Mental Health Indicator Interaction in Predicting Substance Abuse Treatment Outcomes in Nevada

Lawrence Greenfield [a]; Michael Wolf-Branigin [b]
[a] Greenfield and Associates, Kensington, Maryland, USA [b] George Mason University, Fairfax, Virginia, USA

PLEASE SCROLL DOWN FOR ARTICLE

informa
healthcare

Mental Health Indicator Interaction in Predicting Substance Abuse Treatment Outcomes in Nevada

Lawrence Greenfield

Greenfield and Associates, Kensington, Maryland, USA

Michael Wolf-Branigin

George Mason University, Fairfax, Virginia, USA

Background: Indicators of co-occurring mental health and substance abuse problems routinely collected at treatment admission in 19 State substance abuse treatment systems include a dual diagnosis and a State mental health (cognitive impairment) agency referral. These indicators have yet to be compared as predictors of treatment outcomes. *Objectives:* 1. Compare both indices as outcomes predictors individually and interactively. 2. Assess relationship of both indices to other client risk factors, e.g., physical/sexual abuse. *Methods*: Client admission and discharge records from the Nevada substance abuse treatment program, spanning 1995–2001 were reviewed (n = 17,591). Logistic regression analyses predicted treatment completion with significant improvement (33%) and treatment readmission following discharge (21%). Using Cox regression, the number of days from discharge to treatment readmission was predicted. Examined as predictors were two mental health indicators and their interaction with other admission and treatment variables controlled. *Results*: Neither mental health indicator alone significantly predicted any of the three outcomes; however, the interaction between the two indicators significantly predicted each outcome (p < .05). Having both indices was highly associated with physical/sexual abuse, domestic violence, homelessness, out of labor force and prior treatment. *Conclusions and Scientific Significance*: Indicator interactions may help improve substance abuse treatment outcomes prediction.

Keywords Co-occurring disorder, DSM, mental health indicator interaction, state treatment system, substance abuse, treatment outcomes

INTRODUCTION

Clients diagnosed with co-occurring mental health and substance abuse issues have poor responses to treatment (1), longer

treatment histories (2), greater services needs (3), higher levels of homelessness (4), higher risk for HIV (5, 6), higher levels of hospitalization for mood disorder (7), and history of childhood trauma (8). Meanwhile, within the New Jersey substance abuse treatment system, problems were found in the detection of co-occurring disorders (9). Such problems have generated calls for the integration of substance abuse and mental health services in a variety of settings (10, 11), as states began integrating the management of these services (12).

A standard indicator of mental health problems is a DSM diagnosis (13). Yet, a history of mental health issues may be an alternative indicator of problem severity (14). To optimize the prediction of mental health problems in state substance abuse treatment programs, the relationships of a co-occurring diagnosis and recent mental health problem history for predicting treatment outcomes were compared both independently and interactively. In the absence of costly post-treatment outcome data, treatment completion and the pattern of treatment admissions and readmissions found in agency records may suggest treatment success or failure (15, 16). Three outcomes were predicted: 1) Treatment completion with significant improvement (including abstinence), 2) Return for a second admission following discharge, and 3) Number of days elapsed between program discharge and readmission. It was hypothesized that either mental health issue alone would better predict treatment outcomes compared to neither indicator, and that the interaction between indicators would be a stronger predictor of treatment outcomes compared to either indicator alone or neither indicator.

Consistency between the outcomes was expected as reflected by the client's level of problem severity. Therefore, clients that failed to complete treatment with significant improvement would also be more likely to return for a second admission and do so within fewer days following discharge compared to those that completed treatment with significant improvement. To corroborate the findings, the relationship of each mental health indicator individually and combined to other potential risk factors was assessed, including unemployment, homelessness,

domestic violence, physical abuse, sexual abuse, family substance use, and prior history of substance abuse treatment.

