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The Influence of Treatment Attendance on Subsequent Aggression among Severely Mentally Ill Substance Abusers

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Abstract

The interrelationships between severe mental illness, substance use, and aggression are of longstanding importance with implications for community treatment programs, treatment research and public policy. Through the analysis of longitudinal data collected from 278 patients over a 6-month period following admission to an outpatient dual diagnosis treatment program, this study examined the association between dual diagnosis treatment attendance and subsequent aggression among individuals diagnosed with both a severe mental illness and a substance use disorder. We also tested substance use and psychiatric symptoms as mediators of this treatment-aggression relationship. The results of structural equation modeling analyses indicated that dual diagnosis treatment was associated with lower levels of subsequent aggression. Mediation analyses indicated that greater treatment involvement was associated with reduced substance use, which was associated with lower levels of aggression; thus, substance use was found to mediate the relationship between dual diagnosis treatment and aggression. Surprisingly, severity of psychiatric symptoms did not predict later aggression. These findings suggest that targeting substance use reduction in treatment may have the additional benefit of reducing the risk of later aggression among dual diagnosis patients.

Keywords

Treatment; Aggression; Severe mental illness; Substance abuse; Dual diagnosis

1. Introduction

The interrelationships between severe mental illness, substance use, and aggression are of longstanding importance with implications for community treatment programs, treatment

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research, and public policy. Effectively preventing and managing aggression not only benefits patients and their families, but also provides a safer environment for society as a whole, as aggression has the potential to escalate to violent crimes such as rape, manslaughter, and murder. Prior studies have explored the interrelationships among mental illness, substance use, and violent behavior (Boles & Johnson, 2001), but limited attention has been given to potential avenues for reducing aggression among patients with both a severe mental illness and a substance use disorder.

Aggression and violence among persons with a severe mental illness (SMI; e.g., schizophrenia, bipolar disorder) have received increasing attention both in the scientific community (Fazel et al., 2009) and the mainstream media (e.g., Carey & Hartocollis, 2013). In most studies, aggressive behavior has been found to be more common among individuals with a SMI than among those without a SMI (Link, Andrews, & Cullen, 1992; Silver, 2006); however, empirical findings challenge the notion that mental illness inevitably leads to aggression and violence (Buckley et al., 2003; Siroitch, 2008). Among SMI patients, the prevalence of violence varies greatly. Epidemiological and clinical studies alike suggest that among individuals dually diagnosed with a mental illness and a substance use disorder, violence and aggressive behavior is more closely associated with substance use than with mental illness (Cheung & Schweitzer, 1998; Erkiran et al., 2006; Swanson et al., 1990; Swanson et al., 2002; Fazel et al., 2009). Substance abuse has been shown consistently to be a significant risk factor for aggression and violence among people with a mental disorder (Siroitch, 2008; Soyka, 2000). Among individuals without substance abuse histories, few differences in rates of violence and aggression have been found when comparing mentally ill individuals with matched non-mentally ill samples from the same neighborhood (Steadman et al., 1998). Although most studies involve cross-sectional data, there is some evidence from longitudinal studies to support the positive relationship between substance abuse and aggression among mentally ill persons (Hodgins, Lapalme, & Toupin, 1999; Steadman et al., 1998). In a systematic review of the literature, Fazel and colleagues (2009) examined factors associated with violence among individuals diagnosed with schizophrenia and other psychoses. They concluded that, although SMI individuals were significantly more likely to exhibit violent behavior, most of the risk appeared to be mediated by substance abuse comorbidity. As a result, they proposed that public health strategies for violence reduction should consider focusing on the prevention and treatment of substance abuse among SMI individuals.

Several studies have shown that involvement in treatment is associated with lower risks of aggression among persons with a SMI (Skeem, Monahan, & Mulvey, 2002; Swanson et al., 2000; Swanson, Swartz, & Elbogen, 2004; Swartz et al., 2001). For example, Swanson and colleagues (1997) found that the absence of ongoing mental health treatment was associated with a significantly increased risk of aggressive behavior among people with mental disorder. These same investigators examined the impact of involuntary outpatient commitment combined with regular outpatient service utilization on aggression and found that it was effective in reducing violence among persons with a SMI (Swanson et al., 2000). Similarly, on the basis of a longitudinal analysis of 871 civil-commitment psychiatric patients, Skeem, Monahan, and Mulvey (2002) found that patients who received more treatment sessions during a 10-week intervention period were approximately three times less

likely to be violent during a subsequent 10-week period than those who received fewer sessions, even after controlling for substance use. These results suggest that treatment, even if administered involuntarily, can be effective in reducing rates of violence and aggression among SMI individuals.

