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Six-Month Post-Release Outcomes for Inmates with Traumatic Brain Injury in Supported Community Programming

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Abstract

Traumatic brain injury (TBI) is a serious public health issue. The incidence of TBI is much higher in the incarcerated population than in the general population, making this a uniquely vulnerable population. *Methods:* This study looks at data from the Jail Based Behavioral Health Services (JBBS) to examine recidivism rates among inmates participating in supportive programming. It also uses data from a state brain injury program to examine the impact of case management on community engagement in the justice-involved population with a history of brain injury. *Results:* Statewide data for a population of inmates who elect to participate in jail-based behavioral health service program reflect a self-reported TBI history rate of 36.4%. Six-months after release from jail, 11.9% of those persons with TBI reported a reoffense relative to 8.5% of those individuals without a history of TBI. Recidivism rates comparing individuals with a history of TBI and those without a history of TBI were not significant. Participating inmates with a reported TBI history were 4.22 times more likely to have experienced trauma ($\chi^2 = 35.58$, $p < .001$) and 3.52 times more likely to have a mental illness diagnosis relative to incarcerated persons without TBI ($\chi^2 = 27.85$, $p < .001$). Six months after release, 56.8% of participating individuals with a history of TBI were receiving community treatment, 27.8% of these individuals were not in treatment, and 3.4% reported that they had completed treatment. Case management also appears to confer a protective benefit and prevent escalation of needs. A closer study of recently-released inmates receiving individual case management confirms that there is an extraordinarily high attrition rate from referral to receipt of services where 70% of people referred for case management fail to make a connection. For those that do receive services, these data suggest that it prevents an escalation of psychosocial needs. In this study, there were no differences in reported community participation as measured

by M2PI scores (t_{24} = .497, p = 0.624) at intake and at six months of case management. *Conclusions:* The present study confirms that case management confers a benefit to persons with TBI who are released from the criminal justice system. Further, in a population of persons who elect to participate in jail-based behavioral health service program, the recidivism rates for the more vulnerable population of persons with TBI history are no different from the larger population of returning citizens. Future research should examine the degree to which these outcomes are directly impacted by the level or type of treatment. The limitations of the present study are discussed.

Six-month post-release outcomes for inmates with traumatic brain injury in supported community programming

The Centers for Disease Control (CDC) has labeled traumatic brain injury (TBI) a serious public health issue (Centers for Disease Control and Prevention, 2015) with a prevalence rate in the general population of 8.5% (Silver, Kramer, Greenwald, & Weissman, 2001). TBIs contribute to about 30% of all injury-related deaths (Taylor et al., nd) and there are roughly 2.8 million TBI-related ED visits/hospitalizations and deaths every year (Taylor et al., nd). Age, race, and socioeconomic status all affect the vulnerability to TBI. For example, individuals 125% below the poverty line have greater odds of sustaining a TBI and older, African-American adults also have greater odds of being injured (Kisser, Waldstein, Evans & Zonderman, 2017).

TBIs can have a life-long impact (Centers for Disease Control and Prevention, n.d.). Fifty percent (50%) of people with TBI will experience a decline in their daily functioning or die within five years of a moderate or severe brain injury; in fact, an individual's life expectancy is shortened by nine years after TBI (Centers for Disease Control and Prevention, n.d.) Individuals with a moderate to severe TBI who require inpatient rehabilitation services have poorer outcomes. In one study, after five years, 22% of inpatients with a moderate to severe TBI had died and 30% got worse. Only 22% stayed the same and 26% improved (Centers for Disease Control and Prevention, n.d.). There is a consensus that even a mild TBI can result in some poor outcomes such a lower performance on executive functioning tasks including reduced processing speed, attention/executive dysfunction, and memory problems (Carroll et al., 2004; Cos & Werf, 2007; Levin, Eisenberg, & Breton, 1989; Levine, 1988; Mathias & Coats, 1999; Zeitzer & Brooks, 2008). TBIs of all severities are also associated with substance abuse and other problematic behaviors (Ray & Richardson, 2017). Those behaviors can include increased

aggression, hypersexuality, and a lack of impulse control (Eghwrudjakpor & Essien, 2008; Fazel, Licthtenstein, Grann & Langstrom, 2011; Leon-Carrion & Ramos, 2003; Turkstra, Jones & Toler, 2003). All of these behaviors are related to a risk for involvement in the criminal justice system (Eghwrudjakpor & Essien, 2008; Fazel, Licthtenstein, Grann & Langstrom, 2011; Leon-Carrion & Ramos, 2003; Ray & Richardson, 2017; Turkstra, Jones & Toler, 2003).