METHOD

The Treatment Episode Data Set (TEDS)

A secondary analysis was completed employing discharge and (re)admission data from the Nevada Treatment Episode Data Set (TEDS) for the years 1995–2001. One indicator of a co-occurring disorder in TEDS was a DSM diagnosis (13) documenting the presence of both mental health and alcohol or other drug abuse (AOD) problems. Two Nevada TEDS "YES" or "No" variables were used to determine first, whether the diagnosis was made by a "doctor" and if so, then whether the client has a psychiatric problem in addition to his or her alcohol or other drug abuse (AOD) problem. Unavailable in the Nevada data set examined were the DSM code for an additional psychiatric condition and the methodology for arriving at the DSM diagnosis. A second variable in the Nevada TEDS that may be an indicator of recent mental health history was a mental health/mental retardation (cognitive Impairment) State agency referral. Nineteen States currently report both mental health referral and DSM diagnostic information in TEDS (17).

Sample

Analyzed at admission and discharge were records for 24,146 client admissions from January 1, 1995 through February 5, 1999. After excluding children below 18 and clients entering detoxification, $N = 17,591$ clients remained for the analysis. Of this group, 33% completed treatment with significant improvement—including abstinence—and 3,706 (21%) were discharged and readmitted to a second treatment during the latter period.

Design

To examine the client treatment characteristics associated with either a dual diagnosis or mental health/agency referral or both, a four-part variable was developed including 1) Neither indicator (NI) ($N = 16,072$); 2) Mental health/cognitive impairment agency referral only (MHR Only) ($N = 229$); 3) A dual diagnosis only (DD Only) ($n = 1,016$); and 4) Both indicators (BI) ($n = 274$). Client and treatment variables were assessed for significance, using Analysis of Variance (ANOVA) for client age, a continuous variable, and chi-square for the remaining variables, all were categorical.

Multivariate analysis was used to assess the mental health indicators and their interaction as predictors of treatment outcomes while controlling for the remaining client and treatment variables. Binary logistic regression (LR) analysis predicted the presence or absence of treatment completion with significant improvement and readmission following discharge, for each outcome. To assess the interaction, the equation $Y = a + Bx + Cy + Dz$ was used, where a is the intercept represented the

NI group at baseline, and the coefficients B, C, and D represented MHR Only, DD Only, and BI, respectively. To adjust for data censoring, a Cox regression (survival) analysis predicted the number of days to readmission. Readmissions on or before February 5, 1999 were classified as events, whereas subsequent readmissions were censored. Statistical analysis was completed using SPSS 16.0.

Variables

Independent Variables

DD Only, MHR Only, NI, and BI were each coded *Yes or No (Y/N)*. The demographic variables included age, a continuous variable, gender (*Male, Female*); and race (*White, Non-White*), having a minor child, being a veteran, twelfth grade or higher education, and enrollment in school or training with each coded Y/N. Victimization/social risk variables included domestic violence, physical abuse, sexual abuse, family involvement in substance use, criminal justice referral, and homeless were each coded Y/N. Employment was coded *Full-time*, *Part-time*, *Unemployed*, *Out of the labor market.* The substance use variables were primary substance of abuse, coded *Alcohol*, *Crack*, *Other cocaine*, *Marijuana*, *Heroin/morphine*, *Methamphetamine*, *Other*, and frequency of primary substance use in the past 30-days, coded *No use*, *Used less than daily*, *Daily use*. Five treatment variables were assessed, prior substance abuse treatment, continuing care referral, admission period, service type, and long length-of-stay (LOS). Prior treatment, i.e., before January 1, 1995, and planned after care/continuing care referral were each coded Y/N. For admission period, clients admitted early, i.e., January 1, 1995 through December 31, 1996, were compared to clients admitted late, i.e., January 1, 1997 through February 5, 1999.

Five treatment modalities for alcohol or drug abuse dependence were assessed as follows: 1) *Short-term residential*, 2) *Long-term residential*, 3) *Intensive outpatient*, 4) *Outpatient non-methadone*, and 5) *Outpatient methadone*. As expected, fully, 97% of methadone treated clients, were served in outpatient settings. LOS was defined as the number of days from admission to discharge. An LOS at or above the 75th percentile was required for a long LOS (Y/N), defined separately by modality as Short-term residential 23 days, Long-term residential 166, Intensive outpatient 74, Non-methadone outpatient 73, and Methadone outpatient 245.

