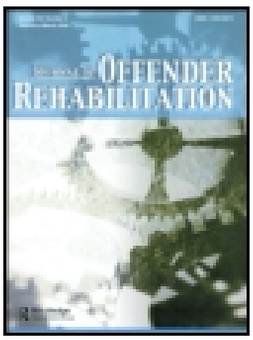

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Brain injury in an offender population: Implications for reentry and community transition

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ABSTRACT

This article describes a demonstration project conducted over two years with men from a maximum-security prison in southeastern PA. The project's core strategy was to identify inmates with history of brain injury, determine their medical/physical, neurocognitive, and behavioral barriers to successful re-entry, and create and implement release plans including connections to brain injury resources and community supports. Ultimately the goal was to reduce recidivism and improve productivity among the participants. More than 75% of those screened reported a possible history of brain injury, and 74% of those tested demonstrated evidence of neurocognitive impairment. Most injuries occurred prior to the age of 21 and incarceration. The average number of reported brain injuries per participant was 3.8. Impairments were most commonly in the areas of memory and executive functioning. Connections to resources were made for those involved in the project using a process called NeuroResource Facilitation. Outcome data was limited by the time constraints of the project, but preliminarily indicated a reduction in recidivism and an increase in productivity. Implications of this project, including recommendations for further action in corrections settings, are included.

KEYWORDS

Reentry; treatment needs; co-occurring disorders; community-based rehabilitation; brain injury; resource facilitation

Introduction and project description

Brain injury poses a public health challenge in the United States. Whether traumatic or acquired by disease, brain injuries often have lifelong consequences. It is estimated that 5.3 million people in the United States are living with permanent disabilities as the result of traumatic brain injury (TBI; Selassie et al., 2008). Nontraumatic brain injuries, including stroke and epilepsy, affect 8.2 million individuals per year for a total estimate of 13.5 million people living with brain injuries (Nagele, 2016). Meta-analysis of studies of prevalence among the U.S. population indicate that 12% of the

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general population has had a TBI with a loss of consciousness, with males being twice as likely to be represented (Frost, Farrer, Primosch, & Hedges, 2013). This estimate may be low as it is further recognized that a significant number of children may have sustained brain injuries without receiving a diagnosis or treatment (Cantor et al., 2004). Furthermore, marginalized populations like those living in poverty often report higher prevalence of TBI. In fact, between 27% and 54% of those in high risk populations, including the homeless and the incarcerated, report a history of TBI, with 9% to 12% of that group reporting chronic symptoms (Dams-O'Connor, Pretz, Billah, Hammond, & Harrison-Felix, 2015).

Even when compared to highest estimates of prevalence within the general population, brain injury is significantly overrepresented in offender populations. Farrer and Hedges (2011) reviewed 26 studies of lifetime prevalence of TBI in an incarcerated sample and found an average of 51.1% of those included had history of TBI. Another meta-analysis of 20 qualified studies conducted between 1983 and 2009 estimated the overall prevalence of a history of TBI among offenders to be 60% (Shiroma, Ferguson, & Pickelsimer, 2012) while a more recent systemic review including European and Australian studies found a prevalence of 46% (Durand et al., 2017). Among justice-involved youth, history of brain injury is also commonplace. In a recent study in New York, 50% of males and 49% of females in juvenile detention centers were found to have had at least one brain injury (Kaba, Diamond, Haque, MacDonald, & Venters, 2014). Similarly, Farrer, Frost, and Hedges (2013) found that juvenile offenders were 3.38 times more likely to have had a TBI than juveniles not involved in the criminal justice system.

Given these numbers, the U.S. Department of Health and Human Services Health Resources Services Administration and the Centers for Disease Control and Prevention have focused some attention on the issue by funding epidemiological research and targeted grants to states. Still, there is no consistent screening at intake or surveillance for a history of TBI in correctional facilities in the United States. In 2011–12, research by the Bureau of Justice Statistics indicated that 50% of those who were incarcerated in state, federal, and local prisons or jails reported a chronic health condition (Maruschak, Berzofsky, & Unangst, 2015). However, specific questioning about a history of brain injury was not included as part of their survey. Given the prevalence of brain injury suspected in the American prison system, it is apparent that corrections professionals are often interacting with, treating, and making recommendations for individuals with brain injury, but may be doing so without awareness of, or regard for, the complications their brain injuries may present.

In 2013, Yuhasz surveyed correctional health care professionals to assess their knowledge about brain injury. Findings revealed that while the sample had fewer misconceptions about TBI than the general public, they were not as attuned to the subtler sequelae of TBI as were rehabilitation professionals. Specific misconceptions included their belief that how hard one works is predictive of recovery, the perception that those who are "knocked out" for brief periods of time usually have no lasting effects, and a belief that there is no increased risk for a second head injury after a first. Given that these professionals play a vital role in the health care of the incarcerated, it is essential that they have the training to recognize, assess and provide appropriate assistance to those with brain injury related problems.

