. In this paper, we do not test these causal mechanisms directly, but instead estimate a reduced-form relationship and the contribution of that relationship to racial disparities in treatment completion. Our analysis is guided by three research questions:

1. Relative to white patients, are African American and Hispanic patients exposed to higher levels of neighborhood disadvantage either where they live or attend treatment?
2. If so, are these neighborhood differences independently related to individual alcohol treatment completion?
3. How much of differences in treatment completion between these groups can be explained by patient-, facility-, and neighborhood-level differences, and specifically by neighborhood disadvantage?

In addressing the third research question, this paper employs a post-regression decomposition—to date uncommon in health disparities research—to directly estimate the share of the racial disparity associated with individual-, facility-, and neighborhood-level race differences.

Beyond the neighborhoods where patients live, this research also advances the health disparities literature by investigating the location where services are delivered, the “treatment context.” Jacobson (2004) emphasized attention to both residential and treatment contexts as part of a broader “treatment ecology” view encompassing all of the “principle geographic contexts experienced by the client over the course of treatment and the interrelationships among them.”

**Methods**

**Data**

The study area is Los Angeles County (LAC), California, the second largest publicly funded substance abuse treatment system in the United States in terms of treatment admissions (US Department of Health and Human Services, 2003). Levels of racial residential segregation with respect to both Hispanics and African Americans in LAC are high (McConville, Ong, Houston, & Rickles, 2001), providing a context to examine neighborhood differences.

Patient-level data are standardized intake and discharge forms completed by treatment staff at all community-based, outpatient recovery programs (i.e. not incarcerated or in a detoxification program) in LAC that received public funds during fiscal years 1998–2000. Programs are required to collect and report information on all patients whose treatment is funded by these sources as part of the County Alcohol and Drug Programs Administration’s (ADPA) Participant Reporting System (LACPRS). Patients funded by other sources are limited at these programs. LACPRS data are collected by treatment staff based on patient self-report at admission and discharge. Data include demographics, substance abuse problems, source of
referral, legal status, employment, treatment completion, and the zip codes of the home and treatment locations. We analyze treatment episodes for patients ages 18 or older at admission who reported alcohol as their primary substance abuse problem, and who both lived and attended treatment in LAC. The analysis excludes homeless patients, whose residential location is not reported. Many patients in the sample were treated more than once during 1998–2000. To permit generalization of findings to the population of patients rather than episodes, only the first episode for each patient during 1998–2000 that did not end in transfer or referral to another program is included in the analysis.

The sample is restricted further to African American, Hispanic, and white patients. Patients self-report their race based on the following definitions: White—A Caucasian person having ancestry among the people of Europe, North Africa, or the Middle East; Black/African-American—A person whose ancestry is among the Black racial groups of sub-Saharan Africa; Hispanic—People with origins in Mexico, Cuba, Puerto Rico, Central or South America or any other Spanish culture (including Spain). Patients also self-report their “ethnicity/cultural group”, although responses to this closed-form item actually refer to nations of origin (e.g. Cuban, Mexican, Japanese, Asian Indian) and include the catchall categories “Other Hispanic/Latino” and “None”. Patients who reported their race as Hispanic or their “ethnicity/cultural group” as Cuban, Mexican, Puerto Rican, or Other Hispanic/Latino were classified for this study as Hispanic.

It is important to recognize that race and ethnicity are socio-political rather than biological classifications and as such are inherently subjective (Ford & Kelly, 2005). Furthermore, it is possible that patients may misreport their race and ethnicity if they perceive a racial/ethnic bias by treatment staff. The degree of such measurement error in LACPRS is unknown. Consequently, race and ethnic classifications must be interpreted as subjective, negotiated (between respondent and treatment staff) constructs reflecting patients’ perceptions of the most expedient response.

Of remaining cases, 105 (2.2%) reported an invalid residential zip code and were omitted. Seventy-six clients who live or attend treatment in a zip code with fewer than 1000 households or families, based on census data, were also omitted to avoid outliers from low precision of the disadvantage measure. One zip code (90704, Catalina Island) is omitted because it is an island far from the rest of the county. These restrictions reduce the sample of zip codes from 259 to 246 (representing 96.5% of the LAC Census 2000 population) and the sample of patients from 4604 to 4528, representing 92.2% of non-homeless adults living and receiving community-based, outpatient treatment for a primary alcohol problem in LAC. The final sample includes patients from 98 of the 109 outpatient substance abuse facilities serving patients with a primary alcohol problem during this period.

