Demographic and Mental Health Predictors of Arrests Up to 10 Years Post-TBI: A Veterans Affairs TBI Model Systems Study

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ABSTRACT

Objective: Examine rates and predictors of arrests in Veterans and Service Members (V/SM) who received inpatient rehabilitation for traumatic brain injury (TBI).

Setting: Veterans Administration (VA) Polytrauma Rehabilitation Centers.

Participants: 948 V/SM drawn from the VA TBI Model Systems cohort with arrest data up to 10 years post-TBI.

Design: Longitudinal cohort study; secondary analysis of pre-TBI characteristics predicting post-TBI arrests.

Main Measures: Disclosure of arrests pre-TBI and up to10 years post-TBI.

Results: 36% of the sample had been arrested prior to their TBI; 7% arrested post-TBI. When considering all variables simultaneously in a multivariate model, pre-TBI mental health treatment (aOR = 4.30, CI: 2.03, 9.14), pre-TBI heavy alcohol use (aOR = 3.04, CI: 1.08, 8.55), and number of follow-up interviews (aOR = 2.05; CI: 1.39, 4.50) were significant predictors of post-TBI arrest.

Conclusion: Arrest rates of V/SM prior to TBI were consistent with rates of arrest for people of similar ages in the United States. Post-TBI rates were lower for V/SM than published rates of post-TBI arrests in civilians with TBI. As part of rehabilitation planning for V/SM with TBI, providers should assess for pre-injury mental health services and alcohol misuse to (1) identify those who may be at risk for post-injury arrests and (2) provide relevant resources and/or supports.

Key words: arrest; criminal behavior; mental health; brain injuries; traumatic; alcohol; military personnel; veterans

INTRODUCTION

Between 17-23% of Veterans and Service Members (V/SM) sustain a traumatic brain injury (TBI) during their service[1,2], a range consistent with the 21-24% of lifetime prevalence of TBI in the general population.[3,4] V/SM are at risk of TBI during their service due to occupational hazards and behavioral risk factors.[5,6] TBI is associated with externalizing behavior such as substance use, violence, and being arrested.[7-9] Criminal behavior and subsequent arrests convey greater risk for limiting community integration after TBI. Family members and friends may withdraw their social support after an arrest.[10] Employers are less likely to offer jobs to candidates with criminal records.[11] Among civilians with moderate or severe TBI, 7-9% had committed a felony prior to their head injury.[10] In addition, 12% of civilians with TBI were arrested between 1 and 5 years post-injury. Risk factors for post-TBI arrests included male sex, age < 25 years, history of pre-injury felony charges, and pre-injury substance misuse.[10]

Little is known about the rates and predictors of arrests in V/SM with TBI. Twelve percent of a national sample of V/SM who served after September 11, 2001 had been arrested prior to their deployment, and 9% were arrested after their deployment. About 23% of the entire sample screened positive for TBI (severity unknown).[12] Screening positive for TBI did not predict being arrested in this younger sample (M_{age} = 36.2, *SD = 10.1)*.[12]

Other research of incarcerated V/SM did not screen or assess for history of TBI. For example, White (2012) found incarcerated Veterans (TBI status unknown) of all war eras were older and more educated than incarcerated civilians. Incarcerated Veterans were also more likely to be arrested for violent crimes, to report use of "hard" drugs (opiates and crack cocaine), and to report more mental health problems compared to incarcerated non-veterans.[13]

It is important not to generalize outcomes regarding prevalence and risk factors for post-TBI arrests from civilians to V/SM, as findings from civilian literature do not always translate to V/SM populations.[14] Longitudinal studies have demonstrated that when compared to civilians with TBI, V/SM with TBI were more likely to be male and employed.[14,15] V/SM also had higher education levels, were more likely to have experienced combat, and were more likely to have used mental health services prior to their TBIs. V/SM with TBI also tended to achieve better rehabilitation outcomes compared to civilians with TBI.[14]

Due to the demographic and rehabilitation differences between civilians and V/SM with TBI, it is unknown if the same predictors of arrests found in civilians with TBI would replicate in V/SMs with TBI. This study aims to extend this line of research by examining the rates and longitudinal predictors of arrests in V/SM with TBI of all severity levels. This study improves upon prior research by examining a nationally representative sample from a longitudinal study with well-characterized TBI across the severity spectrum using widely accepted severity metrics. Identifying any modifiable risk factors of arrests may allow for early intervention within rehabilitation settings and facilitate improved community reintegration outcomes.