JUSTICE INVOLVEMENT

Research has unequivocally confirmed that the incidence of TBI history is higher in an incarcerated population (Alley, 2016). The incidence of TBI history in an incarcerated population is reported to range from 41-51% (Farrer & Hedges; 2011) to 60.25% (Shiroma, Ferguson, & Pickelsimer, 2010) to as high as 82% (Schofield et al., 2006). Adults with TBI histories also report higher rates of incarceration compared to their non-TBI history counterparts (Williams et al., 2010). Adolescents with a TBI history are significantly more likely to have been arrested than those without a TBI (Luukkainen, et al., 2012; Rantakallio, Koiranen, & Möttönen, 1992) and adults with a TBI history report that their current sentence is not their first more often than individuals without a TBI. This suggests that these individuals are more frequently in custody (Piccolino & Solberg, 2014) and studies have also shown that inmates with TBI have a higher rate of disciplinary actions while incarcerated (Merbitz, Jain, Good, & Jain, 1995; Morrell, Merbitz, & Jain, 1998).

There is also some indication that TBI increases the risk for rearrest, or recidivism, after release from correctional settings (Ray & Richardson, 2017). Recidivism is often operationalized as any rearrest that results in a conviction following a discharge from jail or corrections (Ray & Richardson, 2017). Research suggests that individuals with a TBI history

recidivate sooner and more often than those persons without a TBI (Ray & Richardson, 2017). In one study, Ray and Richardson (2017) used the Ohio State University Traumatic Brain Inventory Identification Method (OSU-TBI-ID), a structured interview to identify TBI history, to screen incoming inmates. They reported that one-third of these inmates endorsed a history of TBI. Those inmates were followed for 12-29 months after their release to monitor rates of rearrest. Fully half of the study population were rearrested. The authors compared time from release to rearrest and found that individuals without a TBI history went longer until the recidivism event. This means that individuals with a TBI history were arrested sooner after release than those without a TBI history. In that study, individuals with a TBI history had a recidivism rate of 69%, while individuals without a TBI history had a recidivism rate of 37%. Recidivism was measured by looking at arrest records in that county. Those authors also reported that people with a TBI history had a greater number of prior lifetime arrests than those without a TBI history.

In addition to risk for re-offense, there are a host of other post-release problems for inmates with a TBI history including a greater risk for homelessness and unemployment. Research has shown that executive functioning difficulties, such as those that characterize TBI, affect an individual's ability to obtain resources such as employment or housing (Lee & DePrince, 2015). With respect to housing, individuals who have been incarcerated have significantly more housing insecurity than those who have never been incarcerated. Specifically, incarcerated men are twice as likely to be homeless compared to men who have never been incarcerated (Geller & Curtis, 2011). The rate of TBI among homeless individuals is also much higher than in the general population (Oddy, Moir, Fortescue, & Chadwick, 2012). Oddy, Moir, Fortescue, and Chadwick (2012) found that 48% of homeless individuals reported a history of

TBI, while only 21% of non-homeless participants reported a history of TBI. In another study, 43% of homeless adolescents and young adults reported a history of TBI (Mackelprang, Harpin, Grubenhoff, & Rivara, 2014).

Employment is also affected by TBI. The CDC reports that employment and social outcomes are relatively poor after TBI. Five years after injury, only 55% of individuals who were employed at the time of the injury are employed, and 33% of individuals with a moderate to severe TBI report that they relied on others for help with activities of daily living (Centers for Disease Control and Prevention, n.d.). One study found that 21% of a sample of veterans or service members who sustained a head injury were unemployed one-year post-injury (Dillahunt-Aspillaga et al., 2017). And another study found that individuals with a traumatic brain injury were only 16% likely to achieve stable employment as compared to a non-brain injured population (Odgaard, Johnse, Pedersen, & Nielsen, 2017). Another prospective study followed individuals with brain injury for 10 years and found that only 43% of study participants were employed 10 years post-injury (Grauwmeijer, Heijenbrok-Kal, Haitsma & Ribbers, 2017).

