THE AMERICAN JOURNAL ON ADDICTIONS

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Journal:	*The American Journal on Addictions*
Manuscript ID:	AJA-2014-0821
Manuscript Type:	Regular article
Date Submitted by the Author:	30-Oct-2014
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Keywords:	Addiction Severity Index, Alcohol Abuse, Dual Diagnosis, Relapse, Depression, Intoxication

American Journal on Addictions

Original Research

The Effects of Residential Dual Diagnosis Treatment on Alcohol Abuse

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ABSTRACT

Background & Objectives: Dual diagnosis treatments' aim to treat drug disorders by targeting co-occurring mental disorders and environmental problems. The purpose of this study was to test if this treatment can significantly produce better treatment outcomes in patients with an alcohol disorder by also addressing their co-occurring disorders.

Methods: This multi-center study of dual diagnosis (DD) programs involved 804 residential patients with co-occurring alcohol and mental health disorders. The Addiction Severity Index was administered at admission and at 1, 6, and 12 months after discharge. Eight ANCOVAs used mean intoxication days per month after discharge as the outcome variable, pre-admission intoxication days per month as a covariate, and 8 variables associated with relapse (e.g. depression) as factors.

Results: Repeated measures analysis showed the intoxication rate per month stabilized between months 6 and 12 with 68% still in remission and an 88% mean reduction from baseline ($F = 519$, $p < .005$). A comparison between patients with and without weekly relapse produced significant differences in hospitalization (odds ratio 11.3 : 1; 95% C.I., 5.5 to 23.2).

Conclusion and Scientific Significance: Patients with these factors at admission did not have significantly higher intoxication rates after discharge than patients without them. This suggests that these DD programs successfully integrated treatment of both disorders and explains their effectiveness.

KEYWORDS: Addiction Severity Index (ASI), alcohol abuse, dual diagnosis, relapse, depression, intoxication.

INTRODUCTION

The 21st century increase in dual diagnosis treatment of co-occurring drug and mental health disorders is, in part, a result of recognition that they typically co-exist and difficulty in achieving long-term remission using treatment-as-usual. Dual diagnosis programs today routinely integrate treatment of both with specific psychosocial interventions,[1] medical management,[2] motivational interviewing,[3] and cognitive behavioral therapy [4-5] using both group and individual counseling based on well-defined treatment principles.[6] The American Society of Addiction Medicine (ASAM) has developed a three tier taxonomy of addiction-only services (AOS), dual diagnosis capable (DDC), and dual diagnosis enhanced (DDE) services with the difference between the latter two being the capability of integrating treatment of all severities of both disorders.[7] This taxonomy does not imply that AOS or DDC programs are not desirable; some addicts do not have mental health disorders necessitating dual diagnosis treatment and others who might benefit from such treatment do not require DDE services due to low severity. However, disagreement still exists among psychiatry as to whether dual diagnosed patients should receive integrated treatment or be referred to addiction-only specialists before commencing mental health treatment,[8-9] a question that deserves empirical testing.

Some have indicated[10-12] that there is a lack of well designed dual diagnosis studies that consider the differences between effectiveness and efficacy. The latter requires randomized controlled trials (RCTs) to determine causation that have high internal validity. The primary limitation of dual diagnosis RCTs is low external validity due to the use of extensive inclusion/exclusion criteria that hinder generalizability to clinical practice. Effectiveness studies require naturalistic, non-experimental designs (NNEDs) which tend to have high external

validity due to little or no patient exclusion criteria that allows generalization to patients in clinical settings, but fail to consider internal validity. The primary limitation is that these designs may demonstrate association, but not causation. McHugo and his colleagues[10] recommend that non-experimental dual diagnosis research should attempt to improve internal validity and recommend six procedures for dual diagnosis research that this study used.

First, "the methods, settings and interventions of an experiment [should] approximate the real-life situation that is under study". Second, the study should use interventions that have produced significant results in RCTs. Third; the intervention should utilize residential sites since they produce better outcomes than out-patient services. Fourth, short-term outcomes need to be compared with long-term outcomes since deterioration over time in dual diagnosis research is typical. Fifth, secondary outcomes of interest to patients should be tested to see if they are associated with abstinence. Sixth, moderators that influence response to treatment can be controlled statistically as 3-way interactions using analysis of co-variance. These procedures suggested by McHugo et.al. can make substantial improvements to the internal validity of naturalistic non-experimental designs.