METHOD

Participants and Setting

Participants were enrolled prospectively into the Veteran Affairs (VA) Polytrauma Rehabilitation Centers TBI Model Systems (PRC TBIMS) National Database–a multicenter, longitudinal study of TBI outcomes following delivery of comprehensive inpatient rehabilitation. Inclusion criteria for the PRC TBIMS National Database were as follows[16]: (a) TBI diagnosis per case definition: a traumatically-induced structural brain injury or physiological disruption of brain function due to external force evidenced by onset or worsening of: loss/decreased

consciousness; mental state alteration; memory loss for events immediately before or after the injury; transient or stable neurological deficits; or intracranial lesion; (b) age ≥ 16 years at time of TBI; (c) admission to a PRC for inpatient rehabilitation; and (d) informed consent by the participant or legally authorized representative. Analyses for this study were restricted to a subset of PRC TBIMS participants: (e) enrolled between 2010 and 2018; (f) eligible for at least one follow up interview at either 1-, 2-, 5-, or 10-years post-TBI; and (g) available arrest data provided at any follow-up interview post-TBI. The TBI that resulted in enrollment into the PRC TBIMS was considered the "Index TBI".

Procedures

This study was a sub-analysis of the VA PRC TBIMS study approved by local IRBs at five VA polytrauma centers: Richmond, VA; Tampa, FL; Minneapolis, MN; Palo Alto, CA; and San Antonio, TX. The study conformed to all state and federal research regulations. Demographic information, military background, pre-TBI arrests, and pre-TBI mental health variables were obtained at study enrollment via interview.[16] Study staff reviewed medical records for information about TBI characteristics and rehabilitation variables. Post-TBI arrest histories were gathered during follow-up telephone interviews. No participants were incarcerated at the time of data collection.

Variables of Interest

Criminal arrests. There were two arrest variables (pre- and post-TBI) and one incarceration (pre-TBI) variable. At admission into the rehabilitation program, participants and/or their family members reported if the participants had ever been arrested and if they had penal (felony) incarcerations prior to their TBI. Pre-TBI arrest was included as a predictor in the final multivariate model (described below). At each follow-up interview, V/SM were asked if

they had been arrested in the past year. If the V/SM failed to complete a follow-up interview, arrest records in the states where the participants resided were searched to see if they were currently incarcerated. We grouped anyone who self-reported being arrested during at least one follow-up interview and those who were identified by state records as being incarcerated as the arrested post-TBI group. Arrested post-TBI was our main outcome variable for the univariate and multivariate models. Because people who had sustained their TBI longer ago and those who completed more follow-up interviews would have had more opportunities to report being arrested, we also examined years since index TBI and number of follow-up interviews as predictors of arrests. Finally, we reported the number of arrests at each follow-up interview in Table 2.

Baseline and rehabilitation variables. Demographic characteristics assessed at the time of admission into rehabilitation included sex, age at the time of index TBI, years of education, yearly income, race/ethnicity (White, Black, Hispanic, and all other races), marital status, years in active duty, and whether or not the individual had been deployed in combat (Table 1).

TBI characterization. TBI characteristics included severity of index TBI classified as mild, moderate, or severe based on the most severe metric available[17] (i.e., Glasgow Coma Score, time to follow commands, or duration of altered consciousness/posttraumatic amnesia; Table 1). Other TBI characteristics included the cause of injury for index TBI (grouped as [violent or penetrating] vs. [vehicle, fall, and other]), and from the Ohio State University TBI Identification Method [OSU TBI-ID][18] count of all lifetime TBIs and youngest age of any TBI.