Brain injury affects individuals in ways that are often life-altering, yet invisible. Problems with executive functioning including difficulties with attention, initiation, problem-solving, judgment, inhibition of behavior, planning/anticipation, self-monitoring, emotional regulation, motor planning, organization, mental flexibility, and working memory can impact all aspects of daily functioning and productivity (Fortin, Godbout, & Braun, 2003; Dennis, Guger, Roncadin, Barnes, & Schachar, 2001). They can also result in impaired self-awareness whereby an individual is not able to accurately appraise their abilities or performance (Spikman & van der Naalt, 2010). The neurocognitive deficits associated with brain injury can easily be misunderstood in correctional settings and may be interpreted as behavior problems, defiance, or the result of "criminal thinking." The behavioral correlates of executive dysfunction have implications for an individual's ability to meet the demands of correction environments, be paroled, and stay out of prison. Problems with executive dysfunction have also been associated with disciplinary problems or misconducts in prison (Merbitz, Jain, Good, & Jain, 1995; Shiroma, et al., 2010); the inability to complete required treatment or meet expectations for parole (Piccolino & Solberg, 2014); exposure to further risk of head injuries (León-Carrión & Ramos, 2003); and mental health problems (Walker, Hiller, Staton, & Leukefeld, 2003).

In addition to a number of well-researched risk factors for recidivism including age, gender, unemployment, and history of addiction, executive dysfunction has been identified as a possible risk factor (Mann, Hanson, & Thornton, 2010; Langevin & Curnoe, 2011; Ross & Hoaken, 2011). Meijers et al. (2015) reviewed studies of executive function in adult offenders and non-offender controls and found that impaired attention, set-shifting, working memory, problem-solving, and inhibition were most frequently affected in offender populations. It logically follows that individuals with those impairments would have difficulty in meeting the demands of school, work, independent living and/or parole, especially without assistance

(Ewing-Cobbs et al., 2006; Krasny-Pacini et al., 2017; Nybo, Sainio, & Müller, 2004; Tranel, Hathaway-Nepple, & Anderson, 2007).

While corrections programing has improved vastly over the past few decades, with a greater emphasis on reentry (Jonson & Cullen, 2015; Ndrecka, 2014), promoting prosocial skills, and decreasing risk factors for recidivism (Landenberger & Lipsey, 2005), concurrent reductions in rates of reincarceration have been relatively small. Many believe that offender rehabilitation programs need to better account for participants' unique abilities, challenges, and motivation (Clarke, Simmonds, & Wydall, 2004; McMurran & McCulloch, 2007). In fact, Ross and Hoaken (2011) specifically call for the use of rehabilitation techniques most often used for individuals with brain injury including cognitive retraining and the development and practice of compensatory strategies. They specify the need for using functional or real-life activities and allowing adequate time and support for learning while using these approaches.

While it is no longer debatable that brain injury is overrepresented among the incarcerated, further research is needed in describing the kinds of injuries incurred, the neurocognitive deficits most often seen, and most importantly, the nature of successful interventions. The project described here describes a partnership between the Pennsylvania Department of Corrections, the Pennsylvania Board of Probation and Parole, the Brain Injury Association of Pennsylvania (BIAPA) and other community partners including the Office of Vocational Rehabilitation. It was funded by a federal Byrne Justice Assistance Grant (JAG) through the U.S. Department of Justice and the Pennsylvania Commission on Crime and Delinquency (PCCD).

Methods

Purpose/description of the project

The goals of this project were to provide brain injury education in the corrections system, to identify individuals with cognitive impairment due to brain injury, to set up individualized brain injury supports to maximize success upon reentry into the community, and to facilitate successful connections to community based brain injury resources upon release.

Brain injury education

This project was developed in response to needs determined in the context of providing education and training about brain injury in the Pennsylvania Criminal Justice system, in consultation with representatives from the PA Department of Corrections and the Pennsylvania Board of Probation and

Parole. This collaboration led to a focus on the reentry of offenders into the community upon release and the need to identify those with brain injury so that they could be connected with appropriate brain injury services and supports to facilitate a successful transition. staff at the State Correctional Institution (SCI)–Graterford were integrally involved in the planning, implementation and evaluation of the project, both through monthly meetings with the project team and frequent contact with project staff in the context of the day-to-day work. Staff from probation and parole were consulted throughout the project, especially as we followed individuals in the community.

An advisory committee was formed with representatives from stakeholder groups to provide input into project development. These included the Pennsylvania Department of Corrections, Pennsylvania Board of Probation and Parole, Pennsylvania Office of Vocational Rehabilitation, Lancaster County Re-Entry Coalition, Philadelphia Re-Entry Coalition, the Montgomery County Justice Advisory Board, and the Acquired Brain Injury Network of Pennsylvania. Education about brain injury was ongoing throughout the project in SCI Graterford; with supervising parole agents as well as Assessment, Sanctioning and Community Resource Agents; the Bureau of Community Corrections; and with Parole Hearing Examiners.

