Brain Injury

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/ibij20

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To cite this article: Elizabeth Ahlers, Kim Gorgens, Marybeth Lehto & Judy Dettmer (08 Feb 2024): Six-month post-release outcomes for inmates with traumatic brain injury in supported community programming, Brain Injury, DOI: 10.1080/02699052.2024.2309269

To link to this article: https://doi.org/10.1080/02699052.2024.2309269

Published online: 08 Feb 2024.

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https://doi.org/10.1080/02699052.2024.2309269

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

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ABSTRACT

Objective: The goal of this study is to examine the effectiveness of case management services for a population of justice-involved individuals with TBI history.

Methods: Two thousand three hundred and eighty-nine records from statewide behavioral health and brain injury program databases were used in two studies.

Results: Participants with a reported TBI history were more likely to have experienced trauma and to have a behavioral health diagnosis relative to incarcerated persons without TBI. Six months after release, 56.8% of participants with a history of TBI were still receiving community treatment, 27.8% were not in treatment, and 3.4% had completed treatment. There was a high attrition rate; 70% of people referred for case management failed to maintain contact.

Conclusions: For those that did receive services, these data suggest that it prevented an escalation of psychosocial needs. There were no differences in community participation as measured by the Mayo Portland Adaptability Index's Participation Index (M2PI) scores ($t_{24} = .497$, $p = 0.624$) at intake and after 6 months of case management. This study confirms that case management confers a benefit to persons with TBI who are released from the criminal justice system. Further, recidivism rates for this vulnerable group were no different from the larger population of returning citizens.

ARTICLE HISTORY
Received 3 May 2021
Revised 1 March 2023
Accepted 19 January 2024

KEYWORDS
TBI; justice-involved; recidivism; case management; re-entry; returning citizens; brain injury

The Centers for Disease Control and Prevention (CDC) has labeled traumatic brain injury (TBI) a serious public health issue. Survivors of a moderate or severe TBIs may have lifelong impairments in cognitive function and experience significant changes in thinking and behavior (1,2). There is a consensus that even a mild TBI can result in poor outcomes such as lower performance on executive functioning tasks including reduced processing speed, attention/executive dysfunction, and memory problems (3–7). TBIs of all severities are also associated with substance abuse and other problematic behaviors (8). Those behaviors can include increased aggression, symptoms of depression, and a lack of impulse control (9–13). All of these behaviors are related to a risk for involvement in the criminal legal system (10–13).

Justice involvement

Several individual and community factors have been identified as risk factors for and vulnerability to TBI. Research has unequivocally confirmed that the incidence of TBI history is higher in an incarcerated population than the general population (8%) (1,14). Several studies have reported TBI history in an incarcerated population as 41–51% (15), 60.25% (16), and as high as 88% (17). In Colorado, researchers reported that the overall rate of TBI history in a justice-involved population is 55% (18). This is a dual relationship, adults with TBI histories also report higher rates of incarceration compared to their non-TBI history counterparts (19). TBI increases the risk for rearrest, or recidivism, after release from correctional settings (8,18). Research suggests that individuals with a TBI history recidivate sooner and more often than those persons without a TBI (8). In one study, Ray and Richardson (8) used the Ohio State University Traumatic Brain Inventory Identification Method (OSU-TBI-ID), to screen incoming inmates. The authors found that individuals without TBI history had fewer lifetime arrests, a lower recidivism rate (37% vs 69%), and recidivated at a later time than individuals with 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. Executive functioning difficulties, such as those that characterize TBI, affect an individual's ability to obtain resources such as employment or housing (20,21). Indeed, incarcerated men are twice as likely to be homeless compared to men who have never been incarcerated and more than half of the individuals experiencing homelessness report a TBI history (22–24).

Regarding employment, the CDC reports that employment and social outcomes are relatively poor after TBI. Two separate studies found that 5 years after injury, only 55% of individuals who were employed at the time of the injury reported being employed, and 10 years after injury only 43% reported being employed (25,26). One study found that individuals with a traumatic brain injury were only 16% as likely to achieve stable employment as compared to a non-brain injured population (25). This

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increased risk for unemployment and homelessness is related to high risk for recidivism. Bunting et al. (27) found 1-year post-release that being unemployed was a significant risk factor for recidivism and being without housing was positively associated with this relationship. A clear view of risk factors for criminal legal involvement and recidivism places individuals with a TBI history as a priority for intervention.