There were methodological, measurement, and sustainability issues with many of the older studies that caused some to conclude the evidence was not clear that integrated therapies worked better than routine care.[13] Others[14] have concluded that most dual diagnosis patients attain short term remission of substance use disorders although longer term relapse is problematic. RachBeisel[13] reported in a review of dual diagnosis research before the separation of dual diagnosis capable and enhanced classifications that that between 41 and 61% achieved at least short term remission.

The above literature led to three main questions for this study. First, will all three of these DDE centers produce superior short and one year outcomes than found in the literature using a repeated measures analysis on alcohol use, intoxication, other illegal drugs, and ASI composite scores? If so, this could provide empirical evidence to support dual diagnosis integrated treatment following a diagnosis of co-occurring disorders. Second, and perhaps most important of all, if the reason that these dual diagnosis programs perform better than sequential treatment is due to their successful treatment of co-occurring mental heal disorders and environmental problems associated with alcohol misuse, that can be empirically tested with these data as follows; among patients who reported psychological, familial, or legal problems at intake, their mean days per month of intoxication during the year after discharge should not be significantly higher than patients who reported no such problems. If these dual diagnosis centers produced excellent outcomes and if there is no association between post-discharge intoxication and these variables, that would be strong evidence that the reason was due to these institutions sufficiently addressing co-occurring disorders and other problems during integrated dual diagnosis treatment. We found no other study that has ever tested whether dual diagnosis centers can eliminate the association between co-occurring mental health problems at intake and post-discharge relapse. The third question deals with secondary issues of patient concern and public policy, i.e., the utilization of hospital ER visits and admissions due to alcohol and mental health disorders among individuals who became intoxicated weekly when compared to patients who avoided weekly intoxication. We found no other addiction study that has examined this before either.

METHODS

Subjects, Location, and Assessment Instruments

The DDE sample came from 1,972 adult patients sequentially admitted to one of 3 treatment programs in Tennessee or California between 2008 and 2010. Staff in each site administered the Addiction Severity Index[15] and the University of Rhode Island Change Assessment Scale[16] to patients during admission as part of their normal intake process. The sample was reduced to the 1,030 patients who: (a) met DSM clinical criteria for alcohol dependency and reported intoxication during the 30 days prior to admission; and (b) agreed to participate in a study in which they would be asked to re-take the Addiction Severity Index (ASI) periodically after discharge. Attempts were made to interview each former patient at 1, 6, and 12 months after discharge with 804 of 1,030 (78%) completing at least one of the three post-discharge interviews and 369 completing all three. This resulted in a naturalistic, non-experimental design with high external validity capable of measuring program effectiveness while preserving internal validity using these procedures suggested by McHugo.

Measurement of main outcome variables

Weekly intoxication was defined as any patient who reported weekly intoxication during the previous 30 days or at any time since the previous interview. Mean intoxication days per month was calculated by summing the mean days of intoxication for all reported months and dividing by the number of completed post assessment interviews.

Ethics

Ethical approval was provided by the institutional review board of Foundations Recovery Network. Informed consent for all patients occurred at admission. Patients were told that if they decided to participate in the study, institutional staff will attempt to locate them at one, six, and twelve months after discharge and repeat the ASI to see how well they are doing. They were told that no service would be withheld if they decided to not participate in the post-discharge research and they could change their mind and withdraw from the study at any time without fear of reprisal.

RESULTS

There have been minimal differences in patient characteristics at admission to the three dual diagnosis enhanced sites in this study. Table 1 shows the sites are similar in days of intoxication, illegal drug use, and co-occurring issues related to mental health, age, race, and gender. The primary difference is the third site is substantially smaller, but still has similar baseline sample characteristics.

The change in alcohol use, intoxication, illegal drug use, and all seven ASI composite scores over three post-tests are found in the Table 2 as well as a repeated measures analysis on all ten measures. The table consists of data from the 368 patients who completed all assessments, a requirement for repeated measures analysis. The means in Table 2 for each time period were compared with the means for all 804 participants to examine the effect of missing data. Its affect was negligible on the mean changes, i.e., never greater than 2 percent. The right column contains the results of the repeated measures analyses. With the exception of employment, the means at one, six, and twelve months were always lower than preadmission rates for the other nine variables with each being significant at the .005 level. It is also noteworthy that there were no

/

significant differences between the 6th and 12th month assessment for any measure other than employment which continued to improve significantly. The stability between 6 and 12 months is a new and unexpected finding. Further deterioration is expected with the passage of time due to new relapses exceeding continued remissions, but that was not the case among these patients. There were modest increases in alcohol use, intoxication, and drug use on the 6th month assessment but they were not followed by increases at the 12th month assessment. The above patterns were consistent among patients who completed all or only some of the post-discharge assessments.