Dependent Variables

Three dependent variables were assessed. The first was treatment completion with significant improvement (including abstinence), ($N = 5,811$), coded Y/N. The second dependent variable was treatment re-admission within 215 days following discharge; coded Y/N. For this variable, clients discharged after June 30, 1998 were excluded from the analysis, giving each remaining client ($N = 14,711$) 215 days or more to return. The third dependent variable, number of days to readmission

TABLE 1
Client and treatment characteristics by mental health indicator group (N = 17,591)

	Neither Indicator (N = 16072)	MH Referral (N = 229)	Dual Diagnosis (N = 1016)	Both Indicators (N = 274)	Chi Square	df	p
CLIENT VARIABLES							
A. Demographic							
Female (%)	30.2	54.1	51.6	40.1	263.5	3	.001
Race is non-white (%)	30.7	31.4	22.8	23.8	33.8	3	.001
Mean Age ((S.D.)	34.3, (9.4)	34.2, (8.3)	34.1, (8.7)	36.2. (8.3)	NA^		
Veteran (%)	11.4	10	7.6	10.6	12.73	3	0.01
Has minor child(ran) (%)	54.6	65.1	56.8	46	20.2	3	.001
Twelfth grade education (%)	69.5	62.3	66.5	63.5	15.3	3	.05
Enrolled in school/training (%)	4.8	2.6	6.7	2.9	12.07	3	.01
B. Victimization/Social Risk							
Domestic violence victim (%)	32.8	52.2	49	54.7	196.7	3	.001
Physical abuse victim (%)	28.3	54.8	47.6	46.4	276.4	3	.001
Sexual abuse victim (%)	15.1	29.7	37.2	43.8	497.9	3	.001
Family substance abuse (%)	64.1	76.7	78.9	82.2	139.5	3	.001
Criminal justice referral (%)	57.1	NA	38.1	NA		1	NA
Homeless (%)	30.1	46	33	45.4	55.9	6	.001
Employment (%)					386.2	9	.001
Full-time	37.5	15.7	22.1	4.7	NA		
Part-time	7	7.4	6.9	2.6	NA		
Unemployed	28.7	31.9	31.5	27.7	NA		
Not looking for work	26.6	45	39.5	63.5	NA		
C. Substance Abuse							
Primary Substance (%)					135	18	.001
Alcohol	46	36.7	36.2	53.3	51.1	3	.001
Crack	8.1	14	8.9	8.8	11.3	3	.05
Other cocaine	2.8	4.8	3.1	5.5	10.5	3	.05
Marijuana	9.9	9.5	5.5	9.5	0.5	3	NS
Heroin/Morphine	10.1	3.5	9.3	1.5	33.4	3	.001
Methamphetamine	21.1	29.3	30.3	18.6	56.5	3	.001
Other	2	2.2	2.9	2.9	0.5	3	NS
Past 30-day Primary Substance Use (%)					38.5	6	.001
No use	32.1	26.2	31.3	27.6			
Used less than daily	34.8	43.7	35.5	50			
Daily Use	33.2	30.1	33.3	22.4			
TREATMENT VARIABLES							
Treated prior to 1995 (%)	47.5	55	56.8	67.2	76.4	3	.001
Admitted Early (1995–1998) (%)	54.7	53.3	44.7	42	54.5	3	.001
Continuing care referral (%)	13.8	4.8	25.2	14.2	118.3	3	.001
Service Received (%)					760.2	12	.001·
Short-term residential	20.1	30.1	29.7	54.7	250.4	3	.001·
Long-term residential	10.6	7.9	5.9	1.8	45.4	3	.001·
Intensive outpatient	9.8	41.9	13.7	32.1	384.5	3	.001·
Outpatient non-methadone	51.3	19.2	44.6	11.3	273.7	3	.001·
Outpatient methadone	8.2	0.9	6.1	0	45.9	3	.001·
LOS at/or above 75th percentile	27.9	38.4	25.4	27.7	15.8	3	0.05

^ANOVA F = 3.99, df = 3, p < .001.

was calculated as the difference in days between discharge and readmission. Excluded here were clients with out of order readmission and discharge dates or missing information (7%).