Despite the increased attention devoted to understanding factors that reduce violence and aggression among SMI individuals, there has been little research devoted to exploring how treatment that includes interventions for both mental illness and substance abuse reduces aggression and violence in this population. Drake et al. (2008) conducted a systematic review of 45 controlled studies of psychosocial interventions for people with co-occurring substance use and SMI including individual counseling, group counseling, family intervention, case management, residential treatment, contingency management, and legal intervention. About half of the studies showed positive effects of interventions on substance use, and one-fourth reported positive mental health outcomes. Only four studies examined the impact of psychosocial interventions on aggression and/or criminal involvement outcomes (Aubry et al., 2003; Carmichael, Tackett-Gibson, & Dell, 1998; Chandler & Spicer, 2006; Mangrum, Spence, & Lopez, 2006). Two of these studies found evidence that integrated treatment was associated with decreased violence, namely a reduction in arrests (Carmichael, Tackett-Gibson, & Dell, 1998; Mangrum, Spence, & Lopez, 2006); however, none of the studies explored how these psychosocial treatments exert their positive impact on reducing aggression and violence. That is, if treatment involvement is associated with subsequent aggression, does more treatment lead to lower levels of aggression and violence? If so, is this beneficial effect mediated by reduced substance use, psychiatric symptoms, or both? The current study represents an effort to fill this gap.

The present investigation involves the analysis of longitudinal data collected over a 6-month period as part of a study determining predictors of post-treatment initiation alcohol use among individuals dually-diagnosed with an alcohol use disorder and a severe mental illness (i.e., schizophrenia-spectrum or bipolar disorder), the vast majority of whom were also diagnosed with a co-morbid drug use disorder (Bradizza, Maisto, Vincent et al, 2009). The present aims were to examine the longitudinal relationship between dual diagnosis treatment attendance and subsequent aggression in this sample including whether earlier substance use and psychiatric symptoms mediated this treatment – aggression relationship (see Figure 1). We hypothesized that dual diagnosis treatment participation would directly influence subsequent aggression but also indirectly influence aggression through reduced levels of substance use and improved mental health. Specifically, we predicted that 1) More days of dual diagnosis treatment attendance (X_7) during months 1 to 4 would be related to lower levels of aggression during months 5 and 6 (X_{10}); 2) Lower levels of substance use during months 3 and 4 following treatment initiation (X_8) would be associated with lower rates of aggression during months 5 and 6 (X_{10}); 3) Higher levels of psychiatric problems during month 4 (X_9) would be associated with higher levels of aggression during months 5 and 6 (X_{10}); 4) More days of dual diagnosis treatment attendance (X_7) would be associated with reduced levels of aggression (X_{10}) by diminishing substance use (X_8); 5) Greater attendance at dual diagnosis treatment (X_7) would be associated with reduced levels of aggression (X_{10}) by improving mental health (X_9). Prior research has demonstrated that several demographic variables such as age, gender, and supervised residential settings are associated with

substance use among the severely mentally ill (Bradizza et al., 2009; Buckley et al., 2003; Sirotich, 2008); as a result, these variables (X_1 , X_2 , and X_3) were included as control variables in our analyses.

2. Methods

2.1. Participants

This longitudinal study is described in detail elsewhere (Bradizza, Maisto, Vincent et al, 2009). Briefly, participants were 278 men and women dually-diagnosed with a schizophrenia-spectrum or bipolar disorder and alcohol abuse or dependence disorder who enrolled in treatment at a publicly-funded community mental health center in Buffalo, New York that provides integrated mental health and substance abuse services. Participants were all receiving outpatient individual and group treatments at the center, and the average duration of treatment during the study time period was 15.1 weeks.

The sample was 54% women and 46% men, with a mean age of 39.40 years ($SD = 8.35$; Range: 18-60) and a mean of 11.64 years of education ($SD = 1.86$). Nearly two-thirds (65%) of participants were African American, 27% Caucasian, 4% Hispanic, 3% Native American, and 1% other ethnicities. The vast majority of participants were single (97%), unemployed (98%), and low income (85% reported annual incomes $< \$10,000$). During the past year, 64% of participants reported receiving public assistance, 17% disability income and 17% illegal (e.g., selling drugs, prostitution) income. At baseline, 41% lived in supervised settings (e.g., group home, halfway house) and 59% in unsupervised settings (e.g., apartment, private home).