Participants

The focus of intervention was on inmates in the Transitional Housing Unit (THU) program at SCI Graterford, a maximum security prison in Pennsylvania, about 30 miles outside of Philadelphia. These individuals were within 10 months of release or review by the parole board and had institutional support for release. All were expected to be returning to Philadelphia or its surrounding suburban counties. Over the course of the project, referrals were expanded, along with the scope of the project. As treatment specialists within the prison became increasingly aware of brain injury, referrals to the project began to come from prison staff outside of the THU based on presenting problems they thought might be associated with brain injury. Participation in the project was voluntary; and all of those identified for participation in the project provided informed consent.

Screening

Upon consent, participants were screened by project staff for a history of brain injury using the Traumatic Brain Injury Questionnaire (TBIQ; Diamond, Harzke, Magaletta, Cummins, & Frankowski, 2007). This semi-structured interview consists of three sections: screening for a history of

events that could have caused a mechanically induced brain injury; gathering details about the injuries reported, including loss or alteration of consciousness; and identifying symptoms associated with the events. This project was inclusive of all acquired brain injuries (ABI), thus items were added to supplement the TBIQ to screen for a history of significant sicknesses affecting the brain. To get a clear picture of the potential effect of injuries or disease on an individual's function, items about emotional functioning, educational history, employment history, problems with relationships, and changes in reading, writing and calculation abilities were also included.

Once an individual was identified as having a history of an event or events that could have resulted in an ABI, neurocognitive testing was administered by neuropsychology interns under supervision of a clinical neuropsychologist to determine whether the individual demonstrated cognitive impairments that could be associated with the ABI event, and which could negatively impact the ability to be successful in the community upon reentry.

Neurocognitive testing

The neurocognitive testing battery was designed to focus on tests of memory and executive function, as these are seen as critical skills to be able to be successful in postrelease community life. The battery consisted of the following published, standardized tests: Repeatable Battery for the Assessment of Neurological Status (RBANS), Trail Making Test A&B, Booklet Category Test, Brown-Peterson Consonant Trigrams, and Tower of London. These tests measure memory for new information, attention, initiation, problem-solving, inhibition of behavior, planning/anticipation, self-monitoring, organization, mental flexibility, and working memory. After testing, the project team including the Program Manager, NeuroResource Facilitator and volunteer clinical neuropsychologist, met to review the screening and testing results, identify cognitive strengths and weaknesses, consider potential outcomes, and determine the need for brain injury services and supports. All individuals were informed of the results of screening and neurocognitive testing in person. Those found to have cognitive impairments that would likely impact success in the community were entered into the next phase of the project: NeuroResource Facilitation (NRF).

NeuroResource facilitation

NRF is a service designed to identify resources and provide hands-on, ongoing support to individuals and their families so that they may access

needed resources and services over an extended period of time (Connors, Terrill, & Ward, 2001; Ragnarsson, Thomas, & Zasler, 1993). NRF is a method of identifying brain injury needs, assisting people in applying for the services they need, and then assuring they get started with these services. It has been shown to increase both community participation and employment among individuals with brain injuries (Trexler, Parrott, & Malec, 2016; Trexler, Trexler, Malec, Klyce, & Parrott, 2010). NRF began in this project when the individual was informed of the results of his screening and neurocognitive testing. It occurred through a series of meetings over the course of the individual's remaining time in prison and continued into the community upon release. NRF was performed by a brain injury specialist with over 20 years of experience in working with people with ABI and included brain injury education and counseling, resource identification and application, advocacy, transportation training, medical case management and support, and the development of compensatory strategies for successful community living.

Prior to release, NRF focused on brain injury education, reentry planning, and resource application. The NeuroResource Facilitator and the individual identified goals, areas of concerns, and risks based on the individual's strengths and weaknesses, and then crafted a plan to include resources, services, justice-related requirements, and natural supports to be implemented both before and after release. The facilitator determined the individual's goals and needs regarding a productive daily activity pattern when released from prison. For many individuals, this included a referral to the state vocational rehabilitation agency. The facilitator worked with the prison vocational staff to set up work trials for individuals who were not already working in the prison and put strategies into place that could help individuals compensate for their cognitive impairments on the job. Likewise, if the individual needed to complete classes required for parole (e.g., substance abuse, violence prevention, or sex offender treatment), the facilitator worked with the individual and class leaders to implement strategies based on their neurocognitive strengths/weaknesses to facilitate successful completion. As time for release neared, reentry efforts were coordinated with Department of Corrections and parole staff. A prison-based brain injury education and support group was also initiated. All project participants were offered the opportunity to join the group. The group consisted of an eight-week cycle, with educational content presented on various topics followed by suggestions for management/compensation and group activity and discussion. Topics were offered by the facilitator as well as generated by the group members and included: cognitive changes after brain injury; emotional changes after brain injury; substance use and abuse after brain injury; headache; sleep disturbance and fatigue; relationships;

brain TLC: nutrition, stress management, exercise. In addition, each group session included a primer on brain structure and function. This group was co-facilitated by the NeuroResource Facilitator and a prison-employed psychological services specialist.

Community resources necessary to support an individual's goals were identified early, and connections to them were facilitated. A variety of resources were set up to pay for brain injury specific services: the state trust fund program; the state Office of Vocational Rehabilitation; and state Medicaid Waivers. These programs require extensive applications (often 30 pages or more), and the process can take as long as nine months before one is accepted for services. The facilitator and individuals met frequently, prior to release, to complete these applications.