The third table is an analysis of the total sample and three subgroups: those who reported no intoxication after discharge, those who reported weekly intoxication and those who reported some intoxication that was less than weekly. The reported average intoxication per month during the year after discharge fell from 12,913 to 1,159 (91% less) for the entire sample, an average improvement from 16 to 2 days of intoxication per month. This was primarily due to 526 (65%) reporting no intoxication during the year after discharge. However, 165 (21%) reported weekly intoxication at some point during the year after discharge, and 120 (15%) reported less than weekly intoxication during this time period and averaged two days per month.

There was one potential confound in the third table, i.e., it is possible that former patients who were not reached during one or two of the post-assessments were significantly more likely to have become intoxicated weekly and therefore not available giving a false impression of how few were in this group. This was tested by comparing the proportion who were intoxicated weekly who participated in one, two or all three post-tests (chi-square = 0.495, df = 2, p = .78). The proportion was lowest among those who participated all three times, i.e., .21, highest among

those who participated twice at .24, while those who participated once were at .22. These minimal differences negate the potential limitation of missing data lowering the weekly intoxication rate.

Table 4 is the most important table, theoretically, because it appears to explain why most former dual diagnosis patients maintained remission for one year. Previous research has shown that co-occurring problems, such as found in the Problem Severity Index, are associated with significantly higher post discharge drug use (Simpson et. al., 1999). That was tested two ways on each of 8 variables in Table 4, i.e., with mean intoxication rates and weekly intoxication rates using analysis of variance and analysis of covariance. This table compares patients who had or did not have, at the time of admission, any of these 8 measures related to mental health disorders. Table 4 shows that the presence of or absence or any of these 8 measures at admission were not significantly related with higher weekly intoxication or mean days of intoxication after discharge. This table suggests that patients who suffered from mental and alcohol disorders, and were treated for both concurrently using dual diagnosis protocols, produced better short and longer term alcohol outcomes than sequential treatment because of the effectiveness of the integrated treatment of the co-occurring disorders and other measures that have been historically associated with elevated relapse.

Tables 5 and 6 report mean differences in secondary outcomes of interest to patients as suggested by McHugo. These tables show that hospitalizations and emergency room visits attributed to alcohol, drugs, and/or mental health problems occurred among 1 to 4% of patients who never reported becoming intoxicated weekly after discharge in Table 5. However hospitalizations and emergency room visits attributed to alcohol, drugs, and/or mental health

problems occurred among 12 to 31% of patients who reported weekly intoxication. The odds ratios of utilizing various hospital services among those who reported weekly intoxication after discharge varied between 5.8 and 14.3 to 1 depending on the reported problem. The odds of having a related criminal matter increased by 2.1 as well.

While Table 5 examines hospital service utilization using the dichotomous nominal variable of use or not, Table 6 focuses on the mean number of days of hospitalization and days visiting the ER for problems related to alcohol, drugs, and mental health issues. The difference in days of in-patient hospital services, (.71 versus .04) for drugs/alcohol and for mental health problems (.58 versus .09) has important economic implications; the saving associated with less hospitalization among those who ceased to become intoxicated weekly may be considerably larger than the cost of dual diagnosis treatment for the entire sample. A similar pattern is found for the number of ER visits due to alcohol and/or drug related problems as well as visits due to mental health problems. Table 6 also shows that former patients who were still becoming intoxicated weekly were more than twice as likely to have a criminal matter pending, an important secondary concern for patients, clinicians, insurance carriers, and the criminal justice system.

DISCUSSION

The primary strength of this naturalistic, non-experimental time-series study was the utilization of the methodological and statistical suggestions by McHugo to improve such dual diagnosis research. The repeated measures show that alcohol misuse, illegal drug use, and mental health disorders can remain in remission long term, when defined as one year, for about two-thirds of patients and intoxication per month fell between 88 and 90% depending on whether one

includes all patient data or only those who completed all assessments using Tables 3 or 4. We are unaware of any published experimental or quasi-experimental study that report similar results. This still begs the question of what would happen if this was followed up by a multi-year study in which long-term was defined as two, three, five years or longer? That limitation remains.