Measurement

Completion status is coded at discharge by treatment counselors as follows: (1) “completed treatment/recovery plan, goals”; (2) “left before completion with satisfactory progress”; or (3) left before completion with unsatisfactory progress”. We created a dichotomous indicator coded 1 if the patient unambiguously completed treatment and 0 otherwise because the terms “satisfactory” and “unsatisfactory” are not defined in instructions to counselors. Determination of a patient’s “recovery plan” and “goals” is also subjective, but in our view less subject to racial bias because treatment programs typically have clear guidelines regarding what patients must achieve to graduate treatment. Completion rates are not used by ADPA to determine funding levels or other incentives or disincentives to programs.

Patient-level characteristics to control for differences in patient composition across zip codes were selected for their association with treatment outcomes in the treatment literature: age, sex, and education (highest school grade completed); employment, and medical beneficiary status; indicators of addiction severity; source of referral into treatment, involvement in the criminal justice system; and distance-to-treatment (e.g. Anglin & Hser, 1990; Beardsley et al., 2003; Hser et al., 2001; Joe et al., 1998).

Employment is reported as full-time (≥35 h/week), part-time (<35 h/week), unemployed, or not in the labor force (not seeking work in the past 30 days).

Addiction severity measures include indicators of any secondary and tertiary substances reported as problems at admission, injection drug use, whether the patient has ever received prior treatment, age at
first use or intoxication (in years), and approximate
days of alcohol and non-alcohol use during the
month prior to admission. We approximate days of
past month use by recoding the latter item for each
substance as follows: “no past month use” = 0
days; “1–3 times in past month” = 2 days; “1–2
times per week” = 6 days; “3–6 times per
week” = 18 days. Days of non-alcohol drug use is
then calculated as the sum of days of use of any
secondary and tertiary substances reported.
Whether the patient has ever been diagnosed with
a chronic mental illness is included as a severity
measure because psychiatric problems complicate
recovery from addiction (McLellan, Lewis, O’Brien,
& Kleber, 2000).

Source of referral into treatment is classified as
court or criminal justice, school or employer, self-
referral, or other. The latter category includes a
small number of referrals from health care provi-
ders, 12-step groups, and other community organi-
sations. Legal status is an indicator coded 1 if the
patient was on parole or probation at admission.

Distance-to-treatment is known only up to the
level of patients’ home zip codes in these data
because patients provide their zip code, rather than
street address. Standard practice in such cases is to
approximate distance-to-treatment from the zip
code population centroid (Beardsey et al., 2003).
However, we refine our distance estimates by
computing race-specific population centroids (His-
panic, non-Hispanic white, and non-Hispanic black)
in each zip code using Census 2000 data. The
distance between white and Hispanic population
centroids (mean = 1.0, SD = 0.9 miles) and white
and African-American centroids (mean = 0.7,
SD = 0.9 miles) was considerable, confirming the
need for the adjustment. Patients were assigned the
Euclidean distance (in miles) between the relevant
race-specific zip code centroid and the street address
of the treatment facility.

We use a common version of the disadvantage
measure shown previously to have high reliability
(Sampson, Raudenbush, & Earls, 1997) (z = 0.91 in
this sample), in which four measures of economic
priviation and social disorganization from Census
2000 data are standardized and then summed within
each zip code: (1) percent of individuals living in
poverty; (2) male unemployment rate; (3) percent of
female-headed households; and (4) percent of
families receiving public assistance. Elements (1)
and (2) are computed by aggregating counts from
census tracts—the finest unit available—to zip codes
proportional to the share of tract area. Elements (3)
and (4) and total counts of persons, households, and
families for the denominators are aggregated from
block groups.

Analytic strategy

An important concern for studies of neighbor-
hood influences on outcomes is confounding from
facility- and individual-level confounders. We use a
multilevel statistical framework to guard against
such confounding and a post-regression decomposi-
tion to estimate the share of the racial disparity
associated with racial differences at each level.

Three stages of analysis correspond to the three
research questions. First, χ2 tests (for dichotomous
variables) and t-tests (for continuous variables) were
used to identify African American–white and
Hispanic–white differences in neighborhood disad-
vantage at the home and treatment locations, and
for racial differences in patient characteristics
previously linked to treatment outcomes in the
literature. Wilcoxon rank sum tests produced results
similar to the t-tests reported.