Participants met criteria for current alcohol dependence (97%) or alcohol abuse (3%) and had high rates of comorbid drug use disorders with 86% meeting *DSM-IV* criteria for at least one drug use disorder (76% cocaine abuse/dependence, 46% marijuana, 23% opiates, 16% sedatives/hypnotics and 9% amphetamines) in addition to their alcohol use disorder. All participants were diagnosed with either *DSM-IV* bipolar disorder (56%) or a schizophrenia-spectrum (32% schizoaffective, 12% schizophrenia) disorder. Patients had long treatment histories; on average, they had 8.19 ($SD = 13.42$; $Mdn = 4.00$) prior episodes of psychiatric treatment and 14.04 ($SD = 14.06$; $Mdn = 10.00$) prior episodes of substance abuse treatment.

2.2. Procedure

Approval for this study was obtained from the University at Buffalo's Institutional Review Board. Participants were recruited during the 2-week period following treatment admission asked regarding their willingness to participate in a 6-month study of substance use and mental health. Five hundred and nineteen (519) individuals were assessed for eligibility and 224 (43%) were ineligible as they did not meet inclusion criteria. Therefore, 295 (57%) met all study criteria. Of these eligible individuals, 16 did not attend the baseline interview and 1 declined participation. As a result, 278 eligible individuals completed the baseline interview, and 224 (81%) were followed up for the entire 6-month follow-up period. The research staff contacted participants at monthly intervals for 6 months following the baseline assessment. Face-to-face interviews were conducted at baseline and the 2-, 4-, and 6-month assessments

at which time all assessments were completed. Telephone contact was made for the 1-, 3-, and 5-month interviews which assessed memory-sensitive information such as substance use and treatment utilization for the prior month. Completion rates for the original sample of $n = 278$ individuals who completed the baseline assessment were as follows: 238 (86%) at 1 month, 202 (73%) at 2 months, 216 (78%) at 3 months, 198 (71%) at 4 months, 206 (74%) at 5 months, and 224 (81%) at 6 months.

2.3. Measures

Demographic information—This information was obtained via standard questions regarding age (in years), gender (dummy coded; 1 = women and 0 = men), and residential setting (dummy coded; 1 = supervised residential settings such as group homes and 0 = unsupervised settings including apartments, private home, shelters).

Aggression—In our model, aggression is a measured variable represented by five items assessing how often the followings happened because of participants' drinking or drug use: (a) have arguments with family and friends; (b) get into physical fights when under the influence; (c) get arrested due to behavior when they were drunk or high; (d) cause injury to someone else; and (e) damage property or break things. These questions were administered for the previous 12 months at baseline and 2 months at the 2-, 4-, 6-month follow-ups. Each item was scored on a 4-point scale (0 = never, 1 = once or a few times, 2 = once or twice a week, 3 = daily or almost daily), and items were summed for scoring ($\alpha = .78$ at the baseline assessment).

Psychiatric symptoms—Psychiatric symptoms are represented by a latent variable with seven indicators. Six of them are the subscales of the Brief Symptom Inventory (BSI; Derogatis, 1993), which is a measure of psychological symptoms. Responses to the BSI are made on a 5-point scale (0 = not at all, 4 = extremely). The subscales of Depression (six items, $\alpha = .88$), Anxiety (six items, $\alpha = .86$), Paranoid Ideation (five items, $\alpha = .79$), Psychoticism (five items, $\alpha = .75$), Interpersonal sensitivity (four items, $\alpha = .77$), and Hostility (five items, $\alpha = .83$) were used. The seventh indicator is the Positive Symptoms subscale of the Structured Clinical Interview for the Positive and Negative Syndrome Scale (SCI-PANSS; Kay, Opler, & Fiszbein, 1992). This subscale assesses positive symptoms of psychosis such as hallucinations and delusions. Purnine and colleagues (2000) confirmed the validity of the positive symptoms scale among SMI individuals diagnosed with a substance use disorder. According to Shrout & Fleiss's (1979) formula, interrater reliability (interclass correlation = .84) for this scale in our sample was excellent.