Mental health and substance use. Pre-TBI mental health and substance use predictors included report of having ever received mental health treatment and use of illicit or nonprescription drugs (each coded as “yes” or “no”). Alcohol use was assessed by the number

of drinks per week in the month prior to the injury. Scoring included abstaining (0 drinks per week), light (between 1 and 3 drinks per week), moderate (between 3 and 14 for men, or between 3 and 7 for women) and heavy use (greater than 14 for men, and greater than 7 for women).

Rehabilitation outcomes. Functional Independence Measure[19] (FIM) is an 18-item measure that assesses one's independence in activities of daily living. Providers on the rehabilitation units assessed the participant's independence on 13 motor and 5 cognitive tasks at admission and discharge. Scores for each item ranged from 1 (total dependence) to 7 (complete independence). Total scores range from 18 to 126. Higher scores indicate greater independence. Total FIM scores at discharge were used as a predictor of post-TBI arrests.

Data Analysis

Data were analyzed using statistical software R v3.6.1.[20] Descriptive statistics were expressed as quantiles or percentages. Arrested post-TBI was the outcome variable and dichotomized as yes or no. A univariable logistic regression model was fit for the binary outcome to evaluate the bivariate association between arrest and each risk factor. A multivariable logistic regression model was then fit for the binary outcome as a function of all risk factors. Redundancy analyses checked for collinearity among risk factors; no risk factors were identified as redundant. Nagelkerke R^2 was used to measure how well the model predicted post-TBI arrests, with a higher R^2 indicating better prediction. Discrimination index (area under the receiver operating characteristic curve) measured how well the model discriminated between those who had been arrested and those who had not, with higher scores indicating better discrimination.

Interactions. The relation between youngest age of first TBI and being arrested prior to TBI was examined in an interaction term. Younger age is a predictor of arrests[10,13] and re-

conviction[9] in the civilian literature. We expected that those who had sustained a TBI at a younger age and were arrested prior to their TBI may be at highest risk of being arrested again after their index TBI. In addition, the relation between TBI severity and FIM Total score at discharge was examined for potential interaction effects. It was anticipated that those who had more severe TBIs accompanied by higher functional independence at discharge would be more likely to be arrested.

RESULTS

Of 1,081 participants eligible for this study, 1,020 completed at least one follow-up interview (716 at 1-year post-injury, 659 at 2 years, 429 at 5 years, and 78 at 10-years post-TBI). Of these, 948 had valid arrest history data, and these participants comprised the study sample for univariate analyses. A subset of the 948 with arrest history data (n = 616) also had data available for all predictors, and they were retained for the multivariate analysis. We compared the multivariate sample (n = 616) to the total sample (N = 948). The groups were similar on demographic, TBI, and mental health variables (see Table, Supplementary Digital Content 1).

Sample Characterization

Demographic, military history, and injury characterization are summarized for the entire sample and subgroups (Arrested post-TBI [n=67] and Not Arrested [n=881]; Table 1). For the overall sample, most participants were male (94%), married (44%), and with a median age of 30 years at the time of their index TBI [IQR 24, 43). The sample was predominantly white (67%). Most participants had greater than a high school diploma (57%) and earned below $50,000 per year (66%). The sample had served a median of 5 years in active duty, during which time 68% were deployed to a combat zone. The majority (64%) experienced a severe TBI. The most common cause of the TBI was vehicular crashes (47%).

History of pre-injury arrests was common (34%) for the overall sample. However, being arrested after their Index TBI was rare (7% [n=67]; see Table 1). Three of the 67 V/SM who were arrested post-TBI were identified with public state records. V/SM who were arrested were less likely to be white and were more likely to be divorced or separated. V/SM who were arrested post-TBI also differed in their TBI characteristics with more vehicular-related injuries, moderate severity of TBI, greater number of TBIs, and higher functional status on the FIM. Finally, more V/SM who were arrested post-TBI reported a history of pre-injury mental health treatment and problematic substance use compared to those who were not arrested. Strikingly, 50% of those arrested post-TBI had been arrested pre-injury compared to 33% of those not arrested post-TBI. The models below test if the differences between those who were arrested post-TBI and those not arrested post-TBI are significant. The incidences of arrest reported at each TBIMS follow-up interview are summarized in Table 2.