Second, a four-level, logistic, variance compo-
nents model (Rabe-Hesketh & Skrondal, 2005;
Snijders & Bosker, 2002) estimated the share of
variance in completion due to clustering among
home neighborhoods, treatment neighborhoods,
and treatment facilities. In this patient-level model,
the log odds of completion was regressed on
random effects for home zip code, treatment zip
code, and treatment facility, with no covariates. The
share of variance in completion associated with each
level is the estimated variance of the relevant
random effect divided by the total estimated
outcome variance.

Finally, a Oaxaca decomposition was used to
decompose racial differences in treatment comple-
tion into contributions from racial differences in
home and treatment location disadvantage, patient
characteristics, and random effects at each level.
Oaxaca decomposition is a method frequently used
to estimate sources of wage differentials in labor
markets (Oaxaca, 1988; Oaxaca & Ransom, 1994),
but to our knowledge has not been used previously
in analysis of health disparities. The first step of the
decomposition is a multilevel regression model in
which the log odds of completion is regressed on an
intercept, z; African American and Hispanic race
indicators, A and H; a vector X of patient-level
variables, home and treatment neighborhood dis-
advantage; and random effects for facility, \( u_f \), treatment zip code, \( u_z \), and home zip code, \( u_h \) (Eq. (1)). Indices \( i, f, z, \) and \( h \) reference patients, facilities, and treatment and home locations, respectively.

\[
L_{ifzh} = \log \left( \frac{p_{ifzh}}{1 - p_{ifzh}} \right) = \alpha + \beta^{AA} A_{ifzh} + \beta^H H_{ifzh} + \beta^X X_{ifzh} + u_i + u_z + u_h. \tag{1}
\]

Second, the mean difference in outcome between African Americans and whites is decomposed based on the regression estimates:

\[
(L^W - L^{AA}) = \left( \bar{z}^W \bar{X}^W - \bar{X}^{AA} \right) + (\bar{u}_z^W - \bar{u}_z^{AA}) + (\bar{u}_h^W - \bar{u}_h^{AA}) - \beta^{AA}. \tag{2}
\]

The first right-hand side term in Eq. (2) represents the part of white–African American differences in the log odds of completion that is attributable to mean race differences on observed covariates. The second, third, and forth terms represent contributions from mean race differences in the estimated random effects. The last term represents the part that remains unexplained. For example, if \( D \) represents past month drinking and \( \hat{\beta}^{ALC} \) is the estimated coefficient on \( D \) from regression (1), then the part of white–African American differences in completion due to differences in past month drinking is estimated as \( \hat{\beta}^{ALC} (\bar{D}^W - \bar{D}^{AA}) \). The percent of the differential associated with each factor (e.g. \( 100 \times [\hat{\beta}^{AA}] / [L^W - L^{AA}] \)) is also reported.

Decomposition is favorable to another method often used to quantify the proportion of racial differences attributable to a variable of interest, in which several separate regression models are estimated, each successively adding a new block of variables of interest. Analysis then centers on how the estimated odds ratio on race moves toward parity as each block of variables is added (e.g. Sudano & Baker, 2006). Although easy to implement, when blocks of variables are correlated, results from this “staged model” approach are sensitive to the order in which the blocks are added. Importantly, decompositions such as the Oaxaca method based on a single model are not vulnerable to this problem.

To improve symmetry of the continuous predictors and bring in outliers, a square root transform was applied to the disadvantage measure and a log transform applied to the distance measure.

Continuous variables were centered by subtracting their sample means. An estimated odds ratio on a centered continuous predictor represents the change in the log odds of completion expected from a unit increase over the predictor’s sample mean.

A potential problem for this analysis is high correlation between home and neighborhood measures. However, 81% of patients in the sample have different home and treatment locations and variance inflation factors for linear versions of our models were all well below 10, indicating the absence of multi-collinearity problems.

All models were fit using Markov chain Monte Carlo (MCMC) methods in WinBUGS 1.4 using standard, normally distributed, diffuse just proper priors for coefficients1 and random effects and Gamma (0.001, 0.001) priors for random effect precision terms. Eq. (2) was embedded in the MCMC model in order to obtain posterior distributions and confidence intervals for the decomposition estimates. Models were run to convergence as measured by the potential scale reduction factor \( (R = 1) \) (Congdon, 2001).