Substance use—The Timeline Followback calendar method (TLFB; Sobell & Sobell, 1992) was utilized to assess substance use during the 2 months prior to the baseline interview and during each subsequent month for the 6-month study period. All TLFB variables were adjusted for participant self-report of days living in a controlled environment (i.e., jail, hospital). Prior literature supports the reliability and validity of the TLFB interview for psychiatric outpatients (Carey, 1997). In our analyses, substance use is a latent variable consisting of four summary indicators: number of drinking days; number of heavy drinking days; drinks per drinking day; and number of drug use days. Heavy drinking days

were defined those in which men had five or more drinks and women had four or more drinks.

Treatment utilization—Treatment utilization was defined as the number of days during the first 4 months following treatment enrollment that participants either received outpatient treatment and/or were in attendance at a self-help group meeting (e.g., Alcoholic Anonymous, Narcotics Anonymous, or Double Trouble in Recovery).

3. Results

3.1. Preliminary Analyses

Preliminary analyses examined the frequency of aggressive behavior during months 5 and 6 following the initiation of dual diagnosis treatment separately for those who met criteria for (a) schizophrenia, (b) a bipolar disorder, and (c) schizoaffective disorder. There were no statistically significant differences among groups in frequency of aggression; therefore, we combined the three groups in all subsequent analyses.

Descriptive Statistics—Table 1 reports the descriptive statistics for the aggression, psychiatric symptoms, substance use, and treatment utilization variables used in the structural equation modeling analyses.

Data screening—Prior to conducting structural equation modeling, univariate distributions of all continuous variables were examined, and transformations were performed when needed. Aggression variables (baseline and follow-up months 5 and 6) were common-log transformed to reduce skewness. The treatment utilization variable was square-root transformed to reduce kurtosis. Due to significant skewness and kurtosis, square root transformations were used for the number of drinking days variable (baseline and follow-up months 3 and 4) and common-log transformations for the number of heavy drinking days, drinks per drinking day, and the number of drug use days variables (baseline and follow-up months 3 and 4).

Missing data—As mentioned earlier, a total of 278 eligible participants completed the baseline interview, and 224 (81%) were followed up for the entire 6 months period. The literature indicates that the full information maximum likelihood (FIML) algorithm is superior to conventional missing data methods such as listwise deletion (Allison, 2002); therefore, we adopted FIML and used the entire sample of 278 participants for our structural equation modeling analyses.

3.2. Structural Equation Modeling

Overview—We conducted two-step structural equation modeling analyses to test our model-based hypotheses. First, we tested a measurement model for all the latent variables using confirmatory factor analysis (CFA). As repeated measures over time are likely to have correlated errors, where appropriate, we added covariances between observed variable residuals (Cole & Maxwell, 2003). Second, we tested the structural model to investigate the hypothesized relationships among model variables.

Mplus Version 6 with FIML estimation was utilized to test both the measurement and structural models. The following goodness-of-fit criteria were used: the standard root-mean-square residual (SRMR) was $< .08$, the root-mean-square error of approximation (RMSEA) was $.08$, and the comparative fit index (CFI) was $.90$. Modification indices (MIs) were examined to assess whether model fit could be improved with additional parameters. Univariate z tests on unstandardized coefficients (critical value of 1.96) were used to determine the statistical significance of factor loadings and structural coefficients. As is standard in Mplus, standard errors for indirect effects were determined using the delta method (MacKinnon, Lockwood, & Williams, 2004).

In our model, aggression (baseline and follow-up months 5 and 6) and treatment utilization (number of days of outpatient or self-help group attendance during follow-up months 1 through 4) were measured variables. The three demographic variables (i.e., age, gender, and residential setting) were also measured variables. Psychiatric symptoms (baseline and follow-up month 4) formed a latent variable with seven indicators: BSI Depression, BIS Anxiety, BSI Paranoid ideation, BSI Psychoticism, BSI Interpersonal sensitivity, BSI Hostility, and the PANSS Positive Symptom subscales. Substance use (baseline and follow-up months 3 and 4) was a latent variable with four indicators obtained from the TLFB data: number of drinking days; number of heavy drinking days; drinks per drinking day; and number of drug use days. Our hypothesized model (see Figure 1) includes controls for prior levels of dependent variables and maintains the hypothesized temporal relations among predictor, mediator, and outcome variables (Cole & Maxwell, 2003). The assessment points (i.e., treatment utilization during months 1-4, substance use during months 3 and 4, psychiatric symptoms at month 4, and aggression during months 5 and 6) were specifically chosen to preserve the hypothesized temporal order among model variables. As a result, our analyses reflect a rigorous test of whether the frequency of treatment attendance and later aggression is mediated by substance use or psychiatric symptoms.