Modeling of Arrest Status Post-TBI

Table 3 summarizes the univariate associations of demographic, military, injury characterization, and pre-injury psychosocial history variables with arrest status post-TBI. As expected, pre-injury arrest history predicted post-TBI arrest status (unadjusted odds ratio, uOR = 2.06; CI: 1.25, 3.41). Index TBI characterized as moderate in severity compared to mild severity was associated with greater risk for arrest post-TBI ([uOR] = 2.62; CI: 1.07, 6.38). History of pre-injury mental health treatment (uOR = 2.27; CI: 1.38, 3.75), pre-injury moderate (uOR = 2.89; CI: 1.52, 5.48) and heavy (uOR = 3.31; CI: 1.54, 7.13) alcohol use (compared to abstaining) were all significant in unadjusted analyses. Finally, greater number of follow-up interviews was associated with being arrested post-TBI (uOR = 1.68; CI: 1.20, 2.34). Non-significant trends were noted for race, number of TBIs, and FIM status at discharge.

Table 4 summarizes the multivariate model that included the variables from univariate modeling for participants with complete data across all predictors (n=616). Pre-injury mental health treatment (aOR = 4.30, CI: 2.03, 9.14) and pre-injury heavy alcohol use (aOR = 3.04, CI: 1.08, 8.55; compared to abstaining) were significantly associated with arrest status post-TBI. Number of follow-up interviews (aOR = 2.50, CI: 1.39, 4.51) was associated with post-TBI arrests while years since index TBI was not (aOR = 1.03, CI: 0.86, 1.23). No other covariates or interactions were statistically significant. However, the overall interaction between TBI severity and higher FIM status at discharge (directionality) suggested a trend toward significance due to the combination of FIM total scores being above the median for those with severe TBIs (compared to mild TBI) being related to post-TBI arrest. The overall model explained 23.3% of the variance with a C index of 80.8%.

DISCUSSION

The V/SM pre-index TBI arrest rate of 34% is comparable to - but slightly higher than - the arrest rate for 24-34 year olds in the United States general population (30%).[21] V/SM in our sample had a median age of 30 years when they sustained their index TBI. The post-TBI V/SM arrest rate (7% of the sample) is lower than the 12% of civilians with TBI who reported being arrested after their injuries[10] despite our study having a longer follow-up timeframe. When each pre-injury variable was considered independently, TBI severity (moderate vs. mild), being arrested prior to TBI, ever receiving mental health treatment, moderate to heavy alcohol use (compared to abstaining), and number of follow-up interviews were all associated with being arrested post-TBI. When simultaneously considering all variables, receiving mental health treatment prior to the index TBI, pre-TBI heavy alcohol use, and completing more follow-up interviews were related to arrests after TBI. TBI severity was not a significant predictor of arrests

when other variables were simultaneously considered in the same model. However, consistent with Elbogen and colleagues,[10] those with more functional independence and severe TBIs showed a tendency toward post-TBI arrest.

V/SM were just as likely to be arrested prior to their index TBI as the civilian population. However, based on previous publications,[10] V/SM were less likely to be arrested after their TBI compared to civilians with TBI. One hypothesis for this difference in post-TBI arrest rates might be the level of resources and supports available to V/SM with TBI following inpatient rehabilitation. TBI is a chronic condition that is related to lower income, less education, and unemployment,[3] all factors related to arrests. V/SM with TBI have access to the polytrauma network of care that extends across the United States and post-discharge services that are often provided at no cost. The polytrauma network may help offset the risks that are associated with arrests after TBI. Another possible reason for these discrepancies in post-TBI arrest rates may be differences in injury severity of the civilian sample[10] compared to this V/SM cohort. Elbogen and colleagues' sample did not contain any participants with mild TBI. One-fifth of our sample sustained a mild TBI which may account for our lower V/SM arrest rate.