RESULTS

Client and Treatment Characteristics
Client

For each of the four mental health indicator groups, i.e., NI, MHR Only, DD Only, and BI, Table 1 shows the mean age and percentage of clients having various other client characteristics. With the exception of education, demographic differences while significant were not consistent.

As predicted, consistently higher percentages of clients who had one or both mental health indicators reported higher rates of victimization/social risk, including domestic violence physical abuse, and sexual abuse, compared to NI. Clients who had one or both mental health indicators also reported higher rates of family substance use, homelessness, and being out of the labor market compared with NI. Conversely, these

TABLE 2
LR analysis model predicting treatment completion with significant improvement (17,024)

	B	S.E.	Wald	df	Sig.	OR
Female vs. Male	−0.131	0.043	9.102	1	0.003	.877
Employment			54.197	3	0	
Full-time	0.351	0.052	45.478	1	0	1.421
Part-time	0.107	0.082	1.712	1	0.191	1.113
Unemployed	0.055	0.05	1.212	1	0.271	1.057
Not in labor force (Ref.)						
Twelfth grade education (Y/N)	0.162	0.04	16.615	1	0	1.176
Primary substance use frequency			59.112	2	0	
Less than daily in past 30 days	−0.339	0.044	59.027	1	0	.712
Daily use in past 30 days	−0.173	0.05	11.888	1	0.001	.841
No use in past 30 days (Ref.)						
Type of Service			1421	4	0	
Long term residential	−1.488	0.068	477.67	1	0	.226
Intensive outpatient	−1.573	0.069	521.01	1	0	.207
Outpatient	−1.828	0.056	1066	1	0	.161
Methadone	−3.902	0.21	344.043	1	0	.02
Short term residential (Ref.)						
Criminal justice referral (Y/N)	0.352	0.04	75.617	1	0	1.422
Long LOS (Y/N)	0.967	0.04	597.947	1	0	2.63
Physical abuse victim (Y/N)	−0.148	0.043	12.052	1	0.001	.862
Family substance abuse (Y/N)	−0.118	0.04	8.83	1	0.003	.889
Homeless (Y/N)	−0.23	0.043	28.36	1	0	.795
Primary substance			122.594	6	0	
Crack	−0.657	0.073	80.395	1	0	.518
Other cocaine	−0.312	0.108	8.404	1	0.004	.732
Marijuana/hashish	−0.351	0.063	31.221	1	0	.704
Heroin/morphine	−0.472	0.121	15.129	1	0	.624
Methamphetamine	−0.337	0.049	48.059	1	0	.714
Other substance	−0.406	0.139	8.546	1	0.003	.666
Alcohol (Reference)						
Prior treatment (Y/N)	−0.12	0.038	10.038	1	0.002	.887
Continuing Care (Y/N)	0.271	0.051	28.597	1	0	1.311
Admitted '97–'99 vs. '95–'96	0.196	0.036	29.093	1	0	1.217
Mental health referral (Y/N)	−0.308	0.169	3.336	1	0.068	.735
Dual diagnosis (Y/N)	0.115	0.079	2.113	1	0.146	1.121
MH Referral by Dual diagnosis	−0.598	0.237	6.375	1	0.012	.55
Constant	0.474	0.086	30.444	1	0	1.607

clients were less likely to report working full-time compared to NI.