Test of the Measurement Model—The results of CFA indicated that the fit of the measurement model (see Appendix Figure) was acceptable: $X^2(192) = 422.71$, $p < .001$; SRMR = $.06$, RMSEA = $.07$, 90% CI $[.06, .07]$; CFI = $.95$. The standardized factor loadings of the measurement model are presented in Table 2. The majority of the loadings were large ($.65-.96$) and two loadings were in the moderate range ($< .60$). All loadings were statistically significant ($p < .001$) confirming that the indicators were reliable.

Test of the Structural Model—The test of the structural model (see Figure 2) showed adequate model fit: $X^2(314) = 674.91$, $p < .001$; SRMR = $.08$, RMSEA = $.06$, 90% CI $[.06, .07]$; CFI = $.92$. An examination of the modification indices indicated that they were trivially small relative to the model chi-square (all MIs < 50) and also were not justified conceptually or theoretically. As a result, no post hoc model modifications were performed.

Among the exogenous variables, significant correlations ($p < .05$) were: (1) age with types of residential setting (coded 0 = unsupervised, 1 = supervised) ($r = -.22$, $p < .001$), (2) age with baseline aggression ($r = -.16$, $p = .006$), (3) age with baseline substance use ($r = -.13$, $p = .040$), (4) gender (coded 0 = male, 1 = female) with baseline aggression ($r = .12$, $p = .046$), (5) baseline aggression with baseline substance use ($r = .14$, $p = .021$), (6) baseline

aggression with baseline psychiatric symptoms ($r = .22, p < .001$), and (7) baseline substance use with baseline psychiatric symptoms ($r = .19, p = .003$).

Direct Effects—As shown in Figure 2, neither aggression nor substance use assessed at baseline was related to treatment attendance, but participants with greater initial psychiatric symptoms reported fewer treatment days. Treatment participation during months 1-4 had a statistically significant direct relationship to aggression at months 5 and 6 ($\beta = -.03, p < .001$) such that greater days of treatment attendance were associated with lower levels of aggression. Substance use was a strong and significant predictor of aggression among these SMI patients. Participants with lower levels of substance use in months 3 and 4 reported lower levels of aggression in months 5 and 6 ($\beta = .42, p < .001$). However, in contrast to our predictions, psychiatric symptoms in months 3 and 4 were not significantly associated with subsequent aggression in months 5 and 6. In addition, there were no significant direct relationships between the demographic variables (i.e., age, gender, and types of residential setting) and aggression.

Mediation Effects—Treatment participation had both direct and indirect effects on later aggression. The indirect effect via substance use and psychiatric symptoms accounts for 40% of the total effect of treatment on aggression. As hypothesized, the relationship between number of treatment days and subsequent aggression was partially mediated by substance use. The path from treatment during months 1-4 to substance use in follow-up months 3 and 4 and then to aggression in months 5 and 6 was statistically significant ($\beta = -.16, p < .001$).

The results also indicate that baseline psychiatric symptoms were indirectly associated with aggression in months 5 and 6 through days of treatment attendance. The specific indirect effect for the path from baseline psychiatric symptoms to treatment and then to aggression was statistically significant ($\beta = .04, p = .036$), indicating that lower levels of baseline psychiatric symptoms were associated with a greater number of treatment days and subsequent lower levels of aggression. In addition, the specific indirect effect for the path from baseline psychiatric symptoms to aggression in months 5 and 6 via treatment during months 1-4 and substance use in months 3 and 4 was also significant ($\beta = .02, p = .027$) indicating that the association between baseline psychiatric symptoms and later aggression was mediated by the days of treatment attendance and substance use.

Stability of Psychiatric Symptoms and Substance Use—As expected, days of treatment attendance was inversely related to substance use ($\beta = -.38, p < .001$). However, there was no evidence that number of days of treatment attendance was related to psychiatric symptoms. The stability coefficient for psychiatric symptoms (i.e., autoregressive effect) was strong and statistically significant from baseline to follow-up months 3 and 4 ($\beta = .65, p < .001$), indicating stable levels of psychiatric symptoms from baseline to month 4. The stability coefficient for substance use was also statistically significant but lower ($\beta = .25, p < .001$), indicating that substance use was less stable between baseline and follow-up than psychiatric symptoms. As mentioned earlier, greater attendance in treatment was associated with less substance use, which in turn was associated with lower levels of aggressive

behaviors. Substance use served as a mediator in the relationship of treatment to aggression, while psychiatric symptoms did not.