CASE MANAGEMENT

One intervention demonstrated to have some success in promoting successful community integration is case management. Case management is defined as "A collaborative process of assessment, planning, facilitation and advocacy for options and services to meet an individual's health needs through communication and available resources to promote quality cost-effective outcomes" (Moore, 2009, p. 34). A meta-analysis by Rapp et al. (2014) found that case management was more helpful than standard care for a diverse range of outcomes.

Specifically, case management has been found to be helpful in assisting individuals with complex behavioral health needs to secure stable housing and employment (Grace & Gill, 2014). Clark, Guenther, and Mitchell (2016) reported that participants in case management were more likely to be housed after six months when compared to treatment as usual. With respect to employment, Morgenstern et al. (2009) interviewed women assigned to either welfare services or intensive case management and found that the likelihood of being employed full-time was directly related to the receipt of case management services. That was also true for employment outcomes for persons with brain injury (Grigorovich et al., 2017). More broadly, case management has also been shown to improve financial independence in the highest risk clients (Cox et al., 1998).

Quality of life is also affected by case management. Case management has been shown to have a positive effect on various quality of life measures among individuals with chronic health conditions (Flanagan, Damery, & Combes, 2017). Granbom, Kristensson, and Sandberg (2017) researched community engagement outcomes after case management and found that older adults were more engaged in leisure activities after three months in case management relative to a control group. The same outcomes are reported for psychosocial functioning as measured by the Social Adjustment Scale-II (Jerrell & Ridgely, 1995); case management is directly related to the engagement of community services (Rapp, 2014).

Incarcerated individuals also benefit from case management. Specifically, case management has been shown to help directly with community reintegration after incarceration. For example, prisoners with mental illness who received case management report a higher quality of life after release (Jacoby & Kozie-Peak, 1997). In one study, Ventura et al. (1998) found that previously incarcerated individuals who received community case management had a

lower probability of rearrest and a longer period of time after release before rearrest. Specifically, individuals who received case management spent 21 months in the community before rearrest as compared to 14 months for those who did not receive case management. In a more recent study, Sullivan, McDonald, and Thomson (2016) found that offender case management reduced expected reimprisonment rates by 100% and reduced expected reconviction rates from 48% to 33%.

Individuals with a history of brain injury also benefit from case management. In research, adaptation to life with a brain injury and community integration is often measured by the Mayo-Portland Adaptability Inventory (MPAI-4; Bellon, Malec, & Kolakowsky-Hayner, 2012). Individuals with a history of brain injury who receive case management demonstrate increased community integration on the MPAI-4 (Cuthbert et al., 2014). Similarly, O'Donoghue and Meixner (2017) found that individuals with TBI who receive care coordination maintained or improved their MPAI-4 scores over time. This is true for adults and also for families with children with brain injury (Scheinberg, et al., 2005). But, despite the breadth of empirical support for case management across populations, there is little research on the effectiveness of case management with the more specific population of justice-involved individuals with brain injury.

Given the lack of research with this population, their vulnerability to poor post-release outcomes, and the expenditure of resources required to successfully deploy case management resources in justice settings, an examination of the effectiveness of those services for a population of justice-involved individuals with TBI history is essential. The present study details recidivism rates for justice-involved individuals with TBI history using statewide data and quantifies the impact of case management on community engagement in a selected population.

METHOD

Design

This research was conducted to address the following two hypotheses. Study One investigates recidivism as it relates to history of TBI and the relationship between TBI history and Treatment Status. It was hypothesized that individuals with a history of TBI would recidivate at a greater rate than those without a history of TBI and have greater psychosocial needs. Study Two provides a more detailed investigation of individuals with TBI who receive care coordination services post-incarceration. It was hypothesized that individuals who receive case management would maintain or improve their community participation as measured by the participation subscale of the MPAI-4. All statistical analyses were conducted using IBM SPSS 25.