Results from the interaction in the multivariate analysis suggested severe TBI was associated with being arrested after the TBI when combined with greater functional independence. Thus those with severe TBIs may have had subtle social or behavioral impairments (e. g., communication difficulties, unable to detect sarcasm or facial expressions[22,23]) combined with less supervision. Communication difficulties are a common problem for Veterans with TBI of all severity levels[24] and this may inhibit the individual from interacting appropriately with law enforcement.[25] Assessing for and treating communication disorders can be a treatment target for rehabilitation programs. In addition, training law

enforcement personnel about the unique needs of people who have experienced TBI is another potential avenue to assist this group of individuals.[26]

Contrary to the civilian literature,[10] youngest age of any TBI, lower education, male sex, and illicit drug use were unrelated to arrests in V/SM with TBI. This further differentiates V/SM and civilian TBI populations.[14] Discrepancies between the civilians and V/SM cohorts may be due to the limited variance on these factors in this V/SM sample. For instance, 94% of the sample was male, and only 9% reported illicit drug use. The recruitment of V/SM admitted to polytrauma centers may have resulted in a cohort that differs from one comprised of average civilians with TBI[27] and individuals with TBI in correctional settings.[28] V/SM in the VA PRC TBIMS are more likely to be young men who experienced vehicular accident and violence resulting in mostly severe head injuries.[27]

Non-white races were positively associated with arrests but this did not reach statistical significance in the multivariate model. Future research should continue to examine how race relates to arrests and the criminal justice system. There has been clear documentation that people of non-white races have a greater likelihood of being arrested and imprisoned in the United States.[29] As an example, American black men born in 2001 have a 1 in 3 chance of being imprisoned during their lifetime, which can be compared to the 1 in 17 chance that American white men will be imprisoned.[30]

Notably, pre-TBI mental health treatment predicting post-TBI arrests is a novel finding in V/SM with TBI. Elbogen and colleagues did not examine mental health service use in their civilian TBI sample. V/SM in general are at higher risk of having mental health disorders compared to civilians.[31,32] While this is concerning, V/SM also have greater access to mental

health resources compared to their civilian counterparts which increases the chance they will initiate mental health care.[33]

Clinically these findings suggest that V/SM rehabilitation programs should assess for premorbid mental health symptoms and alcohol use to prompt treatment referrals while the V/SM is still in the polytrauma system. Alcohol use is an especially important treatment concern, as veterans with a TBI history were twice as likely to have an alcohol use disorder compared to those without a TBI history.[34] Appropriate environmental modifications could also be put in place at discharge, such as offering and providing information and transportation for local Alcoholics Anonymous meetings. Proactive intervention might also include financial counseling as recommended by Elbogen and colleagues.[12] Treating the symptoms in rehabilitation or immediately after discharge may increase the chances of successful community reintegration. The VA may be uniquely positioned to provide early intervention. V/SM can be followed and receive treatment throughout the country within the polytrauma system of care, which is a benefit not afforded to civilians with TBI.

Limitations of this study include reduced sample size for the multivariate modeling due to missing data. However, the sample that was included in model building did not differ from the total sample on demographic, TBI, or mental health characteristics. Reasons for arrests were not measured, and future research should examine these including whether they were violent or non-violent. Because this is a longitudinal study with ongoing enrollment, V/SM had different follow-up periods. V/SM who had been in the study longer had more opportunity to be arrested. The multivariate model demonstrated that while time since index TBI was not related to arrest post- TBI, the number of follow up interviews was. We controlled for number of follow-up interviews in the multivariate model. Three V/SM were identified by state records as being

incarcerated at the time of a follow-up interview, and their arrests might fall outside the 1 year window that was evaluated in those who are interviewed. Furthermore, more information about which specific mental health disorders are related to arrests might help providers more accurately target at-risk V/SM. Finally, this sample consisted of TBI survivors with injury warranting comprehensive inpatient rehabilitation; thus, findings may not generalize to the greater population of persons who experience TBI.

Strengths of the study include being the first investigation to longitudinally examine the arrest rates of V/SM who had sustained a TBI. Our national sample was large and included index TBIs of all severity levels which increases the generalizability of results. Also, our sample consisted of V/SM who had received rehabilitation for TBI, allowing the results to generalize to V/SM with TBI who are outside of correctional settings. Longitudinally monitoring arrests up to 10 years after TBI is a strength of more common cross-sectional studies.