**Precision of estimates**

MCMC is a simulation-based method that is part of the Bayesian statistical paradigm. In Bayesian analysis, summaries of the posterior distribution, rather than \( p \)-values and significance tests, are used to characterize the likely value of an estimated parameter (e.g. an odds ratio) (Congdon, 2003). Because posterior distributions need not be normal or symmetric, but follow the data, symmetric confidence intervals (CIs) provide less information than the probability a parameter is above or below some critical value. For regression results, we report whether there is at least 95% probability that each odds ratio (OR) is greater (or less) than 1 (i.e. the direction of the effect is clear); for the decomposition, we report whether there is at least a 95% probability that the share of the disparity explained is positive (or negative). In addition, we plot the posterior distribution of the OR estimates for key variables of interest, home and treatment neighborhood disadvantage. Our emphasis on the likely value of parameters rather than \( p \)-values follows numerous critiques of the relevance of statistical testing in epidemiological studies (e.g. Rothman & Greenland, 1998, pp. 181–186). Importantly, Baye-

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1The prior distribution for coefficients was \( N(0, 1000000) \).
sian CIs can be interpreted as containing the true parameter value with 95% probability.

**Findings**

**Differences between white, African American, and Hispanic Patients**

Table 1 presents the bivariate findings. Mean neighborhood disadvantage for African Americans is approximately 13 times higher in home neighborhoods and 7 times higher in treatment locations compared to whites. Hispanic patients fall between these groups. The three groups also differ with respect to patient characteristics that could be related to completion. Because Hispanic–white differences in treatment completion were not detected, we describe only the African American–white differences here. Compared to whites, African Americans in the sample tend to be older, less educated, more likely to be unemployed, have higher levels of a secondary cocaine/crack problem and more frequent drinking and overall secondary drug use. However, they are also less likely to inject drugs than whites, more likely to have started their substance abuse problem later in life, and are less likely to receive medical benefits or to be referred into treatment by the criminal justice system. African Americans patients also tend to live closer to the treatment facility they attend than whites.

**Variance partitioning model**

Clustering by home and treatment locations alone accounts for just 0.7% (95% CI: 0.0, 2.5) and 1.8%

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Table 1

Race differences in treatment completion, neighborhood characteristics, and patient characteristics at admission to treatment

<table>
<thead>
<tr>
<th></th>
<th>Total % or sample mean (SD)a</th>
<th>White (N = 1216)</th>
<th>African American (N = 1677)</th>
<th>Hispanic (N = 1635)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed treatment</td>
<td>30.2</td>
<td>20.2***</td>
<td>32.7</td>
<td></td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>59.7</td>
<td>57.4</td>
<td>67.8***</td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td>38.99(10.56)</td>
<td>40.52(9.47)***</td>
<td>35.60(9.95)***</td>
<td></td>
</tr>
<tr>
<td>Highest school grade</td>
<td>12.15(2.07)</td>
<td>11.61(1.76)***</td>
<td>10.30(2.82)***</td>
<td></td>
</tr>
<tr>
<td><strong>Addiction severity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First treatment episode</td>
<td>51.1</td>
<td>50.4</td>
<td>44.2***</td>
<td></td>
</tr>
<tr>
<td>Additional drug problemsb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heroin</td>
<td>4.9</td>
<td>1.1***</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>Amphetamines</td>
<td>21.1</td>
<td>1.4***</td>
<td>11.9***</td>
<td></td>
</tr>
<tr>
<td>Cocaine/crack</td>
<td>23.4</td>
<td>36.9***</td>
<td>27.4**</td>
<td></td>
</tr>
<tr>
<td>Marijuana</td>
<td>30.0</td>
<td>27.1*</td>
<td>22.1***</td>
<td></td>
</tr>
<tr>
<td>Other not listed above</td>
<td>7.3</td>
<td>3.7***</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>No other drug</td>
<td>40.5</td>
<td>46.0***</td>
<td>44.8**</td>
<td></td>
</tr>
<tr>
<td>Injection drug use</td>
<td>7.5</td>
<td>2.2***</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>Chronic mental illness</td>
<td>17.6</td>
<td>7.8***</td>
<td>4.5***</td>
<td></td>
</tr>
<tr>
<td>Days drinking in past month</td>
<td>13.77(13.19)</td>
<td>16.24(12.56)***</td>
<td>10.72(12.89)***</td>
<td></td>
</tr>
<tr>
<td>Days secondary drug use in past months</td>
<td>4.74(11.42)</td>
<td>5.84(12.22)***</td>
<td>3.94(10.48)**</td>
<td></td>
</tr>
<tr>
<td>Age of first substance abuse in years</td>
<td>15.65(4.90)</td>
<td>16.65(5.27)***</td>
<td>16.41(4.66)***</td>
<td></td>
</tr>
<tr>
<td><strong>Economic resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in labor market</td>
<td>34.6</td>
<td>37.9*</td>
<td>28.6***</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>35.3</td>
<td>50.4***</td>
<td>36.9</td>
<td></td>
</tr>
<tr>
<td>Part-time (5–34h/week)</td>
<td>8.9</td>
<td>4.9***</td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>Full-time (&gt; 34h/week)</td>
<td>21.2</td>
<td>6.7***</td>
<td>24.3**</td>
<td></td>
</tr>
<tr>
<td>Medical beneficiary</td>
<td>20.2</td>
<td>16.3***</td>
<td>12.7***</td>
<td></td>
</tr>
<tr>
<td><strong>Referral and legal involvement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under legal supervision</td>
<td>35.2</td>
<td>27.1***</td>
<td>40.1***</td>
<td></td>
</tr>
<tr>
<td>Principle source of referral</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-referral</td>
<td>27.6</td>
<td>20.9***</td>
<td>19.0***</td>
<td></td>
</tr>
<tr>
<td>Court/criminal justice</td>
<td>28.2</td>
<td>17.2***</td>
<td>33.3***</td>
<td></td>
</tr>
<tr>
<td>School/employer</td>
<td>1.3</td>
<td>1.0</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>
A larger share, 16.9% (CI: 9.5, 24.6) of completion variance, is associated with clustering by treatment facility, independent of neighborhood differences. Remaining differences between patients independent of neighborhood and facility effects account for 80.6% (CI: 73.3, 86.3) of variance in completion.