Study One

Measure. Individuals entering the justice system in 43 counties in Colorado can elect to participate in the Colorado Office of Behavioral Health's Jail Based Behavioral Health System (JBBS) program in order to receive specialized treatment services in the jail and post-release treatment in the community. If they choose to participate in the program, participants are screened for mental illness, substance use disorders, trauma history, and history of TBI using self-report measures. TBI history is reported using one of two instruments, the HELPS Brain Injury Screening Tool (Picard, Scarisbrick, & Paluck, 1991) or the Traumatic Brain Injury Screening Tool (Ohio Valley Center for Brain Injury Prevention and Rehabilitation, 2009). Both measures ask a series of yes/no questions in order to establish a history of TBI. Both instruments have been used successfully in research and clinical practice to screen for TBI history (Koch, Merz, & Lynch, 1995).

The JBBS program offers individual and group psychotherapy, individual and group treatment substance abuse therapy, DUI therapy and education, educational services, medication management and employment services. At the time of release from jail, a successful discharge is defined as completing the treatment program according to the treatment plan and an unsuccessful discharge is defined as being discharged due to disciplinary actions in the jail or non-compliance with the treatment plan. Referrals to community programming are made for successfully discharged participants. Post-release, the JBBS program conducts interviews over the phone and recently released participants are asked whether they are receiving treatment in the community, were re-incarcerated, or re-offended. Self-report has been demonstrated to be a robust way to measure community participation and recidivism (Measuring Recidivism, 2008). The treatment status of each participant and self-reported arrest status are coded at one month, two months, six month, and twelve-month intervals. Data from 3,159 individuals (2001 to 2017) were available for the present study.

Procedure. Data from Colorado's Jail Based Behavioral Health Services (JBBS) were available from July 1, 2013 through October 27, 2017. Inclusion criteria determined the removal of records with "Inconclusive" (n = 630) and missing (n = 139) TBI categorization, leaving 2,389 records (n_{TBI} = 1,369*;* n_{noTBI} = 1,020). Next, months one through 12 were screened in reverse order, excluding records with "Transition Status" categorizations of "Not Applicable", "Status Unknown", "Deceased" or missing data leaving 483 records for these analyses. Recidivism was operationalized as any self-reported crime following intake into the treatment program. Therefore, the remaining categories were coded as continuous variables analogous to conventional screener data for the ANOVA analysis: 1-New Crime/Regressed, 2-Not in Treatment, 3-In Treatment, 4-Completed Treatment. For the Cox regression analysis, these data

were dichotomized as 1-New Crime/Regressed, 2- Not in Treatment, In Treatment, and Completed Treatment. These categories of reoffense and treatment status are reported by the JBBS program to be mutually exclusive.

Data Analysis. First, to establish a general sense of the post-release path of individuals with TBI, a repeated measures ANOVA was conducted to explore differences in treatment initiated, treatment completed, and treatment discontinued between the two groups. Descriptive statistics for 6-month follow-up treatment status were included for a more detailed representation. Next, a Cox regression survival analysis was conducted to assess time to recidivism to correct for unequal follow-up time distribution. The time-fixed procedure was used because admission date, start of screening, and start of treatment were all on the same day.

For this study, the probability of not recidivating (survival) was calculated using cases that did not recidivate (censored and uncensored) for each time point (Box-Steffensmeier & Jones, 2004). This was accomplished by the management of missing data at the starting point (left censoring) and the ending point (right censoring) which is a common occurrence in recidivism evaluation (Ray & Richardson, 2017). Subsequently, both time to recidivism and likelihood of recidivism can be assessed while controlling for covariate effects on outcomes of interest.

Study Two

Measure. The impact of case management was measured by the M2PI, the Participation subscale of the Mayo-Portland Adaptability Inventory-4 (MPAI-4; Bellon, Malec, & Kolakowsky-Hayner, 2012). The MPAI-4 is designed to measure engagement after brain injury and shows good internal consistency, Cronbach's alpha=0.89 (Kean, Malec, Altman, & Swick, 2011). The 35 items comprise three subscales: the Ability Index, the Adjustment Index, and the

Participation Index. The M2PI was used in the present study to measure the success of case management in helping individuals re-engage with the community. The Participation index subscale measures an individual's capacity to interact with community members, manage household responsibilities, maintain employment, and manage financial responsibilities. Importantly, the Participation index subscale includes an assessment of housing and employment status, two areas demonstrated by previous research to be affected by case management. The instrument can be completed by a client, a case manager or family member. In the present study, the MPAI-4 was completed by case managers. The case managers rate how difficult it is for them to accomplish each task on a scale of 0=No problem to 4=Severe problem. Possible scores on the M2PI range from 0 to 32, with higher scores showing an increase in needs. The present study used M2PI data collected at entry to case management and at a 6-month time point to quantify the effectiveness of case management with a justice involved population of persons with TBI history. These data were acquired from the Brain Injury Alliance of Colorado (BIAC).