Likewise, we are unaware of any other temporal analysis that reported a slight increase in mean alcohol use, intoxication, and illegal drugs at month 6 followed by no significant improvements or deterioration in these three measures at month 12; that is also a new finding that has ramifications for future research. What looks like "stabilization" is not. A few patients relapsing was offset by a few more in remission.

At the 6th month assessment 33 patients relapsed after complete remission at month 1. This suggests the need for further research designed to determine when their increases occurred between month 1 and 6; that could provide insight into its etiology. For example, if remission lasted a few months before relapse, there may be something in the home environment that was not resolved during treatment that could be addressed. If relapse started about a month after discharge, it might reflect unresolved mental or physical health issues during residency. Using McHugo's model, It follows that weekly empirical measures of mental and physical health status during residency might be able to predict who is likely to be in the group who becomes intoxicated weekly during the year after discharge. This could lead to clinical modifications before discharge for this subset only. As McHugo et. al. suggested, if early markers could predict long-term relapse, it should be possible to add a randomized controlled trial component to this smaller group designed to test various clinical treatments to see what lowers relapse for this

smaller subgroup. None of this would have been apparent without a descriptive, naturalistic, non-experimental time-series design to complement previous randomized controlled trials.

The three-way analysis of covariance provides empirical support as to why these dual diagnosis programs performed so well; the 8 variables that were associated with relapse in a national study[24] were not so associated in this study. Patients with any one of these 8 variables became intoxicated on average only 1 more time per year than patients without the same variables. Presumably, this was because the dual diagnosis sites were quite effective in dealing with these co-occurring mental health and other issues.

Two additional limitations remain concerning generalization to all dual diagnosis programs. First, these were dual diagnosis enhanced programs and it is unknown as to what percent of patients had disorders so severe as to need their enhanced services. Second, all three dual diagnosis sites also incorporate holistic practices such as dialectical behavior therapy[17], acupuncture[18], nutrient dense food/education[19], and yoga since there is growing evidence of effectiveness when used in conjunction with other interventions with high efficacy in well-controlled randomized controlled trials in these areas[20-22]. The American Psychiatric Association[23] has recently adopted a consistent position[23], namely, that holistic practices may be worthy to use in conjunction with evidence-based practices, but not as an alternative. All three sites being dual diagnosis enhanced is a methodological limitation since it was impossible to determine if these results were due to typical dual diagnosis enhanced services alone, or a combination of typical and holistic practices. It remains unknown as to how much these complementary practices altered the results without a comparative study.

Lastly, there is now a need to raise the suggested standard follow-up rate[24] of 70% when the annual relapse rates fall to only about a third of patients over a year and weekly intoxication is limited to about a fifth of the sample. Missing data limit how far results may be generalized. The only solutions are more intensive follow-up procedures that do not violate informed consent built into the design and/or more costly intensive procedures to do follow-up among a randomly selected sample who could be reached using stratified randomization based on baseline substance use and mental health status to determine who should be sought out among missing former patients.

Although randomized controlled trials have the highest internal validity and are clearly the best method to measure efficacy, studies like this that are multi-center, multi-modal, naturalistic evaluations have the highest external validity. They offer demonstrable effectiveness and the ability to generalize their findings to clinical practice. The combination of such designs in conjunction with RCTs leads to the most reliable conclusions and the best path forward in substance abuse treatment.

ACKNOWLEDGEMENTS

RDB is partially supported by the National Institutes of Health grants 1R01NS073884 and 1R21MH073624; and VA Merit Review Awards CX000479 and CX000780; The writing of this paper was supported in part by funds from the National Institutes of Health, NIAAA (RO1-AA07112 and K05-AA00219) and the Medical Research Service of the US Department of Veterans Affairs (MOB). TS is partially support by SAMSA grants as well.

We greatly appreciate the edits by Margaret A. Madigan.