Once released, the NeuroResource Facilitator met with individuals in their community placement or home, further facilitated their connection to community programs, and actively worked on next steps to pursue necessary brain injury services and supports. The facilitator met with the individual an average of twice per month or as needed to provide supports and monitor and implement the reentry plan during the first year following release from prison, often following up with applications and facilitating connections with services. Other key elements included providing supportive counseling, in-vivo crisis management, de-escalation, and helping individuals to keep focused on their objectives; this also included instruction and support on how to use a planner, how to remember appointments, and how to get to appointments. The facilitator also worked with parole agents and community corrections staff to assist individuals in meeting their requirements and supporting their plan. Additional referrals were often made to medical assistance, Social Security (SSI or SSDI), physicians, health clinics, faith-based organizations, recovery organizations, volunteer work placements, and community resources for clothing, food and other essentials. Outcome data was collected on reentry plan elements.

Essential partnerships in this project

The PA Department of Corrections was an essential partner in the implementation of this project. The Secretary of Corrections, the Superintendent of SCI Graterford, and the psychologists at the State Correctional Institution all exhibited a high degree of support and "buy-in" to the project. SCI staff worked diligently to understand the purpose of this project and worked collaboratively with community services prerelease. The PA Board of Probation and Parole officer assigned to this SCI was essential for understanding the options for postrelease placement and for facilitating the building of relationships with the Community Corrections Centers.

The Pennsylvania Office of Vocational Rehabilitation (OVR) was another essential partner. OVR counselors from two field offices were assigned as liaisons to the project. The NeuroResource Facilitator identified the potential for supported employment needs for the individual prior to release and assisted in completing the OVR application. Historically the OVR application process was not begun prior to release from prison. By agreement with OVR for this project, the facilitator gathered the information necessary for the OVR application prior to release and transmitted it to the OVR counselor. The counselor processed it so that, in some cases, services were able to start almost immediately after release.

Another critical partner in this project was the Pennsylvania Board of Probation and Parole (PBPP). Prior to a scheduled parole hearing, the NeuroResource Facilitator provided Hearing Examiners with packets including critical information about the individual and his brain injury. This included the neurocognitive testing results, a list of challenges and potential strategies, and the proposed brain injury services reentry plan. Hearing examiners were then able to use this information to inform their process with the potential parolee. Once released, a specialized parole agent, called "Assessment, Sanctioning, Community Resource Agent" (ASCRA) created a linkage to community-based parole officers and assisted in making connections to community resources. This officer functioned as a secondary resource, as they had greater training than did regular parole officers in connecting individuals with special needs to services in the community. Similarly, the regional director of the Bureau of Community Corrections provided linkages and supports to the halfway houses to which individuals were sent.

Results

Screening

There were a total of 163 participants in the project. Five had known brain injury that was clearly documented and, therefore, did not require screening. Therefore 158 participants were screened for evidence of an event that could have resulted in brain injury using the TBIQ with supplemental questions. Of the total participants screened, 120, or 76%, reported an event or events that could have resulted in a brain injury. It should be noted that 59 of the 158 offenders who were screened were referred by corrections staff who believed, either from records or behavior, that they may have had a brain injury, while 99 were screened routinely as participants in the THU reentry program.

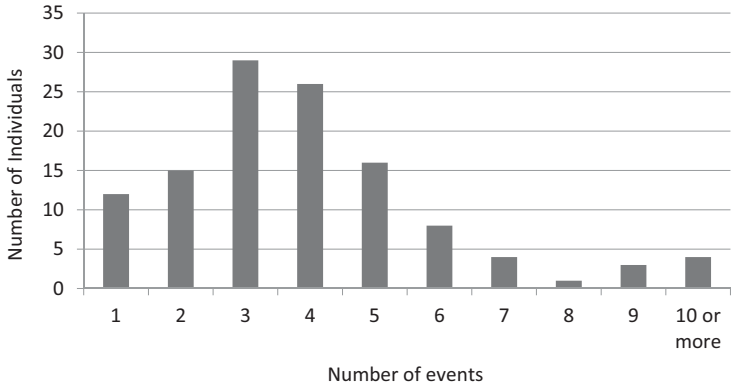

Figure 1. Number of events that could have caused brain injury ($n = 463$).

Type/severity of injuries

The data gathered about the nature of the injury was reported by the offender, and when possible, corroborated by medical records. Across all participants 466 episodes that could have led to brain injury were reported, and 44% of these episodes resulted in some type of medical treatment. Only nine percent of offenders reported that they received any type of brain injury rehabilitation treatment. Based on the parameters of the TBIQ, the majority of events—89%—are best described as *"mild" traumatic brain injuries*—defined as an alteration of consciousness with accompanying symptoms (such as being dazed; slowed, confused, bewildered, stunned, stupefied, seeing stars), having either no loss of consciousness, or loss of consciousness for less than 60 minutes. It was found that 34% of the mild injuries resulted in a loss of consciousness, and 66% resulted in being dazed or confused. Loss of consciousness lasting up to a day, considered *moderate brain injury*, were found in five percent of reported injuries, and greater than one day loss of consciousness, considered a *severe brain injury*, was found in six percent of reported injuries.