Procedure. The Brain Injury Alliance of Colorado provides individuals who have a history of brain injury with specialized care coordination from case managers who are trained to work with individuals with a history of head injury. Care coordination was conducted either in person or over the phone. To track participant progress, the M2PI, the participation index of MPAI-4 was administered at the beginning of case management and then at 6-month intervals (Bellon, Malec, & Kolakowsky-Hayner, 2012). A total of 158 justice-involved individuals were referred to case management. Due to this population's complex needs, not every referral results in enrollment in case management. Individuals with a history of brain injury often have executive functioning difficulties which can affect their ability to follow through with daily tasks, such as this referral, since that requires planning and initiation (Lezak, 1995). Eighty-eight

(88) of the 158 individuals completed an intake with case management. As of February 2018, 26 individuals had participated in case management for at least six months which reflects a 70.45% attrition rate. The magnitude of the attrition rate highlights the difficulty this population has engaging in treatment. One individual was removed due to a missing score at the 6-month follow-up resulting in a valid sample of 25 participants.

Data Analysis. The Pearson's chi-square and Fisher's exact test were used to evaluate differences in the categorical variables across the two groups. Paired samples *t*-tests were used to evaluate the Study Two null hypothesis that there is no significant difference between M2PI Participation sub-scores of individuals who receive case management measured at entry into case management and at six months into care coordination.

RESULTS

Study One

Participants. The sample consisted of 483 participants (M = 333, F = 150). The ages ranged from 18 to 80 years old (M = 35.58, SD = 11.93), and 36.4% of the group had a positive TBI identification and 63.6% were identified as negative for TBI. Roughly sixty-two percent (62.2%) of individuals had a mental illness, 35.1% did not, and 2.7% were inconclusive. The vast majority of individuals had a substance abuse disorder (98.3%), while over half (58.1%) of individuals had a history of trauma. TBI severity, race/ethnicity, level of education are not coded in the dataset. Table 1 shows demographic statistics.

The Chi-square and Fisher's exact tests indicated that there were no significant differences in TBI status by gender and substance abuse. Independent samples *t*-tests found no significant differences in TBI status by age and time-points (baseline, 2-months, 6-months and 1-year). However, individuals with TBI were 4.22 times more likely to have experienced trauma

($\chi^2 = 35.58$, $p < .001$) and 3.52 times more likely to have a mental illness diagnosis relative to those without TBI ($\chi^2 = 27.85$, $p < .001$).

TBI Status and Recidivism.

A repeated measures ANOVA and Cox regression analyses were used to explore recidivism among persons with TBI in this sample controlling for the following covariates: age, gender, and number of days from month one to each time-point (2-months, 6-months and 1-year follow-up).

The first hypothesis was initially evaluated using repeated measures ANOVA to examine treatment status across the four time-points. Mauchly's test indicated the sphericity assumption was violated [x^2 (5) = 84.05, $p < .001$], therefore degrees of freedom were corrected using the Huynh-Feldt correction ($\varepsilon = .887$).

The group means were nearly equal between groups across all months. Means decreased slightly month to month for both groups and ranged from to 2.88 (1-month) to 2.65 (1-year) for those with TBI and from to 2.72 (1-month) to 2.53 (1-year) for those without TBI. Standard deviation estimates increased slightly across the four timepoints groups and ranged from to 0.54 (1-month) to 0.88 (1-year) for those with TBI and from to 0.57 (1-month) to 0.83 (1-year) for those without TBI revealing slightly more variability for both groups with somewhat more variability for the TBI group over the 1-year period ($n_{TBI} = 155$, $n_{noTBI} = 159$).

Among the 483 participants with fully complete entries at each time point, 176 (36.4%) had a reported history of TBI and the remaining 307 (63.5%) had no reported history of TBI. At six-months, 21 of the individuals with a history of TBI (11.9%) had reoffended, and 26 (8.5%) of the individuals without a history of TBI had reoffended. The number of days to recidivism

ranged from for those with TBI (M = 148.73, SD = 39.89) and from 28 to 399 for those without TBI and from 28 to 219 (M = 145.39, SD = 40.08).