Effects of Demographics—Age had a marginally significant relationship to treatment days; older participants attended treatment on more days than did the younger ones. Type of residential setting was significantly associated with treatment days such that those who lived in supervised residential settings received more treatment, which in turn was associated with lower levels of aggression. The specific indirect effect from residential setting to aggression in months 5 and 6 via treatment was statistically significant ($\beta = -.11$, $p = .001$) indicating that treatment mediated the effect of supervised residential setting on reduced aggression. Furthermore, the path from residential setting to aggression in months 5 and 6 via treatment and substance use in months 3 and 4 was also significant ($\beta = -.07$, $p < .001$) indicating that both greater treatment and reduced substance use mediated the relationship between supervised settings and reduced aggression.

4. Discussion

The central goals of this study were to explore the direct and indirect relationships between dual diagnosis treatment and subsequent aggression among individuals with both a SMI and a substance use disorder. Using longitudinal data, we tested a conceptual model in which dual diagnosis treatment was hypothesized to be related to later aggression both directly and also indirectly through its relationship to substance use and psychiatric symptoms. Substance use and psychiatric symptoms were proposed to mediate the relationship between dual diagnosis treatment and aggression.

As hypothesized, number of treatment days was inversely related to subsequent aggression among participants. Prior studies have found that treatment involvement is associated with lower levels of aggression among persons with major mental disorders (Skeem, Monahan, & Mulvey, 2002; Swanson et al., 1997). Our results indicate that this association also exists among dually diagnosed patients. A possible explanation is that patients who spend significant amounts of time attending clinic treatment and self-help groups tend to spend less time in environments that are more likely to lead to aggressive behavior. Furthermore, the actual content of the treatment and skills taught in treatment may produce overall positive outcomes for patients in various ways. These may include enhanced social support and modeling of prosocial behaviors, improved affect regulation skills, and greater assistance with housing and/or employment, which may serve to mediate the relationship between treatment and aggression. Our findings make a unique contribution by indicating that participation in dual diagnosis treatment is associated longitudinally with lower levels of aggression, thereby supporting a causal association between treatment and reduced aggression. However, future research should begin to isolate the active ingredients of treatment that serve to reduce the risk of aggressive behavior.

Consistent with the existing research, the number of days of treatment attendance was inversely related to substance use, which was positively associated with later aggression among these dually diagnosed patients. There is substantial evidence in the literature for implicating substance use as a significant risk factor for violence and aggression in patients

with major mental disorders (Fazel et al., 2009). Our data add to the literature by providing evidence of a longitudinal relationship between earlier substance use and later aggression, supporting a causal link. Furthermore, our study demonstrates a mediating role of substance use in the relationship between greater treatment involvement and a reduction in levels of aggression, and hence suggests that substance use is a treatable risk factor for aggression. Providing treatment appears to be the most effective known strategy for decreasing aggression among individuals dually diagnosed with a SMI and substance use disorder.

The connection between substance abuse and aggression is exceedingly complex. The use of substances may result in poor insight, neurocognitive impairments, hallucinations, impulsivity, as well as other emotional or physiological problems that provide the conditions for increases in aggression (Goldstein, 1985; Volavka & Citrome, 2011). Substance abuse may also lead to violence through social processes such as contact with the drug distribution systems and aggressive acts intended to obtain drugs or money for drugs (Goldstein, 1985). In addition, research has demonstrated that the relationship between substance abuse and aggression is moderated by various individual, social, cultural, environmental, and situational factors (Boles & Miotto, 2003). Given the complexity of the relationship between substance abuse and aggression among the general population, future research should continue to explore ways in which substance use increases the risk of aggression for mentally ill patients and develop treatment approaches that target both personal and contextual factors.