As predicted, the BI group was primarily found to be at higher risk compared to DD Only and MHR Only, for domestic violence (54.7% vs. 49.0%, chi-square = 2.83, df = 1, $p < .05$); sexual abuse (43.6% vs. 37.2%, chi-square = 3.96, df = 1, $p = .053$), and homelessness (45.4 vs. 33%, chi-square = 14.1, df = 1, $p < .001$). Similarly, a higher percentage of BI clients were out of the labor force (65.0% vs. 39.5%), and a lower percentage worked full-time (2.6% vs. 6.9%), compared to DD Only, while similar percentages worked part-time and collected unemployment (chi-square = 74.1, df = 3, $p < .001$). Physical abuse, family substance use, on the other hand, did not differ significantly. Similarly, compared to MHR a higher percentage of BI clients were victims of sexual abuse (chi-square = 10.6, df = 1, $p < .01$), while a lower percentage worked full-time, and a higher percentage were out of the labor force (chi-square = 31.3, df = 3, $p < .001$. Unexpectedly, the BI group reported a lower level of physical abuse compared to MHR (46.4% vs.

54.8%, chi-square = 3.6, df = 1, $p < .05$) and did not differ with respect to domestic violence. Primary substances of abuse differences, while significant, were not consistent.

Treatment

In accord with their expected risk levels, NI was least likely to have received substance abuse treatment in Nevada prior to program admission, compared with MHR Only and DD Only, whereas BI was most likely. On the other hand, the percentage of each group referred for continuing care at discharge was not consistent with expected risk levels, being highest for DD Only, intermediate for both BI and NI, and lowest for MHR Only.

In further analysis, the BI group was compared with DD Only and MHR Only, respectively. As expected, BI clients were more likely to receive prior treatment compared to DD Only (67.2% vs. 56.8%, chi-square = 9.6, df = 1, $p < .001$), and MHR Only (67.2% vs. 55%, chi-square = 7.7, df = 1, $p < .01$). The results for after care were inconsistent with the predicted levels of risk. Therefore, BI clients were less likely to receive after care

TABLE 3
Client and treatment predictors of return for a second admission within 215 days in logistic regression analysis (N = 14,332*)

	B	S.E.	Wald	df	Sig.	OR
Family substance abuse (Y/N)	0.157	0.052	9.082	1	0.003	1.17
Domestic violence (Y/N)	0.246	0.049	25.152	1	0	1.278
Twelfth grade education (Y/N)	0.146	0.051	8.075	1	0.004	1.157
Criminal justice referral (Y/N)	−0.154	0.051	9.259	1	0.002	.857
Homeless (Y/N)	0.47	0.05	89.746	1	0	1.6
Employment	—	—	57.469	3	0	
Full-time	−0.476	0.063	56.936	1	0	.621
Part-time	−0.268	0.1	7.136	1	0.008	.765
Unemployed	−0.175	0.057	9.346	1	0.002	.839
Not in labor force (Ref.)						
Primary Substance	—	—	111.998	6	0	
Crack	0.385	0.082	22.194	1	0	1.47
Other cocaine	0.309	0.134	5.303	1	0.021	1.362
Marijuana/Hashish	−0.017	0.091	0.033	1	0.855	.984
Heroin/Morphine	0.725	0.08	81.761	1	0	2.064
Methamphetamine	0.413	0.061	45.588	1	0	1.512
Other substance	0.37	0.156	5.636	1	0.018	1.448
Alcohol (Ref.)						
Prior treatment (Y/N)	0.091	0.049	3.539	1	0.06	1.096
Admitted late vs. early	0.202	0.047	18.685	1	0	1.223
Long LOS (Y/N)	−0.358	0.057	39.161	1	0	.699
Continuing Care (Y/N)	−0.283	0.069	16.689	1	0	.753
Mental Health Indicators	—	—	—	—	—	—
MHR Only (Y/N)	−0.064	0.2	0.103	1	0.749	.938
DD Only (Y/N)	0.102	0.092	1.228	1	0.268	1.108
MHR by DD Interaction	0.849	0.263	10.435	1	0.001	2.338
Constant	−2.082	0.09	533.14	1	0	.125