Six-months after release from jail, 100 (56.8%) of the individuals with a history of TBI were receiving community treatment (relative to 176 [57.3%] of the individuals without a history of TBI), 49 (27.8%) of the individuals with a history of TBI were not receiving community treatment at six-months (relative to 82 [26.7%] of the individual without a history of TBI), and six (3.4%) individuals with a history of TBI reported that they had completed treatment (relative to 23. [7.5%] of the individuals without a history of TBI).

Overall, results suggested that mean scores for treatment status were significantly different between the TBI and control groups (F [2.66, 805.89] = .517, $p < .001$). This suggests that treatment status for the group with a history of TBI and the group without a history of TBI were distinctly different. To explore this relationship ore specifically, a survival analysis using Cox regression was conducted to evaluate the difference in recidivism rates between the two groups.

A Cox Regression survival analysis was used to examine the association between TBI and risk of recidivism, accounting for when treatment was initiated, completed, and discontinued in order to establish a picture of risk for this group of individuals. This was accomplished by the strategic regression method. The recidivism hazard rate for participants with a history of TBI was 1.69 times greater than those without a history of TBI (Exp[B] = 0.52) and was not statistically significant (p = .08). Summary statistics for the model can be found in Table 3.

Study Two

Participants. A total of 25 participants from the Brain Injury Alliance of Colorado (BIAC) were involved in this study. Statistics were only reported for 20 of these individuals;

five of the participants were missing demographic data. Sixty percent (60%) were male (15 male and 5 female). Twelve (57%) of the participants were White, seven (33%) were Hispanic, one (0.5%) was American Indian, and four (19%) were unreported. Eighty-six percent (86%) were right handed. The ages ranged from 25 years old to 65 years old with an average age of 43.25 years (SD = 12.13). Summary statistics are shown in Table 2.

Case Management Effectiveness. The effectiveness of case management was tested using a paired samples *t*-test using the BIAC data. Results indicated no significant difference between M2PI scores from intake and the six-month time point (t_{24} = .497, p = 0.624), and a moderate positive correlation between those same scores (r = 0.63, p < 0.001; baseline (M = 12.40, SD = 5.859); 6-months (M = 12.88, SD = 5.310). Figure 1 shows gain score results.

Seven participants scored higher after six months of case management with an increase in scores ranging from 2 to 15 points higher. Nine participants scored lower at 6-months compared to baseline and gain scores ranged from 2 to 6 points lower than baseline. Nine other participant scores reflected no change. In this study, scores ranged from 3 to 23 at baseline and 3 to 24 at 6-month follow-up. On average, M2PI scores at 6-months were 0.48 point higher than baseline scores [M = 0.48, SD = 4.831; 95% CI (-2.474, 1.514)].

DISCUSSION

Summary

Incarcerated individuals with a history of brain injury are an incredibly vulnerable population. Incarcerated individuals are more likely than the general population to have a history of TBI (Alley, 2016; Farrer & Hedges, 2011; Schofield et al., 2006; Shiroma, Ferguson, & Pickelsimer, 2010). The general population has a TBI prevalence rate of 8.5% (Silver,

Kramer, Greenwald, & Weissman, 2001), while the incarcerated population has a reported TBI prevalence rate of up to 82% (Schofield et al., 2006). In the present study, the rate of reported TBI was 36% among participants in a jail-based behavioral health program.

Traumatic brain injuries can result in executive functioning difficulties such as reduced processing speed, attention/executive dysfunction, and memory problems (Carroll et al., 2004; Cos & Werf, 2007; Levin, Eisenberg, & Breton, 1989; Levine, 1988, Mathias & Coats, 1999; Zeitzer & Brooks, 2008). Further, these executive functioning deficits place these individuals at an increased risk for involvement in the criminal justice system (Eghwrudjakpor & Essien, 2008; Fazel, Licthtenstein, Grann & Langstrom, 2011; Leon-Carrion & Ramos, 2003; Ray & Richardson, 2017; Turkstra, Jones & Toler, 2003).