Prior studies have shown significant variability in rates of violence among mentally ill patients, with some studies demonstrating higher rates than community samples and others indicating similar rates (Buckley et al., 2003; Steadman et al., 1998; Swartz et al., 1998). Our results indicate that severity of mental illness itself is not a significant predictor of aggression. In our model, severity of psychiatric symptoms did not predict severity of later aggression; instead, aggression was more closely associated with severity of substance use. In addition, we did not find significant improvements in psychiatric symptoms during the 4-month period following the initiation of treatment. Furthermore, the path from treatment attendance to later aggression via psychiatric symptoms was not significant, indicating that psychiatric symptoms did not mediate the relationship between extent of treatment attendance and later aggression. These findings coupled with those in prior studies challenge the assumption that mental illness inevitably leads to an increased risk of aggression and violence. This stands in contrast to public perceptions of SMI individuals as more aggressive and violent, perceptions that are fueled by often exhaustive media coverage of incidents involving violent acts by mentally ill individuals (Torrey, 2011). The perception that mental illness and psychiatric symptomatology uniformly lead to aggression and violence is a major source of stigma for the severely mentally ill that can promote continued discrimination, particularly with respect to employment and housing (Torrey, 2011).

Although psychiatric symptoms were not directly associated with aggression, the results indicate that individuals with greater initial psychiatric symptoms received less treatment, and that attending less treatment was associated with greater aggression both directly and via greater substance use. These findings highlight the need to implement treatment strategies

aimed at improving access to and attendance at dual diagnosis treatment as a means of reducing aggressive behavior.

Our findings should be interpreted with caution. All participants in this study were patients enrolled in dual diagnosis treatment; therefore, our findings may not generalize more broadly to all SMI individuals.

A second limitation is that aggression in our study was measured by items assessing aggressive behaviors while under the influence of alcohol or drugs. As a result, our findings may not include aggression that occurs when not using substances. In particular, the significant relationship between substance use and aggression is subject to the circularity problem, which is a significant weakness of how we measured aggression in our model. However, we believe that our data captured the vast majority of aggression that occurred in our sample given the substantial evidence for the central role of co-morbid substance use in the incidence of aggressive acts among mentally ill patients (Volavka & Citrome, 2011); most studies have found that rates of aggression violence among the severely mentally ill with no co-morbid substance do not differ from rates for non-mentally ill persons (Steadman et al., 1998). Nevertheless, future research should assess aggression among dual diagnosis patients both in non-substance using situations and while under influence of alcohol or drugs.

A third set of limitations involves study methods. Our study focused on relatively short-term (i.e., 6-month) as opposed to longer term (e.g., > 1-year) outcomes; assessing the relationship of treatment and aggression over longer durations has the potential to enhance our understanding of the long-term impact of dual diagnosis treatment on aggression (Drake, O'Neal, & Wallach, 2008). In addition, our analyses relied heavily on self-report data, which may have inflated the strength of the relationships among study variables.

Finally, whereas the current study did control for patient demographic characteristics, our data did not allow for the inclusion of additional treatment-related variables that may influence the relationship between treatment and aggression, such as medication side effects. Although conflicting, there is some evidence in the literature that psychiatric medication side effects such as akathisia (i.e., subjective restlessness) may increase rates of aggression and violence (Leong & Silva, 2003; Rouve et al., 2011). Future researchers are encouraged to integrate a more comprehensive array of factors to further develop the model.

5. Summary and Conclusion

This study examined the relationships among extent of treatment attendance, degree of substance use, severity of psychiatric symptoms, and subsequent aggression among individuals diagnosed with a SMI and a substance use disorder. Structural equation modeling analyses were used to examine whether extent of treatment attendance was associated with subsequent aggression and examined possible mediators of this relationship. Our findings indicate that dual diagnosis treatment was associated with lower levels of subsequent aggression and that greater involvement in treatment was associated with reduced substance use, which in turn, was associated with lower levels of aggression. Thus, substance use was found to mediate the relationship between dual diagnosis treatment and

aggression. Interestingly, our data did not support a direct relationship between severity of psychiatric symptoms and later aggression among dual diagnosis patients.

This study makes a unique contribution to the literature as it is the first known longitudinal study investigating the mechanisms by which dual diagnosis treatment influences subsequent aggression among persons with a SMI and substance use disorder. Importantly, this study is the first that explicitly examined mediators of the relationship between treatment and aggression. Study results suggest that targeting a reduction in substance use during treatment could have the additional benefit of reducing rates of aggressive behavior among SMI patients. Future research should be focused on finding effective strategies for increasing treatment attendance and engagement in this difficult-to-treat population, particularly among more psychiatrically symptomatic patients.