Correlates of treatment completion

The African American–white relative odds of completion moves substantially closer to parity at 1 after adjusting for available patient characteristics and facility and neighborhood random effects, from an unadjusted disparity of 0.58 (CI: 0.49, 0.69) to an adjusted disparity of 0.88 (95% CI: 0.69, 1.09) (Table 2, 3rd column). Based on summaries of the posterior distributions of these estimates, the probability of any racial difference in completion favoring white patients (i.e. pr(OR)<1) declines from 100% in the unadjusted model to 86.5% in the adjusted model (not reported in table).

While neighborhood disadvantage has a negative estimated effect on completion (Adjusted odds ratio [AOR] = 0.85; CI: 0.69, 1.02), no home neighborhood disadvantage effect was detected. Summaries of the posterior distributions (Fig. 1) indicate that the probability of a treatment neighborhoods effect is high (96%)—despite a CI that includes 1—confirming the need to examine the full posterior distribution.

The odds of completion also decrease significantly with higher education and more days of past month drinking, and increase with age, full-time employment, and criminal justice or school/employer referral. Surprisingly, distance-to-treatment is associated with higher odds of completion. To verify that the relationship between distance and completion is not an artifact of our distance measure, which, unlike previous studies (e.g. Beardsley et al., 2003), is computed based on race-specific zip code centroids, we repeated the analysis with unadjusted centroids and obtained similar results.

Decomposition of white– African American differences in completion

The third column of Table 2 shows the share of the African American–white difference in completion associated with each covariate. As in the second
Table 2
Logit models and decomposition of the white–African American disparity in log odds of completion (N = 4528)