Case management

One intervention demonstrated to have some success in promoting successful community integration is case management. Individuals with a history of brain injury benefit from case management. Randomized controlled studies have shown that individuals with brain injury who participate in resource facilitation (often called case management) returned to work at higher rates. In one study, 64–69% of persons with brain injury who received resource facilitation returned to work compared to 36–50% who did not receive resource facilitation (28–30). Individuals with a history of brain injury who receive case management demonstrate increased community integration and improved their scores over time on the Mayo-Portland Adaptability Inventory (MPAI-4; 31–32), a measure used in research paradigms to measure adaptation to life with a brain injury and community involvement (31).

Justice-involved individuals (32) also benefit from case management, specifically, community reintegration after incarceration. Ventura et al. (32) 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 compared to those who did not receive case management. In a more recent study, Sullivan et al. (33) found that offender case management reduced expected reimprisonment rates by 100% and reduced expected reconviction rates from 48% to 33%. Despite the breadth of empirical support for case management across populations, there is little research on the effectiveness of case management for justice-involved individuals with brain injury who have an indicated high need for this care.

Given the lack of research with this population and their vulnerability to poor post-release outcomes, an examination of the impact of case management intervention on community outcomes for justice involved TBI survivors is warranted. The present naturalistic study details recidivism rates for justice-involved individuals with TBI history, using statewide data, and quantifies the mediating impact of case management on community outcomes.

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 case management services post-incarceration as a way to address their psychosocial needs in order to prevent recidivism. It was hypothesized that individuals with a TBI who receive case management versus would maintain or improve their community participation as measured by the participation subscale of the Mayo-Portland Adaptability Inventory-4 (MPAI-4), a measure of adaptation to life with a brain injury and community integration often used in research (31). All statistical analyses were conducted using IBM SPSS 25.

Study one

Measure

Individuals entering the justice system in 43 counties in Colorado can elect or be referred 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 behavioral health diagnoses, 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 (34) or the Traumatic Brain Injury Screening Tool (35). 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 (36).

The JBBS program offers individual and group psychotherapy, individual and group 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 noncompliance 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 (37). The treatment status of each participant and self-reported arrest status are coded at 1 month, 2 months, 6 month, and 12-month intervals. Data from 3,159 individuals (2016 to 2017) were available for the present study.

Procedure

Data from Colorado's statewide Jail-Based Behavioral Health Services (JBBS) were available from July 1, 2016, through June 30, 2017. Inclusion criteria determined the removal of records with 'Inconclusive' (not enough information to make a conclusion regarding TBI status; n = 630) and missing (n = 139) TBI categorization, leaving 2,389 records (n_{noTBI} =

1,369; n_{TBI} = 1,020). Next, months one through 12 were screened in reverse order, excluding records with 'Transition Status' categorizations of 'Not Applicable' (individuals where transitioning back into the community is relevant), 'Status Unknown' (unknown if the individual was transitioning into the community), '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 as that set of data was more complete than the 12-month follow-up data due to attrition. 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 (38). 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 (8). 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; 35). The MPAI-4 is designed to measure engagement after brain injury and shows good internal consistency, Cronbach's alpha=0.89 (39,40). 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 reengage 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 case management from case managers who are trained to work with individuals with a history of brain injury. Case management 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 (32). 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 cognitive deficits and executive functioning difficulties which can affect their ability to follow through with daily tasks, such as this referral, since that requires self-regulation, organizing, and planning (10–13). 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 6 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 6 months into case management.

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

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.

identification and 63.6% were identified as negative for TBI. Roughly sixty-two percent (62.2%) of individuals had a behavioral health diagnosis (most common diagnoses were Major Depression, Bipolar Mood Disorder, and Generalized Anxiety Disorder), 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 (any reported sexual, physical, or emotional abuse or exposure to violence). 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 ($\chi^2 = 35.58$, $p < 0.001$) and 3.52 times more likely to have a behavioral health diagnosis relative to those without TBI ($\chi^2 = 27.85$, $p < 0.001$).