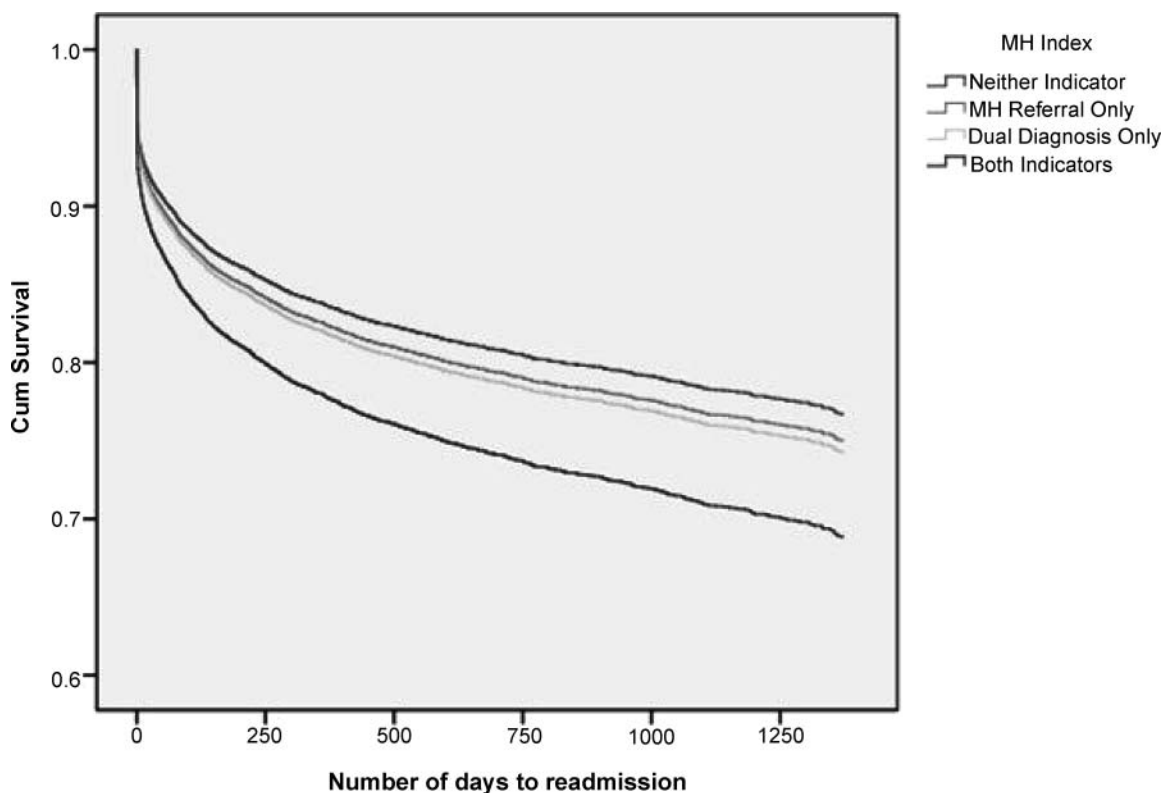*Excluded were clients discharged after 6/30/98 (16.5%) plus clients with missing data (2.1%).

FIG. 1.   Survival function for number of days to readmission by mental health index group.

compared to DD Only (14.2 vs. 25.2, chi-square = 14.7, df = 1, $p < .001$) and more likely to do so compared to MHR Only (14.2% vs. 4.8%, chi-square = 12.2, df = 1, $p < .001$). The remaining treatment differences showed no consistent pattern in relation to the predicted levels of risk.

Treatment Completion with Significant Improvement

Completing treatment with significant improvement were NI 33.1%, MHR Only 26.2%, DD Only 35.4%, and BI 23.7%. While the results were suggestive, to confirm the possibility of an interaction, an LR analysis was completed. Table 2 shows these results. While the mental health indicator main effects were not significant, their interaction was statistically significant and as expected negative in direction (B = −.598, $p < .05$), with the odds of completing treatment .55 times lower for BI compared to NI. Completing treatment with improved functioning (after adjusting for other variables) were 26.1% MHR Only, 36.6% DD Only, and 18.4% BI, compared with 33.1% NI.