<table>
<thead>
<tr>
<th></th>
<th>Variance components model</th>
<th>Full regression model</th>
<th>Decomposition of disparity (% disparity explained)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>95% CI</td>
<td>Estimate</td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>0.88</td>
<td>(0.69, 1.09)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.10</td>
<td>(0.89, 1.34)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.88</td>
<td>(0.73, 1.04)</td>
<td></td>
</tr>
<tr>
<td>Age in years(^b)</td>
<td>1.02</td>
<td>(1.01, 1.03)</td>
<td>-4.6</td>
</tr>
<tr>
<td>Highest school grade(^b)</td>
<td>0.96</td>
<td>(0.93, 0.99)</td>
<td>-3.4</td>
</tr>
<tr>
<td><strong>Addiction severity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First treatment episode</td>
<td>0.97</td>
<td>(0.83, 1.13)</td>
<td></td>
</tr>
<tr>
<td>Additional drug problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heroin</td>
<td>0.87</td>
<td>(0.49, 1.40)</td>
<td>-1.1</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>1.17</td>
<td>(0.90, 1.49)</td>
<td>4.9</td>
</tr>
<tr>
<td>Cocaine/crack</td>
<td>0.95</td>
<td>(0.79, 1.13)</td>
<td>1.3</td>
</tr>
<tr>
<td>Marijuana</td>
<td>1.01</td>
<td>(0.85, 1.23)</td>
<td>0.1</td>
</tr>
<tr>
<td>Other not listed above</td>
<td>0.86</td>
<td>(0.61, 1.18)</td>
<td>-1</td>
</tr>
<tr>
<td>Injection drug use</td>
<td>0.92</td>
<td>(0.59, 1.37)</td>
<td>-1</td>
</tr>
<tr>
<td>Chronic mental illness</td>
<td>1.00</td>
<td>(0.72, 1.34)</td>
<td>-0.2</td>
</tr>
<tr>
<td>Days drinking, past month(^b)</td>
<td>0.99</td>
<td>(0.99, 1.00)</td>
<td>3.3</td>
</tr>
<tr>
<td>Days secondary drug use, past months(^b)</td>
<td>1.00</td>
<td>(0.99, 1.01)</td>
<td>0.7</td>
</tr>
<tr>
<td>Age of first substance abuse (years)(^b)</td>
<td>1.01</td>
<td>(0.99, 1.02)</td>
<td>-1.3</td>
</tr>
<tr>
<td><strong>Economic resources</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in labor market</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.96</td>
<td>(0.79, 1.16)</td>
<td>1.2</td>
</tr>
<tr>
<td>Part-time (5–34 h/week)</td>
<td>1.29</td>
<td>(0.96, 1.72)</td>
<td>1.6</td>
</tr>
<tr>
<td>Full-time (&gt; 34 h/week)</td>
<td>1.93</td>
<td>(1.50, 2.44)</td>
<td>15.5</td>
</tr>
<tr>
<td>Medical beneficiary</td>
<td>1.06</td>
<td>(0.83, 1.33)</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Referral and legal involvement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under legal supervision</td>
<td>1.16</td>
<td>(0.95, 1.39)</td>
<td>1.8</td>
</tr>
<tr>
<td>Principle source of referral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Court/criminal justice</td>
<td>2.36</td>
<td>(1.81, 2.99)</td>
<td>15.4</td>
</tr>
<tr>
<td>School/employer</td>
<td>2.20</td>
<td>(1.18, 3.80)</td>
<td>0.4</td>
</tr>
<tr>
<td>Other</td>
<td>1.12</td>
<td>(0.90, 1.39)</td>
<td>-3.2</td>
</tr>
<tr>
<td>Self-referral</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Distance-to-treatment(^b,c)</td>
<td>1.12</td>
<td>(1.03, 1.22)</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Neighborhood disadvantage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home neighborhood(^b,d)</td>
<td>1.04</td>
<td>(0.93, 1.17)</td>
<td>-9.2</td>
</tr>
<tr>
<td>Treatment neighborhood(^b,d)</td>
<td>0.85</td>
<td>(0.69, 1.02)</td>
<td>32.3</td>
</tr>
<tr>
<td><strong>Explained variance (percent)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All covariates</td>
<td>—</td>
<td>—</td>
<td>11.2</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual-level residual</td>
<td>80.6</td>
<td>(73.3, 86.3)</td>
<td>75.5</td>
</tr>
</tbody>
</table>
Table 2 (continued)

<table>
<thead>
<tr>
<th>Variance components model</th>
<th>Full regression model</th>
<th>Decomposition of disparity (% disparity explained)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>95% CI</td>
</tr>
<tr>
<td>Facility random effect (re)</td>
<td>16.9</td>
<td>(9.5, 24.6)</td>
</tr>
<tr>
<td>Facility neighborhood re</td>
<td>1.8</td>
<td>(0.0, 8.7)</td>
</tr>
<tr>
<td>Home neighborhood re</td>
<td>0.7</td>
<td>(0.0, 2.5)</td>
</tr>
<tr>
<td>Deviance</td>
<td>4833</td>
<td>(4791, 4873)</td>
</tr>
</tbody>
</table>

Notes: Outcome is treatment completion; episodes ending in transfer or referral are omitted. The unadjusted African American–white and Hispanic–white relative odds of completion are .58 (95% CI: .49, .69) and 1.12 (95% CI: .96, 1.32), respectively. Boldface indicates that the direction of the effect is clear (i.e., the probability that an OR is greater (or less) than 1 is at least 95%; the probability that a share of the disparity explained is greater (or less) than 0 is at least 95%).

a Positive shares indicate a relative advantage by whites over African Americans, negative shares the reverse.
b Centered continuous variable.
c Log transformed.
d Square-root transformed.