Events that could result in a brain injury

Most individuals reported more than one event over the course of their lifetime, as depicted in Figure 1.

In fact, the majority of offenders sustained three, four, or five brain injury events. The average number of brain injury events described by those who screened positive was 3.8 events per person. These events occurred throughout childhood, adolescence, and young adult years. The majority of brain injuries occurred during childhood. Figure 2 shows the total number of brain injury events reported and the ages at which they occurred.

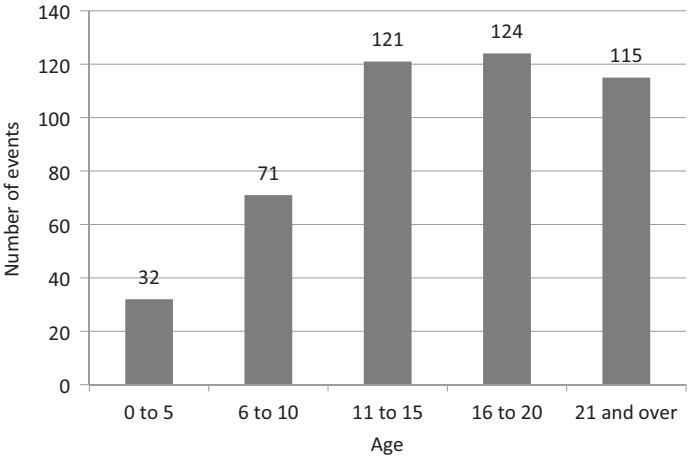

Figure 2. Age at events that could have caused a brain injury ($n = 463$).

The total number of events depicted by first four columns in Figure 2 is 348, indicating that the great majority of brain injury events, 75%, occurred before the age of 21, with a majority (54%) occurring during the adolescent years from 11–20. Only 7% of these events occurred during incarceration, and 93% occurred in the community.

Causes of brain injury

The causes of brain injury in the corrections population studied are shown in Figure 3. The leading cause (33%) was vehicular crashes (car, motorcycles, bikes, ATVs dirt bikes, and others), followed by assaults—30% (gunshots, fights, domestic violence, or blast injuries) followed by an equal number caused by sports injuries 16% (football, boxing, skateboarding, and others) and 16% from falls. Only 5% of the brain injury events were nontraumatic, such as strokes, anoxia, infection, or tumor.

A majority (56%) of the episodes of brain injury were never medically treated. While 44% resulted in some medical treatment, the majority of that was emergency room treatment and release only (no rehabilitation treatment). Only 3% of those having incidents that resulted in brain injury actually received medical rehabilitation treatment.

Nature of neuropsychological impairments

Of those offenders who screened positive for event(s) that could have resulted in a brain injury, 88 received a neurocognitive assessment to determine whether there were impairments. Some individuals (32) were not tested as they were not going to be released within the project period and would not have been available for NRF. Of those that were tested, 74%

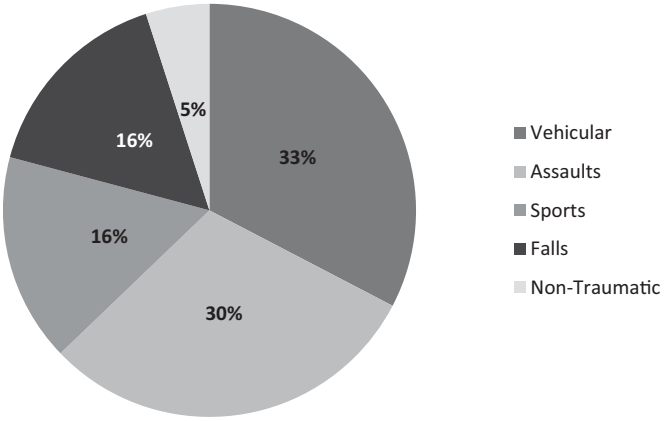

Figure 3. Causes of events that could have caused a brain injury.

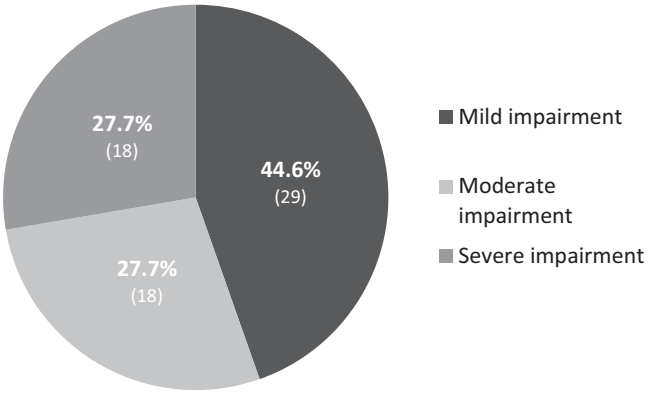

Figure 4. Level of neurocognitive impairment ($n = 65$).

showed impairment when compared with their peers on standardized testing. The levels of neurocognitive impairment were further classified as mild, moderate, or severe impairment, with 44.6% demonstrating mild impairments, 27.7% with moderate impairments, and 27.7% with severe cognitive impairment, summarized in Figure 4.