DECLARATION OF INTEREST

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

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TABLE 1: Patient characteristics at admission to 3 dual diagnosis enhanced programs

Sites States N	Combined 804	La Paloma Tennessee 244	Michael's House California 530	The Canyon California 30
Mean N of days used during previous month				
Alcohol Use	18.5	17.8	20.3	17.5
Intoxication	16.1	15.0	18.8	13.8
Illegal Drug Use	10.6	10.0	12.2	7.0
Multiple Drug Use	8.4	7.7	10.2	4.5
Cannabis	5.0	4.6	6.2	3.8
Sedatives	4.0	3.5	4.6	1.7
Other Opiates	3.7	3.5	1.7	0.4
Cocaine	2.4	2.2	2.9	1.4
Heroin	.82	.83	.89	0
Amphetamines	.81	.66	1.1	1.5
Barbiturates	.42	.26	.84	0
Methamphetamine	.39	.44	.33	0
Proportion affirmative				
Awaiting sentencing	.21	.20	.22	.20
Depression	.74	.75	.72	.67
Anxiety or tension	.83	.81	.87	.87
On prescribed medication	.60	.61	.58	.59
Demographics				
Age (standard deviation)	37.9 (12.1)	37.9 (11.2)	37.8 (12.4)	40.4 (13.4)
Race				
Caucasian	.90	.87	.91	.93
Gender				
Male	.57	.55	.58	.47

Proportions represent the mean number of days clients used various drugs during the 30 days before admission, or the proportion reporting depression. anxiety/tension, receiving prescription meds, or awaiting sentencing. Age is measured in years while the proportion who were Caucasian or male is reported in proportions.

TABLE 2: Change in alcohol use, intoxication, illegal drug use and ASI composite scores before and after discharge from residential dual diagnosis treatment

N = 368 completing all assessments	1 month before admission period 1	1 month after discharge period 2	6 months after discharge period 3	12 months after discharge period 4	Mean change from baseline	p < .001 between periods
Illegal drug use days per month	9.5	0.4	1.0	1.2	**91%**	**1 v 2, 3 & 4**
Intoxication days per month	16.34	1.0	2.1	1.8	**90%**	**1 v 2, 3 & 4**
Alcohol use in days per month	18.8	1.4	3.2	3.0	**87%**	**1 v 2, 3 & 4** **2 v 3 & 4**
ASI drug composite score	.135	.020	.020	.023	**84%**	**1 v 2, 3 & 4**
ASI alcohol composite score	.618	.109	.125	.120	**81%**	**1 v 2, 3 & 4**
ASI family composite score	.326	.139	.133	.123	**60%**	**1 v 2, 3 & 4**
ASI legal composite score	.121	.075	.051	.030	**50%**	**1 v 2, 3 & 4**
ASI psychiatric composite score	.478	.262	.230	.223	**50%**	**1 v 2, 3 & 4**
ASI medical composite score	.288	.148	.150	.185	**44%**	**1 v 2, 3 & 4**
ASI employment composite score	.388	.464	.384	.368	**-4% @ 1** **+5% @ 4**	**1 v 2,** **2 v 3 & 4**

The column labeled "mean change from baseline" represents the 12 month reductions compared to the 30 days before admission for illegal drug use, alcohol use, intoxication days, and reduction in ASI composite scores from admission.

The right hand column shows significant improvements at the .001 level during the year after discharge when compared to pre-admission abuse and ASI scores for all comparisons except employment score.

TABLE 3: Change in intoxication after discharge by subsample

Days of intoxication reported per month N = 804	One month before admission	One month after discharge	Six months after discharge	Twelve months after discharge
Total sample				
(88% monthly improvement)				
mean	16.06	1.35	2.38	2.25
std. error	.36	.174	.256	.266
N	804	661	591	525
sum	12,913	891	1,404	1,182
The subsample with no intoxication after discharge				
(100% monthly improvement)				
mean	16.04	0	0	0
std. error	.45	0	0	0
N	526	431	374	332
sum	8,340	0	0	0
The subsample with weekly intoxication after discharge				
(53% monthly improvement)				
mean	17.23	5.85	10.16	8.52
std. error	.72	.72	.91	.94
N	165	131	124	109
sum	2,843	766	1,270	946
The subsample with some post intoxication that was less than weekly				
(88% monthly improvement)				
mean	14.42	1.18	1.44	2.59
std. error	.97	.30	.20	.60
N	120	106	93	91
sum	1,730	125	134	236

This table shows reductions in intoxication broken down by the categories of no relapse, weekly relapse, and less than weekly relapse.