Fig. 1. Posterior distribution of disadvantage odds ratio estimates. Notes: Estimates are from treatment completion models in Table 2.

Fig. 2 presents the decomposition results aggregated to broader categories: “patient profile” (all covariates, excluding disadvantage); “treatment facility” (facility random effect); “treatment location” (treatment neighborhood disadvantage and random effect); and “home location” (home neighborhood disadvantage and random effect). Of these, only racial differences in patient profile (36.9%; CI: 23.1, 53.9) and facility location (33.4%; CI: 3.4, 66.6) are clearly associated with the disparity (i.e. p(\text{share > 0}) \geq 95\%).

Discussion

What explains observed racial/ethnic differences in completion rates at publicly funded alcohol treatment programs? Previous analysis of treatment outcomes in Los Angeles found that differences in patient characteristics explained 40% of white–African American differences in treatment completion among alcohol outpatients (Jacobson et al., 2006). This paper extends the inquiry to the role of neighborhood context both where patients live and attend treatment, in a subsample of Los Angeles public system patients for whom home and treatment locations could be identified. As in the larger sample, African American patients completed at significantly lower rates than whites (20.2% vs. 30.2%). Hispanic–white differences in completion...
were not detected, also consistent with previous analysis (Jacobson et al., 2006).

Can neighborhood differences, particularly disadvantage, explain racial differences in individual propensities to complete treatment? On this point, findings are mixed. African-American patients tend to live and attend treatment in zip codes with significantly higher levels of disadvantage than whites, with roughly a 13-fold difference at the home location and a 7-fold difference at the treatment location. However, only a small share of the variance in completion is associated with clustering by home (1.8%) and treatment (0.7%) location. After controls for patient characteristics and facility- and zip code-level random effects, the relationship between home neighborhood disadvantage and completion is non-significant. In contrast, we did detect a modest, negative relationship between treatment completion and disadvantage at the treatment site; at the sample mean, a one-unit increase in square root transformed treatment location disadvantage is associated with a 0.85 reduction in the log odds of completion.

To place the regression findings on a more meaningful scale, we conducted a statistical decomposition of racial differences in completion rates based on the regression estimates. Oaxaca decomposition (Oaxaca, 1988; Oaxaca & Ransom, 1994), revealed that even the modest effect size of treatment site disadvantage, when coupled with the 7-fold race differences in disadvantage, accounts for a significant share (32.3%) of African American–white differences in treatment completion. Available patient characteristics explained 36.9% of the disparity; however these figures should be compared with caution given the wide confidence intervals around the point estimates.

An unexpected finding is that higher educational attainment is associated with lower odds of treatment completion in these data. One potential explanation is that patients may find being in the same treatment program as others with relatively lower levels of formal education unsettling, contributing to an eventual dropout decision. In a brief follow-on analysis, we found only weak evidence that patients who report above-average levels of years of education for their treatment program are less likely to complete treatment, after controlling for absolute level of education ($p = 0.07$). Additional qualitative research similar to work by Stahler et al. (1993) could help identify causes for lower completion rates among relatively more educated individuals in alcohol treatment programs.

This study is subject to several important limitations. First, the intake and discharge record data are not validated scientific instruments nor are the data experimental. Findings could be biased by any omitted variables that are correlated with both treatment site disadvantage and treatment completion. For example, if treatment facilities in disadvantaged locations tend to serve patients with alcohol or life problems inversely related to completion, the findings might actually be due to facility differences in patient composition. Specifically, we are unable to control for marital status or household structure with the present data. Omitted variable bias is mitigated to the extent that patient characteristics controlled in the analysis (past month drinking, secondary drug use, age and education, source of referral, legal involvement, employment, distance-to-treatment, and medical coverage, residential zip code) are related to any such omitted confounders. Second, the data reveal nothing about differences in treatment quality across facilities. Differences in facility quality could bias our findings if, for example, African Americans systematically attend lower performing facilities than whites. To mitigate this bias, a random facility effect was included in the regression models, but future research should also investigate whether
there are racial differences with respect to treatment approach, staffing, operational characteristics and resources, patient satisfaction, and other indicators of facility quality. For example, lower levels of group therapy in one sample of outpatient drug programs were associated with better retention (Hser et al., 2001).

An additional danger for this analysis is the possibility that counselors may systematically apply different standards to minority patients than white patients when assessing completion. While we cannot gauge any such tendency with these data, to the extent that racial bias occurs in determination of completion in favor of whites, our findings would tend to underestimate the true disparity.