Figure 5 shows the types and frequencies of neurocognitive impairment among those who were tested. The highest frequency impairment demonstrated was on RBANS Immediate Memory, which measures the ability to recall verbal information either in a list form or a short story (63.9%). This was followed by impaired performance on the Booklet Category Test, which measures nonverbal problem solving and the ability to generate solutions to problems (57.4%). The next most frequently demonstrated impairment was RBANS Attention Subscale, which measures attention and concentration for auditory and visual information (48.3%), followed by impairment on Trails B which measures conceptual tracking and switching

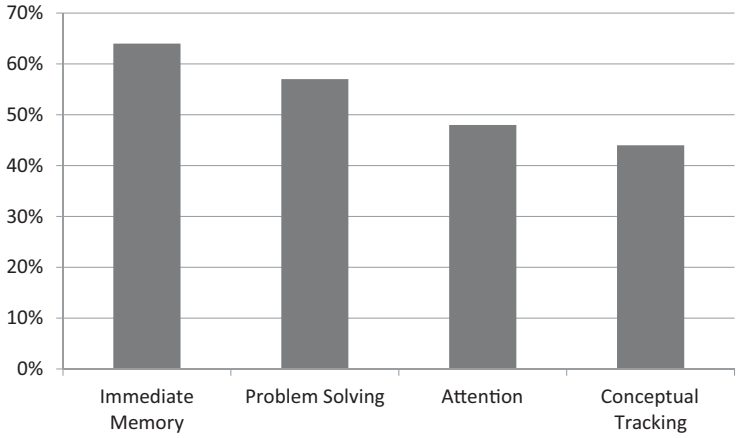

Figure 5. Most frequent neurocognitive impairments.

sets (43.6%). Other areas measured, such as language function and visual spatial construction functions were not as frequently impaired.

NeuroResource Facilitation (NRF)

When an individual was determined to have neurocognitive impairments that would likely interfere with successful community reentry, he was provided NRF. A total of 67 participants were entered into NRF—some without testing if the brain injury was clearly documented and severity precluded testing. At the conclusion of the two-year grant period, 44 of these individuals had been released at some point in time; 23 remained incarcerated at the conclusion of the project.

Applications were made for various resources. A majority of individuals (61%) were assisted to apply for health insurance through medical assistance, and 46% were assisted to apply for an income benefit such as Social Security Disability Insurance and Supplemental Security Income. In terms of brain injury services and supports they were assisted to apply for included the Office of Vocational Rehabilitation (61%), Pennsylvania Head Injury Program (28%), and Home and Community Based Medicaid Waivers (9%). At the conclusion of the project, 46% of the brain injury resources applied for were authorized, and others were in process and pending.

Of the 44 individuals released during this project's two-year period, 50% went to a Community Corrections setting or halfway house. Of the remaining half, 45% went directly home. Others went to various residential facilities.

Postrelease outcomes at conclusion of project

Nearly two thirds of those released were engaged in some kind of productive activity (work, volunteering, and training), with 50% of those released

becoming competitively employed. Nearly half of those who became employed held volunteer jobs or participated in training while they waited for resources to help them find and succeed in paid employment, were applying for jobs, and/or were developing work skills and obtaining references.

Of those released, seven individuals (17%) were reincarcerated during the time they were followed. Of the seven reincarcerations, only two individuals incurred new charges and were convicted; the other five individuals were parole violations (sometimes related to their cognitive impairments). Additionally, there were four individuals who were sanctioned for violations and temporarily held in community correction centers (halfway back). Of those four in halfway back, two individuals were ultimately charged with new crimes but found not guilty, and two individuals were released and subsequently absconded.

Discussion

Consistent with findings in the literature, this study found disproportionately high numbers of inmates with possible history of brain injury. Of participants, 76% screened positive for event(s) that could have caused a brain injury. Shiroma et al. (2012) meta-analysis of previous epidemiology studies projects 60% prevalence of a history of TBI among offenders compared with prevalence estimates ranging from two percent to 42.5% in the general population (Whiteneck, Cuthbert, Corrigan, & Bogner, 2016; Zaloshnja, Miller, Langlois, & Selassie, 2008). The findings in this corrections population were much higher, suggesting that this population is part of a marginalized group, one where brain injury is often mis- or undiagnosed or lost to follow-up. As other researchers are beginning to suggest, those with social disadvantages, including unemployment, poverty, or a history of incarceration or homelessness, are more likely to have sustained a brain injury and underrepresented in TBI outcomes research (Dams-O'Connor et al., 2015; Jourdan et al., 2016).