TABLE 4: Lack of significant associations between mental health indices and two post-discharge intoxication measures for 804 dual diagnosis patients using ANCOVA

Characteristics Before Program Admission	Proportion with Weekly Intoxication after	F	p	Mean days of intoxication per month before	after	F	P
Variables associated with mental health disorders							
On prescribed meds for psychiatric problems							
Yes (n = 478)	.17	1.961	.162	16.05	2.42	2.743	.098
No (n =317)	.10			16.02	1.78		
Major anxiety/tension							
Yes (n= 663)	.16	5.883	.016	16.15	2.44	0.420	.517
No (n = 136)	.10			15.35	1.02		
Major depression							
Yes (n = 592)	.16	0.277	.599	16.47	2.43	0.006	.793
No (n = 207)	.14			14.72	1.54		
Violence control difficult							
Yes (n = 162)	.14	2.425	.120	16.40	2.34	.179	.186
No (n = 636)	.15			15.91	2.17		
Concentration or Memory difficulties							
Yes (n = 412)	.16	.475	.491	16.30	2.08	.430	.512
No (n = 387)	.14			15.76	2.32		
Hallucinations							
Yes (n = 54)	.14	.813	.367	14.61	1.83	.234	.629
No (n = 745)	.15			16.15	2.23		
Serious suicide thoughts							
Yes (n = 147)	.11	1.382	.240	16.00	2.15	.029	.865
No (n = 653)	.16			16.04	2.21		
Suicide attempts							
Yes (n = 47)	.15	.004	.953	14.94	1.12	1.75	.186
No (n = 752)	.15			16.11	2.25		
Totals N =804	.15			16.06	2.24		

This table shows that in 15 of 16 inferential tests that clients with any of 8 mental disorders that are associated with elevated relapse were not significantly more likely to relapse. The one that is significant at the .016 level may be due to the use of 16 tests.

TABLE 5: Odds ratios of secondary results of high patient interest after discharge

Post discharge Addiction Severity Index secondary measures of high interest to patients		Post discharge weekly intoxication since last interview No	Yes	Chi square p	Odds ratio 95% CI
Hospitalized due to alcohol and/or drug related problems?	yes	11 (2%)	29 (17%)	64.47 < .001	11.3 5.5 to 23.2
	no	606 (98%)	141 (83%)		
Hospitalized due to mental health related problems?	yes	8 (1%)	16 (11%)	34.38 <.001	9.0 3.8 to 21.4
	no	601 (99%)	134 (89%)		
ER visit due to alcohol and/or drug related problems?	yes	16 (3%)	40 (24%)	88.88 < .001	11.6 6.3 to 21.4
	no	600 (97%)	129 (76%)		
ER visit due to mental health related problems?	yes	8 (1%)	16 (11%)	34.38 <.001	9.0 3.8 to 21.4
	no	601 (99%)	134 (89%)		
Have a related pending criminal matter?	yes	43 (8%)	24 (15%)	6.67 = .014	2.0 1.2 to 3.4
	no	491 (92%)	137 (85%)		

The Chi-square values show that client hospitalization rates and ER visit rates are significantly higher for clients who relapsed. Those who relapsed were between 9 and 11.6 times more likely to be hospitalized or taken to the ER. This demonstrates substantial cost savings for this type of post-release medical services when treatment is successful.

TABLE 6: Mean differences in secondary outcomes of interest to patients with important public policy implications

Secondary outcomes		N	Mean days or incidents	Std. error	t	p
Hospitalized due to alcohol and/or drug related problems?	yes	170	.71	.186	6.65	<.001
	no	617	.04	.014		
Hospitalized due to mental health related problems?	yes	166	.58	.253	3.02	=.003
	no	615	.09	.050		
ER visit due to alcohol and/or drug related problems?	yes	169	.46	.088	8.19	<.001
	no	616	.04	.011		
ER visit due to mental health related problems?	yes	169	.22	.050	2.24	=.025
	no	617	.07	.042		
Have a related pending criminal matter?	yes	161	.27	.056	3.13	=.002
	no	534	.12	.020		

The second column shows the mean number of days of hospitalization and non-admitted ER visits broken down by the reason for being admitted into a hospital. For example, the 170 clients who were hospitalized for alcohol/drug problems were in-patients for 121 days (170 x .71). The other 617 clients were hospitalized for a total of 25 days (617 x .04= 25) due to reasons other than alcohol or drug problems.