These limitations stand in contrast to the strengths of this study’s data, namely, that they provide broad coverage of a public treatment system in a large, metropolitan area with a high estimated economic cost due to alcohol-related problems (approximately $7 billion annually) (Alcohol and Drug Program Administration (ADPA), 2004). The data allow exploration of racial disparities in practice, rather than in select programs of questionable generalizability. The analysis also took steps to mitigate shortcomings of zip codes as meaningful geographic boundaries for analysis of health outcomes: zip code and patient data were extracted for similar time periods (2000 vs. 1998–2000) because zip code boundaries can change over time. The neighborhood disadvantage measure is computed as an index of per capita, household, and family rates to account for zip code variation in population and area. Still, because results can be sensitive to geographic resolution (Hewko, Smoyer-Tomic, & Hodgson, 2002), replications of this analysis using smaller census areas (e.g. blocks or tracts) would strengthen the findings should detailed data on patient locations become available.

Causal mechanisms that may underlie the observed relationship between neighborhood conditions at the treatment location and treatment completion are unclear and require additional research. However, if neighborhood conditions do in fact influence treatment retention—presumably by increasing the odds of relapse as has been argued elsewhere (Jacobson, 2004)—then it seems counterintuitive that the effect of home neighborhood disadvantage should be smaller than that of treatment neighborhood disadvantage, which the outpatient experiences only in passing. It seems more likely that treatment site disadvantage may be correlated with facility quality or that patients attending treatment in disadvantaged areas are more prone to drop out because they find those areas undesirable. Qualitative research could help to examine these hypotheses. What would seemingly weaken the case for causality further is our finding that Hispanic outpatients live in areas with higher levels of disadvantage than their white counterparts but complete at similar rates. However, the relationship need not be linear and a threshold effect would be consistent with lower completion among African Americans (who experience the highest rates of neighborhood disadvantage). Related to this issue is the so-called Hispanic paradox of better-than-expected low birth-weight and mortality outcomes among Hispanics, despite lower socioeconomic status (SES), higher rates prevalence of diabetes and obesity, and more barriers to health care compared to other groups (for reviews of this literature, see de la Rosa, 2002; Fuentes-Afflick & Lurie, 1997; Lerman-Garbert, Villa, & Caballero, 2004). Although findings in this area are mixed, if the paradox is real, then one potential contributing factor, at least in Los Angeles, could be Hispanics’ higher rate of alcohol treatment completion, which may help to offset the negative health consequences of alcohol consumption associated with lower SES. Future investigations of the Hispanic paradox may wish to consider treatment participation and treatment outcomes in their analyses.

Racial disparities in alcohol treatment outcomes are likely to result from many factors in addition to neighborhood differences that future research should investigate, including racial differences in access to health and mental health care, transportation and other ancillary services, economic resources, patterns of drinking, other aspects of addiction severity, and beliefs regarding treatment appropriateness and effectiveness (Beardsley et al., 2003; Blendon, Aiken, Freeman, & Corey, 1989; Bluthenthal, Brown-Taylor, Guzmán-Becerra, & Robinson, 2005; Caetano, 2003; Fiscella & Williams, 2004; Mayberry, Mili, & Ofili, 2000; Williams & Collins, 2001).

The conditions under which individuals enter treatment may also be relevant. For example, criminal justice referral into treatment has been linked consistently with better retention (Anglin & Hser, 1990). Racial differences in criminal justice referral in this study explained 15% (95% CI: 9.7%, 13.2%) of white–African American differences in
completion. That African Americans in this outpatient sample are 26% less likely than others to have entered treatment by way of the criminal justice system, when it is well known that African Americans have higher population-level rates of incarceration, raises several questions that cannot be addressed by this study. For example, are rates of criminal justice referral to treatment equitable with respect to race given treatment need?

Treatment completion, although not a direct measure of treatment effectiveness, has been shown to be inversely associated with relapse (Simpson, Joe, Rowan-Szal et al., 1997), so that racial differences in treatment completion after adjustment for patient- and neighborhood-level controls can rightly be considered a racial “disparity”, in keeping with definitions recently put forward by Rathore and Krumholz (2004). Importantly, lower rates of treatment completion by African Americans may also contribute to the persistence of racial disparities in the negative consequences of alcohol abuse. In addition to further research, full understanding of this connection will hinge on development and adoption of more rigorous and scientifically validated data collection by public treatment systems.

Acknowledgments

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References