Readmission within 215 Days Following Discharge

The percentage of clients readmitted within 215 days following discharge for the four mental health indicator groups, NI, MHR Only, DD Only, and BI were 15.8%, 18.8%, 20.3%, and 40.4%, respectively. Given the relatively large percentage of BI clients that were readmitted within 215 days following dis-

charge compared to the remaining groups, these findings suggest an interaction. Table 3 shows the LR analysis results further assessing this possibility. Looking at the mental health indicators and their interaction with other factors controlled, neither mental health indicator main effect was significant, suggesting that these indicators alone were not useful as predictors of a readmission following discharge. In contrast, the interaction effect was significant and positive (B = .849, $p < .01$), with an OR = 2.3.

Days to Readmission

In order to assess predictors of the number of days to readmission following discharge, a Cox regression analysis was completed. Again, neither main effect, i.e., a mental health agency referral nor dual diagnosis was a significant predictor. Consistent with the study hypothesis, however, the interaction between indicators was significant and positive (B = .341, $p < .01$). Figure 1 shows the Kaplan Meier cumulative survival rates by group, confirming these results.

DISCUSSION

Employing data collected by the Nevada TEDS from 1995–2001, two mental health indicators at treatment admission; presence of dual diagnosis and a mental health/cognitive impairment agency referral were compared as predictors of treatment

outcomes. Three treatment outcomes were assessed including treatment completion with significant improvement, a return for a second admission within 215 days, and number of days from discharge to readmission. To assess the utility of each mental health indicator alone and their interaction for predicting treatment outcomes, the first two outcomes were examined using Logistic Regression analysis and the third using Cox regression analysis. In each analysis, a two-fold hypothesis was assessed. First, that either indicator alone would better predict the interim treatment outcomes compared to neither indicator. Second, that both indicators combined (interaction) would be a stronger outcomes predictor, compared to either indicator alone (neither indicator). Controlling for other client and treatment factors in the three analyses, both hypotheses were confirmed. Consistent with these results, reports of domestic violence and physical/sexual abuse, unemployment, homelessness, and prior treatment were for the most part more highly associated with BI compared with DD Only and MHR Only.

Taken together, these results raise questions about using dual diagnosis or mental health/cognitive impairment agency referral as the sole indicators of mental health problem severity. As neither indicator alone was a significant outcomes predictor, while their interaction was consistently significant, the findings suggest that mental health indicator interaction may be used to optimize the prediction of substance abuse treatment outcomes.

LIMITATIONS

A limitation of the analysis was the absence of post-treatment data for clients who left but did not return to treatment. On the other hand, treatment completion was found to be a good predictor of post-treatment abstinence (15, 16). Due to the relatively small numbers of clients served by individual providers, a second limitation was our inability to use multilevel modeling to account for provider-level data. Finally, the variable *mental health/cognitive impairment agency referral* might represent two distinct populations. While data shows that cognitive impairment is common among those with mental illness, these impairments are not well recognized or documented (17). Additionally, they may represent no more than 1.2% of co-occurring disorders (18, 19). While the percentage of clients in Nevada having a DSM was relatively low, this percentage increased from 5.5% to 10.6% per year 1995 to 1998 admissions, respectively. Finally, the extent to which recent administrative changes in the Nevada substance abuse treatment program may limit the applicability of the findings should be explored.

CONCLUSION AND SCIENTIFIC SIGNIFICANCE

While Nevada has recently added a diagnostic code to its TEDS data (20–21) not all states may have done so. To improve mental health assessment reliability and validity, we recommend that the remaining states consider doing so as well. To improve treatment outcome prediction, greater consideration should be given to combining recent mental health history with dual diagnosis information. Finally, to assess the impact of recent changes

in the level of program integration on the present findings, we recommend that the study be replicated across states with varying levels of integration.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