The literature also suggests that individuals who have both a history of brain injury and incarceration are at increased risk for recidivating (Ray & Richardson, 2017). Individuals with a history of TBI have been reported to recidivate at a rate of 69% while those without a history of TBI are reported to recidivate at a rate of 37% in the first two+ years after release from jail (Ray & Richardson, 2017). In the present study, 12% of participants in a jail-based behavioral health program with a TBI history reported a reoffense in the first six months after release relative to 8.5% of the individuals without a history of TBI. Secondary analyses confirmed that difference to not be significant.

This is the first study to examine reoffense and community treatment outcomes at the early, six-month mark and the first to evaluate a group of participants in jail-based behavioral health programming specifically. The reported reoffense rate of 12% at six months is markedly lower than the 69% reported over 12-29 months by Ray and Richardson (2017). The rate may be lower in this initial time frame, it may be lowered by treatment participation, or it may simply

lower among the individuals who elect to participate in jail-based programming before release. The degree to which these jail-based behavioral health programs confer a protective benefit against reoffense warrants careful study since these data emphasize the potential importance of treatment programs for justice-involved individuals with a history of brain injury.

The present study also identified the increased vulnerability of psychosocial problems including a trauma history and mental illness. Specifically, inmates with a reported TBI history were more than 4 times more likely to have experienced trauma and more than 3 times more likely to have a mental illness diagnosis relative to incarcerated persons without TBI. Nearly everyone in this sample reported a history of substance abuse. Among those who did not reoffend, the community treatment status and completion rates are also lower relative to returning citizens without TBI. Mental illness and the ongoing risk for recidivism (Eghwrudjakpor & Essien, 2008; Fazel, Licthtenstein, Grann & Langstrom, 2011; Leon-Carrion & Ramos, 2003; Turkstra, Jones & Toler, 2003) would suggest that this population warrants additional support upon release to the community.

Case management has been shown to not only be effective in improving quality of life, reducing rearrest rates but also in promoting community engagement (Ventura et al.,1998, Sullivan, McDonald, & Thomson, 2016). The current study shows that, during the transition from incarceration to community, case management can support functioning and prevent deterioration. In this study, more than 70% of referrals failed to arrive for services. Among those who elected to participate, the majority maintained their level of community engagement and did not have increasing employment, housing, and community involvement needs in the first six months of case management.

The current study aligns with previous research showing that case management helps incarcerated individuals remain engaged in the community. Using the same instrument (MPAI-4), Cuthbert et al. (2014) and O'Donoghue and Meixner (2017) previously reported that individuals with a history of TBI reintegrate into the community better after case management as reflected by stable or improved scores. O'Donoghue and Meixner (2017) found that 83% of their study population maintained or showed improved scores on the MPAI-4. With respect to reduction of re-offense risk, Ventura et al. (1998) found that individuals who received case management spent 21 months in the community before rearrest as compared to only 14 months for individuals who did not receive case management. Sullivan, McDonald, and Thomson (2016) also found that offender case management reduced expected reimprisonment rates by 100% and reduced expected reconviction rates from 48% to 33%. Overall, the present research suggests that in-jail treatment may confer a protective benefit against reoffense and that, with case management support, the needs of justice-involved individuals who have a history of brain injury remain stable over the course of the first six months after release from the criminal justice system. This research also highlights the unique trajectory of behavioral health participants and the markedly elevated rates of attrition from services.

Limitations

Unlike previous research, the present results do not reflect gains in community participation during the first six months of care coordination. It is possible that improvement takes more than six months and previously incarcerated individuals with a history of brain injury may have more needs and may be even slower to improve. Future research on the impact of case management should assess community outcomes for longer periods of time to determine the

necessary amount of time needed for previously incarcerated individuals with a history of brain injury to show gains in community participation.

Also, in the present study, the sample of persons receiving care coordination for at least six months was small (n=25) and consisted only of individuals who elected to follow up with their case management referral. The program data reflect an attrition rate of more than 70% where 158 individuals were referred to case management and 58 of them followed through with the referral. Twenty-five of these individuals remained involved with case management for at least six months. The individuals who dropped out of treatment were no longer reachable by phone. Future research should make a deliberate study the individuals who drop out of contact or who elect not to participate in case management in order to better understand the barriers they face and to develop programming that more proactively addresses those challenges.