Furthermore, individuals in this project reported multiple events that could have caused a brain injury, nearly four on average, which has been reported in similar research in both adults and youth in justice settings (Ferguson, Pickelsimer, Corrigan, Bogner, & Wald, 2012; Kaba et al., 2014). Recent work in sports concussion and the military reveals that the effects of even a mild brain injury, if repeated, are cumulative (Bailes, Petraglia, Omalu, Nauman, & Talavage, 2013; McKee & Robinson, 2014). Furthermore, research demonstrates that sustaining even a single concussion in and of itself is a risk factor for sustaining another concussion; in

fact an individual who sustains a concussion is 5.8 times more likely to sustain another concussion (Zemper, 2003).

Another significant finding was the age at which the participants originally sustained their brain injuries, with the majority of injuries (75%) occurring during childhood. The great majority of these childhood injuries were secondary to vehicle crashes and violence, which differs from the primary causes found in the general population. (Faul, Xu, Wald, Coronado, & Dellinger, 2010). Of those reporting an injury in childhood, 63% did not receive medical treatment, whereas only 27.5% of the general population did not seek medical care. This leads to interesting questions about why this would be so different in an offender population. It could be that individuals did not have access to health insurance/convenient medical care, did not want to get in trouble so did not seek assistance, and/or that their parents/guardians were not aware of the injuries and/or did not pursue medical treatment.

When injuries occur during critical periods of brain development, the result can be impairment in foundational skills upon which higher cognitive skills must be built. This can manifest as arrested development where children do not develop age-appropriate social skills and are not able to anticipate or appreciate the consequences of their behavior (Catroppa, et al., 2015). Additionally, injury to a still-developing brain could impact further maturation and development, particularly in the pre-frontal cortex. The skills associated with this later brain development include problem solving and decision-making, planning, goal formation, and self-evaluation as well as the ability to understand the social intentions of others and/or make moral judgments (Vaughn, Salas-Wright, DeLisi, & Perron, 2014). It follows that individuals with impairments in these areas struggle to transition to adult roles and responsibilities as well as to stay out of trouble with the law, as a result at least in part, of this arrested development (Ilie et al., 2014; Ilie, Mann, Boak, Hamilton, Rehm, & Cusimano, 2017). Similarly, many researchers have found connections between the history of pediatric brain injury and offending behavior (Hughes et al., 2015; Huw Williams, Cordan, Mewse, Tonks & Burgess, 2010; McKinlay et al., 2014; Ryan et al., 2015).

The great majority of events reported by participants in this project would be classified as leading to mild brain injury; as such, they would not be as likely to be diagnosed, identified, or treated. They result in hidden disability and sometimes masquerade as other disorders or issues (Lagarde et al., 2014). The trajectory that became apparent among the participants, many of whom had sustained multiple brain injuries early in life, without identification and intervention, was one of failure in life activities expected of them, namely school, work, and appropriate social behaviors. For those

injured during school age, cognitive impairments can result in learning difficulties, which if not properly diagnosed and supported, can result in youth who are unable to perform up to expectations in the classroom. This can lead either to acting-out behavior in the classroom, avoidance of demands, and/or failure to attend class. These students are at risk for not doing well in school, dropping out, and/or getting into trouble with the law (Chapman et al., 2010). Brain injury related impairments such as poor decision-making, impulsivity, inability to anticipate consequences of behavior, emotional dysregulation, and behavioral dyscontrol can increase the likelihood of engaging in behaviors that put them at risk for criminal involvement. Depression and anxiety often follow brain injury as a maladaptive coping response to changes in functioning, such as not being able to keep up with peers either academically and/or socially. This chain of events can also lead to substance misuse as a means of "self-medication." For those attempting to work, there is often a cycle of being able to get jobs, but not being able to keep them. Problems with communicating with supervisors or peers, learning and remembering job tasks, maintaining behavioral control, and adjusting to changes in the job are frequent causes of job loss after only a few weeks or months. Individuals may be able to get another job, but the same problems keeps happening, resulting in a string of failed work attempts and the inability to sustain themselves.

The implications for corrections treatment and effective release planning are numerous. Similar to prior research (León-Carrión & Ramos, 2003; Merbitz et al., 1995; Piccolino & Solberg, 2014; Shiroma et al., 2010), this population often had trouble "succeeding" within the prison setting or while on parole. Participants often had histories of incurring misconducts, failing mandated programing, or "not making" parole. Interventions which can be done in corrections settings include a more thorough examination of brain injury deficits in the context of the environment, followed by interventions with both the system and individual. Examples include movement of individuals to smaller blocks; one-to-one sessions to develop strategies to be more successful in mandated group programing; advocacy and training with group treatment leaders and other corrections personnel; the development of work trials in environments in jobs that are best suited to the individual's strengths; education about the brain injury and its effects for corrections personnel (including medical providers, counselors, psychologists, employer/supervisors, officers); as well as the development and implementation of compensatory strategies such as planners, notebooks with important information to be recalled, issue and action lists, and effective communication and stress-reduction strategies.

Another significant intervention for all participants served was the identification of, and application for, brain injury and supported living

resources. The complexity of many applications was overwhelming for the great majority of applicants, due to their cognitive impairments, making the role of the NeuroResource Facilitator essential to get these completed. The facilitator assisted individuals to apply for resources and orchestrated the collection of a variety of materials (medical records, records of residency, identification documents, income information, etc.) needed to be deemed eligible for services. Without NRF, it is unlikely that the participants in this pilot would have been able to access these needed services.