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, $p < 0.001$], therefore degrees of freedom were corrected using the Huynh-Feldt correction (ε = .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, $p < 0.001$). 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 more 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

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]
Gener (1 = male)		
Age		
Mental Illness diagnosis (1 = yes)		
Substance Abuse disorder (1 = yes)		
Trauma history (1 = yes)		
−2 log likelihood χ2		489.62 $p = 0.08$

Note: TBI = presence of absence of Traumatic Brain Injury.

[*B*] = 0.52) and was not statistically significant ($p = 0.08$). Summary statistics for the model can be found in Table 2.

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 3.

Case management effectiveness

The impact of case management in this naturalistic study 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 6 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

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 6 months is markedly lower than the 69% reported over 12–29 months by Ray and Richardson (8). 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 behavioral health diagnoses. 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 behavioral health 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. Behavioral health diagnoses and the ongoing risk for recidivism (10–13) would suggest that this population warrants additional support upon release to the community.

Justice-involved individuals are more likely than the general population to have a history of TBI (14–16,18,20). The general population has a TBI prevalence rate ranging from 2% to 8.5% (1), while the TBI prevalence rate for justice-involved individuals is up to 88% (17). In the present study, the rate of

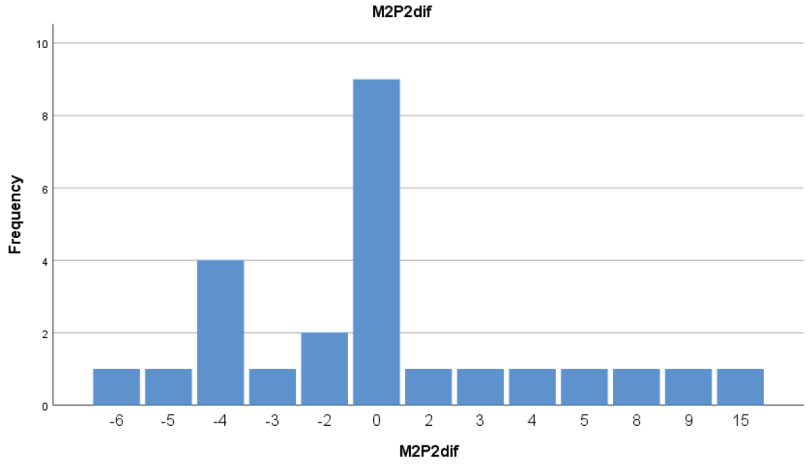

Figure 1. Gain scores distribution from baseline to 6-months.

reported TBI was 36% among participants in a jail-based behavioral health program. TBIs can have significant effects on daily functioning and result in cognitive deficits, such as capacity for self-regulation, disinhibition, and poor judgment which are associated with risky and problematic behaviors and place these individuals at an increased risk for involvement in the criminal justice system (10–13).

The literature also suggests that individuals who have both a history of brain injury and incarceration are at increased risk for recidivating (8,18). 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-plus years after release from jail (8). In the present study, 12% of participants in a jail-based behavioral health program with a TBI history reported a reoffense in the first 6 months after release relative to 8.5% of the individuals without a history of TBI. Secondary analyses confirmed that difference to not be significant.

Case management has been shown to not only be effective in improving quality of life, reducing rearrest rates but also in promoting community engagement (32,33). 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 6 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. (39). and O'Donoghue and Meixner (41) 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 (41) reported 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. (32) 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 et al. (33) also found that offender case management reduced expected reimprisonment rates by 100% and reduced expected reconviction rates from 48% to 33%. The present study extends that body of research.

This study 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 6 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 6 months of case management. It is possible that improvement takes more than 6 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 case management for at least 6 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, 88 of them followed through with the referral and only 25 of these individuals remained involved with case management for at least 6 months. The individuals who dropped out of treatment were no longer reachable by phone. Future research should make a deliberate study of 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 limitations to the data coded in the statewide database, including missing data about race, ethnicity, education status, and TBI severity. This dataset is also 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 justice-involved 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 6 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 prerelease case management services. All told, in-jail treatment and case management remain the most prudent investments of limited resources in justice settings.

Acknowledgement

We would like to thank Mia Baumgartner and Hollis Lyman for their assistance in preparing this paper for publication.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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