REFERENCES

1. Brunette MF, Mueser KT, Drake RE. A review of research on residential programs for people with severe mental illness and co-occurring substance use disorders. Drug and Alcohol Review 2004; 23:471–481.
2. Toneatto T, Negrete JC, Calderwood K. Diagnostic subgroups within a sample of comorbid substance abusers correlates and characteristics. American Journal of Addiction 2000; 9:253–264.
3. Ethai JD, Ford JD. Correlates of mental health service use intensity in the National Comorbidity Survey Replication. Psychiatric Review 2007; 58:1108–1115.
4. Compton SN, Swanson JW, Wagner HR, Swartz MS, Burns BJ, Elbogen EB. Involuntary outpatient commitment and homelessness in persons with severe mental illness. Mental Health Services Research 2003; 5:27–38.
5. Brooner RK, Greenfield L, Schmidt CW, Bigelow GE. Antisocial personality disorder and HIV infection in intravenous drug abusers. American Journal of Psychiatry 1993; 150:53–58.
6. Disney E, Kidor M, Kolodner K, King V, Peirce J, Bellenson P, Brooner RK. Psychiatric comorbidity is associated with drug use and HIV risk in syringe exchange participants. Journal of Nervous and Mental Disorders 2006; 194:577–583.
7. Prince JD, Akincigil A, Hoover DR, Walkup JT, Bilder S, Crystal S. Substance abuse and hospitalization for mood disorder among Medicaid beneficiaries. American Journal of Public Health 2009; 99:160–167.
8. Hyman SM, Paliwal P, Chaplain TM, Mazure CM, Rounseville BJ, Sinha R. Severity of childhood trauma is predictive of cocaine relapse outcomes in women but not men. 2008. Drug and Alcohol Dependence 2008; 92:208–216.
9. Hu MM, Kline A, Huang FY, Ziedonis DM. Detection of co-occurring mental illness in the New Jersey substance abuse treatment system. American Journal of Public Health 2006; 96:1785–1793.
10. Timko C, Dixon K, Moos RH. Treatment for dual diagnosis patients in the psychiatric and substance abuse systems. Mental Health Services Research 2005; 7:229–242.
11. Mangrum LF, Spence RT, Lopez M. Integrated versus parallel treatment of co-occurring psychiatric and substance use disorders. Journal of Substance Abuse Treatment 2006; 30:79–84.
12. Heil SKR, Leeper TE, Nalty D, Campbell K. *Integrating State Administrative Records to Manage Substance Abuse Treatment System Performance*

(DHHS Publication No. [SMA] 07-4268). Technical Assistance Publication (TAP) Series 29. Rockville, MD: Center for Substance Abuse Treatment, Substance Abuse and Mental Health Services Administration, 2007.

13. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders* (IV Edition). Washington, DC: American Psychiatric Association, 2000.

14. Jordan LC, Luke DA, Mowbray CT, Herman SE, Davidson WS, Conklin C. Correlates of functioning in a population with dual diagnosis: An examination of diagnosis and problem history. Journal of Mental Health Administration 1996; 23:260–271.

15. Feidler K, Screen A, Greenfield L, Fountain D. Analysis of three outcome proxies for post-treatment. Submitted to the Center for Substance Abuse Treatment under the National Evaluation Data Services contract. Fairfax, VA: Caliber Associates, 2001.

16. Greenfield L, Burgdorf K, Chen X, Porowski A, Roberts T, Herrell J. Effectiveness of long-term residential substance abuse treatment for women: Findings from three national studies. The American Journal of Drug and Alcohol Abuse 2004; 30:537–550.

17. Mackin RS, Arean PA. Incidence and documentation of cognitive impairment among older adults with severe mental illness in a community mental health setting. American Journal of Geriatric Psychiatry 2009; 17: 75–82.

18. Kessler RC. National Comorbidity Survey. Ann Arbor, MI: Inter-university Consortium for Political and Social Research, 1992.

19. Landreth K, Brandenburg CY, Gottschalk S. Mental health problems and needs in Nevada. In: Justice & Democracy forum on the Leading Social Indicators in Nevada. 2004. Available at http://www.unlv.edu/centers/ cd-clv/healthnv/mentalhealth.html.

20. SAMHSA. Treatment Episode Data Set, State by state Crosswalk of State System Data to TEDS. Substance Abuse and Mental Health Services Administration, Office of Applied Studies. 2006. Accessed on May 4, 2009 from http://www.icpsr.umich.edu/SAMHDA/PDF/tedswalk.pdf.

21. Canfield, MD. Personal Communication, 2008.