Some individuals waited as long as nine months for resources/services to become available. The NeuroResource Facilitator needed to accommodate these delays; this planning involved identifying alternate resources; developing meaningful activity patterns to help the individual be productive in the interim, including volunteer work; and encouraging and supporting individuals through this waiting time. This post-release period is an especially risky time, particularly for individuals with executive dysfunction who may not be able to create a daily activity pattern that meets the requirements of parole and keeps them out of trouble.

Given these many challenges and the complicated web of resources, eligibility requirements, and application procedures required by both brain injury resources and other social service entities, individuals with impairments in memory, initiation, and problem solving would not be able to navigate these challenges to set up resources. It is clear that additional assistance as provided by the model of NRF is indicated for individuals with cognitive impairments. A model relying solely on "information and referral" would clearly be insufficient.

The project yielded results that could be considered successful, with almost two thirds of those released becoming engaged in productive activity (work, volunteering, and training), and 50% becoming competitively employed. The rate of reincarceration across all releases during our two-year project was 17%. Other researchers have found significantly higher rates of recidivism, compared with the whole prison population, among those with mental health and/or substance abuse issues (Baillargeon, Binswanger, Penn, Williams, & Murray, 2009; Wilson, Draine, Hadley, Metraux, & Evans, 2011).

Limitations

This project was a demonstration project and had a number of limitations. These included a sample of convenience, potential selection bias, short length of time followed post release from prison, and the limited number of participants. The report of brain injury was almost exclusively by self-report and usually without confirmation from medical records. More

research is needed to show the long term recidivism for offenders with brain injury, and how this rate can be reduced using NRF.

Conclusion

Brain injury is overrepresented in corrections settings and affects the very skills essential for successful reentry. This project describes specific characteristics found in a convenience sample in a state correctional facility in the greater Philadelphia area. It employed a model of brain injury screening, neurocognitive assessment, and NRF to increase the brain injury resources and living supports available to its participants, increase successful community reentry, and lower the likelihood of criminal reinvolvement.

The results point to a need for further research on the effects of multiple brain injuries in childhood and adolescence as well as to promising practices for improving offender reentry and outcomes:

- Incorporate screening and assessment for brain injury into routine health assessments in Corrections environments;
- Train and educate Corrections and Parole personnel about brain injury;
- Provide NeuroResource Facilitation - Person-specific assistance, beginning before release and continuing upon reentry;
- Implement this model at the earliest point possible, such as with youth offenders.

How NeuroResource facilitation can help: A case example

"Richard" reported that he had many episodes that likely resulted in mild brain injuries. He was involved in many fights as teenager and was dazed at least ten times in these assaults. He was also involved in sports (football, basketball) in which he was concussed five times, all of which involved being momentarily dazed. Richard reported that in his early 20s he was involved in a motorcycle accident while not wearing a helmet, and hit a pole, He was unconscious for less than an hour, and was hospitalized overnight due to a broken jaw. He was not diagnosed with brain injury and did not receive any brain injury treatment or rehabilitation.

Upon screening, Richard identified a number of symptoms frequently associated with brain injury, stating that he struggles with attention and concentration, particularly when doing more than one thing at a time. He also experiences both anxiety and depression and states that his judgment and problem-solving are poor. Richard also reports getting irritated, particularly when he perceives that others are not doing a good job. He also reported headaches and memory problems. Medical history, as reported in

the prison record, documents this hospitalization and confirms the report that there was no brain injury diagnosis or treatment.

Richard dropped out of school in 11th grade, and then worked as a delivery man and as a cook in fast food restaurants sporadically. He is, according to the prison record, the only member of his family involved in the criminal justice system. Records indicate that Richard was first arrested at the age of 23, and pleaded guilty and served time for this offense. He was subsequently re-arrested for violation of his parole. While incarcerated Richard completed a work training program and was employed in the one of the prison's factories. Testing revealed significant impairment in attention, memory, expressive language, and processing speed.

The focus of NeuroResource Facilitation included personal and family education on brain injury, assistance with mandated corrections programing, referral to the state vocational rehabilitation agency for supported employment and cognitive rehabilitation. Prior to release, the NRF met with Richard to review test results, provide and practice strategies for improving recall of novel information and management of anxiety, and to discuss the reentry plan. The NRF also facilitated referral to an existing anxiety-management group within the prison and educated its leaders about his brain injury and cognitive impairments. Richard was released during the course of this project. The NRF assisted him to apply for medical insurance, complete his intake with the Office of Vocational Rehabilitation (OVR), and establish compensatory strategies for time management and information-tracking. The NRF also interfaced with his parole agents and made them aware of his brain injury and the strategies and resources that were in place. Richard became employed at a full-time job with the assistance of OVR and on-site job coaching. He has met his Parole obligations and has obtained a driver's license. Richard also learned to track his appointments and obligations using a planner and to ask for assistance when he needs clarification or repetition of information. He has had no further legal involvement since release (two years).

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