Conclusion

Arrest rates after TBI among V/SM in this sample were lower than those of their civilian counterparts. It is important to provide a holistic interdisciplinary approach to the treatment of V/SM with TBI including treatment for mental health and alcohol use disorders. Reducing the risk of future arrests will assist in effective community reintegration.

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Table 1. *Baseline characteristics of TBI sample*

	Study sample (N=948)		Arrested post-TBI (N=67)		Not Arrested post-TBI (N=881)	
Categorization	**N**	**Summary**	**N**	**Summary**	**N**	**Summary**
Male	947	94% (891)	67	93% (62)	880	94% (829)
Age at index TBI	948	24;30;43	67	24;29;39	881	24;30;44
Years of education	943		67		876	
High school diploma or less		43% (409)		39% (26)		44% (383)
More than high school diploma		57% (534)		61% (41)		56% (493)
Annual earnings	707		50		657	
Below $50,000		66% (464)		68% (34)		65% (430)
$50,000 and above		34% (243)		32% (16)		35% (227)
Race/ethnicity	880		63		817	
White		67% (591)		56% (35)		68% (556)
Black		9% (79)		14% (9)		9% (70)
Hispanic		14% (123)		14% (9)		14% (114)
Other		10% (87)		16% (10)		9% (77)
Marital status	948		67		881	
Single		32% (307)		28% (19)		33% (288)
Married		44% (417)		37% (25)		44% (392)
Divorced		18% (172)		25% (17)		18% (155)
Separated		4% (38)		9% (6)		4% (32)
Widowed		1% (13)		0% (0)		1% (13)
Other		0% (1)		0% (0)		0% (1)
Military Variables						
Years in active duty	829	3; 5;10	57	3; 4; 8	772	3; 5;10
Deployed in combat zone	843	68% (573)	59	68% (40)	784	68% (533)
TBI Variables						
Cause of injury	944		67		877	
Vehicular		47% (443)		54% (36)		46% (407)
Fall		15% (140)		15% (10)		15% (130)
Violence: penetrating		4% (38)		3% (2)		4% (36)
Violence: blast		0% (0)		0% (0)		0% (0)
Other		34% (323)		28% (19)		35% (304)
Injury severity category (3-level)	825		61		764	
Mild		20% (167)		13% (8)		21% (159)
Moderate		16% (129)		25% (15)		15% (114)
Severe		64% (529)		62% (38)		64% (491)
Youngest age of any TBI	948	18; 23; 31	67	17; 22; 30	881	18; 24; 31

Count of additional TBI excluding index	886	0; 1; 2	57	0; 2; 3	829	0; 1; 2
Years since index TBI	948	3; 5; 7	67	4; 5; 7	881	3; 5; 7
Number of follow up interviews	948		67		881	
1		31% (293)		13% (9)		32% (284)
2		40% (377)		46% (31)		39% (346)
3		29% (277)		40% (27)		28% (250)
4		0% (1)		0% (0)		0% (1)
Rehabilitation Variables						
FIM total score at rehab admission	905	56; 90; 113	64	77; 97; 111	841	53; 89;113
FIM total score at rehab discharge	905	105; 115; 120	61	111; 119; 122	844	104; 115; 120
FIM total at discharge > median	905	49% (441)	61	61% (37)	844	48% (404)
Pre-TBI Mental Health Variables						
Ever received mental health treatment	940	37% (344)	67	55% (37)	873	35% (307)
Use of illicit/non-prescription drugs	929	9% (84)	66	12% (8)	863	9% (76)
Drinking category	884		64		820	
Abstaining		44% (387)		25% (16)		45% (371)
Light		17% (149)		12% (8)		17% (141)
Moderate		28% (244)		42% (27)		26% (217)
Heavy		12% (104)		20% (13)		11% (91)
Arrest Variables						
Arrested prior to injury	930	34% (315)	66	50% (33)	864	33% (282)
Penal incarcerations prior to injury	313	14% (45)	33	18% (6)	280	14% (39)

Note: Summary statistics were expressed as quartiles (1st, median; 3rd) for continuous variables and percent (count) for categorical variables. N column is the count of observed data for each variable. FIM=Functional Independence Measure.