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Appendix

Appendix Figure.
Measurement Model

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Figure 1.

Hypothesized conceptual model. Squares or rectangles indicate measured variables, and circles indicate latent variables (measured variable indicators are not shown). Plus signs refer to expected positive relationships and minus signs refer to expected negative relationships. The two meditational paths tested in the 4) and 5) hypotheses are in bold.

Figure 2.

Results of structural model. Standardized estimates are shown. All exogenous variables were allowed to correlate freely in the model. Correlations among exogenous model variables are not shown. $N = 278$. Gender: 0 = *man*, 1 = *woman*; type of residential setting: 0 = *unsupervised*, 1 = *supervised*. $^{\dagger} p < .10$. $^{*} p < .05$. $^{**} p < .01$. $^{***} p < .001$.

Table 1

Means and Standard Deviations of Aggression, Psychiatric Symptoms, Substance Use, and Treatment Utilization Measured Variables

Variable	Assessment									
	Baseline		Months 1-4		Months 3-4		Month 4		Months 5-6	
	M	SD	M	SD	M	SD	M	SD	M	SD
Aggression	11.87	4.04							4.16	4.46
Psychiatric Symptoms										
BSI: Depression	1.77	1.06					1.31	1.06		.44
BSI: Anxiety	1.79	1.02					1.41	1.05		.37
BSI: Paranoid Ideation	1.86	.99					1.44	1.01		.42
BSI: Psychoticism	1.67	.95					1.25	.97		.44
BSI: Interpersonal sensitivity	1.83	1.01					1.48	1.12		.33
BSI: Hostility	1.42	.97					1.15	.94		.29
SCI-PANSS: Positive Symptoms	12.57	3.63					10.71	2.97		.56
Substance Use										
No. of drinking days	12.61	16.45			6.19	12.78				.44
No. of heavy drinking days	8.95	13.31			4.09	10.35				.41
Drinks per drinking day	6.71	7.81			3.37	5.76				.49
No. of drug days	11.34	16.41			5.57	11.85				.40
Treatment utilization			59.92	34.02						

Note.

1. Untransformed means and standard deviations are reported.

2. N = 278 at baseline for all scale scores, except SCI-PANSS (n = 261). For Months 1-4 and Months 3-4, n = 241. For Month 4, n = 197 for BSI scale scores and n = 187 for SCI-PANSS score. For Months 5-6, n = 224.

3. BSI = Brief Symptom Inventory; SCI-PANSS = Structured Clinical Interview for the Positive and Negative Syndrome Scale.

4. Responses to Aggression were made on a 4-point scale (1 = not at all, 4 = many times) regarding how often each item happened in the past 12 months diagnostic or past 2 months at follow-up. The aggression score was computed by summing the 5 items.

5. Responses to the BSI were made on a 5-point scale (0 = not at all, 4 = extremely) regarding symptoms in the past week and then averaged for scoring.

6. Responses to the SCI-PANSS were made on a 7-point scale (1 = absent, 7 = extreme) and then summed for scoring.

7. Treatment utilization is measured by the number of days of any treatment (formal outpatient or self-help).

Table 2

Factor Loadings of the Latent Variables

Latent factor and indicator	Factor loading		
	Baseline	Follow-up Months 3&4	Follow-up Month 4
<i>Psychiatric symptoms</i>			
Depression (BSI) ^a	.85		.90
Anxiety (BSI)	.84 ***		.89 ***
Paranoid ideation (BSI)	.84 ***		.81 ***
Psychoticism (BSI)	.88 ***		.91 ***
Interpersonal sensitivity (BSI)	.78 ***		.89 ***
Hostility (BSI)	.66 ***		.77 ***
Positive symptoms of schizophrenia (PANSS-positive)	.35 ***		.48 ***
<i>Substance use (TLFB)</i>			
Number of drinking days ^a	.86	.92	
Number of heavy drinking days	.91 ***	.95 ***	
Drinks per drinking day	.83 ***	.81 ***	
Number of drug days	.70 ***	.66 ***	

Note. Standardized coefficients based on STDYX standardization in Mplus are reported. All significance tests are based on univariate *z*-tests of unstandardized coefficients. BSI = Brief Symptom Inventory; PANSS = Positive and Negative Syndrome Scale; TLFB = Timeline Followback.

^a Statistical significance of the loading was not tested because loading was fixed at 1.0 to set the scale of the latent factor.

p < .001.