There are also limitation to the data coded in the statewide database. This dataset is limited to individuals who agreed to participate in the jail-based behavioral services program which makes it difficult to generalize to the incarcerated population as a whole since treatment-seeking inmates may be qualitatively unique. In addition, rearrest/reoffense and treatment statuses were coded as mutually exclusive categories, which may result in an under-estimate of the true percent of persons in community treatment since persons who reported a reoffense were not counted among the treatment seekers/completers.

Impact

The present study shows that a population of incarcerated individuals with a history of brain injury have greater psychosocial needs, lower treatment seeking and completion rates and high recidivism rates. Among the minority of returning community members who successfully engage with and remain engaged with case management services, self-reported community

participation remains stable over the first six months after release from criminal justice supervision. The attrition rate of more than 70% after release from incarceration is disturbing and warrants proactive study and the development of better safety net programming including pre-release case management services. All told, in-jail treatment and case management remain the most prudent investments of limited resources in justice settings.

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Tables

Table 1

JBBS Sample Characteristics

Characteristic	*n*	*%*	*M*	*SD*	Range
Age			36	11.9	18-80
Gender					
Male	333	68.9%			
Female	150	31.1%			
Mental Health diagnosis					
Yes	300	62.2%			
No	169	35.1%			
Inconclusive	13	2.7%			
SAD diagnosis					
Yes	474	98.3%			
No	6	1.2%			
Trauma history					
Yes	280	58.1%			
No	174	36.1%			
Inconclusive	28	5.8%			
TBI					
Positive	176	36.4%			
Negative	307	63.6%			

Note: Mental Health diagnosis = presence of mental illness; SAD = presence of Substance Abuse Disorder; TBI = history of Traumatic Brain Injury;

Table 2

BIAC Sample

Characteristic	*n*	%
Gender		
Male	15	60%
Female	5	20%
Age		
20-29	4	16%
30-39	3	12%
40-49	7	28%
50-59	4	16%
60-69	2	8%
Education		
8th grade	1	4%
High School (9-12 years)	11	44%
Some College (13-15 years)	4	16%
Bachelor's Degree (16 years)	2	8%
Master's Degree (17-18 Years)	0	0%
Doctorate/Post Master's (22 years)	1	4%
Ethnicity		
American Indian	1	0.5%
Hispanic	7	33.0%
White	12	57.1%

Note: N=25. Gender=20, Age n=20, Education n=19 and Ethnicity n=20 due to missing data.

Table 3

Cox Regression Recidivism Predictions at 6-months Post Treatment

	Model 1	
Variable	β *(SE)*	Exp β [95% CI]
TBI (1 = yes)	.52 (0.30)	1.69 [0.95, 3.01]
Gender (1 = male)		
Age		
Mental Illness diagnosis (1 = yes)		
Substance Abuse disorder (1 = yes)		
Trauma history (1 = yes)		
-2 log likelihood $\chi 2$		489.62 p = .08

Note: TBI = presence or absence of Traumatic Brain Injury

Figures

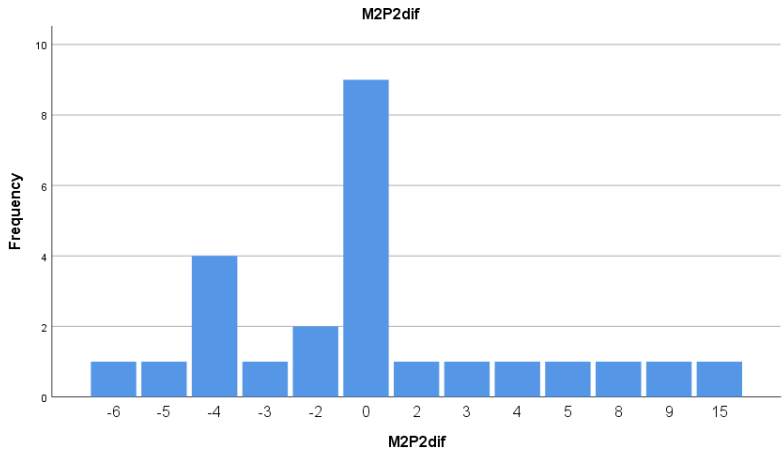

Figure 1. Gain Scores Distribution from Baseline to 6-months.