Table 2. *Rates of Arrests at 4 Time Points Post-TBI (N = 948)*

Follow up Year	Total number for follow up year	Arrested in this follow up year	Arrested pre-TBI and in this follow up year
1	716	20 (2.79%)	9 (1.25%)
2	659	23 (3.49%)	10 (1.52%)
5	429	26 (6.06%)	10 (2.33%)
10	78	2 (2.56%)	1 (1.28%)

Note: V/SM could have completed more than one follow up interview

Table 3. *Associations between baseline variables and post-TBI arrests (N = 948)*

		Univariate Models	
Predictor	**Comparison**	**Unadjusted OR (95% CI)**	**Unadjusted *p*-value**
Gender	Male vs. Female	0.763 (0.294, 1.981)	0.578
Age at index TBI	1 year older	0.991 (0.973, 1.009)	0.338
Years of education	More than HS vs. HS or less	1.225 (0.736, 2.038)	0.435
Race/ethnicity	Black vs. White	2.042 (0.942, 4.427)	0.070
	Hispanic vs. White	1.254 (0.587, 2.681)	0.559
	Other vs. White	2.063 (0.982, 4.333)	0.056
Marital status	Married vs. Others	0.743 (0.445, 1.24)	0.255
Years in active duty	1 year longer	0.968 (0.922, 1.016)	0.182
Deployed in combat zone	Yes vs. No	0.991 (0.563, 1.747)	0.976
Years since index TBI (Current year - Index Date)	1 year longer	0.978 (0.898, 1.065)	0.606
Cause of injury	(Vehicular/ Fall/ Other) vs. (Violence: penetrating)	0.719 (0.169, 3.052)	0.655
Injury severity	Moderate vs. Mild	2.615 (1.073, 6.375)	0.034
	Severe vs. Mild	1.538 (0.703, 3.366)	0.281
Arrested prior to injury	Yes vs. No	2.064 (1.248, 3.413)	0.005
Received treatment for mental health problems: ever	Yes vs. No	2.274 (1.378, 3.753)	0.001
Use of illicit/non-prescription drugs	Yes vs. No	1.428 (0.658, 3.103)	0.368
Drinking category	Light vs. Abstaining	1.316 (0.551, 3.142)	0.537
	Moderate vs. Abstaining	2.885 (1.520, 5.475)	0.001
	Heavy vs. Abstaining	3.312 (1.539, 7.132)	0.002
Youngest age of any TBI	1 year older	0.990 (0.973, 1.007)	0.259
Count of all TBI	1 more TBI	1.125 (0.992, 1.275)	0.067
Number of follow up interviews	1 more follow up interview	1.676 (1.202, 2.337)	0.002
FIM at discharge above median	Yes vs. No	1.679 (0.987, 2.856)	0.056

Note: Logistic regression model was fitted for the probability of arrest as a function of each covariate. OR>1 means more likely to be arrested post-TBI, OR<1 means less likely to be arrested post-TBI. OR=odds ratio; CI=confidence interval. FIM=Functional Independence Measure.

Table 4. Multivariable model with baseline variables predicting arrests post-TBI (n = 616)

Predictor	Comparison	Adjusted OR (95% CI)	Adjusted *p*-value
Gender	Male vs. Female	0.458 (0.131, 1.602)	0.221
Years of education	More than HS vs. HS or less	1.571 (0.777, 3.179)	0.209
Race/ethnicity	Black vs. White	3.142 (0.978, 10.092)	0.054
	Hispanic vs. White	1.751 (0.638, 4.802)	0.277
	Other vs. White	2.403 (0.975, 5.925)	0.057
Marital status	Married vs. Others	1.097 (0.540, 2.227)	0.798
Years since index TBI	1 year longer	1.030 (0.861, 1.232)	0.746
Cause of injury	Vehicular/Fall/Other vs. Violence/penetrating	0.416 (0.050, 3.458)	0.417
Ever received treatment for mental health problems	Yes vs. No	4.301 (2.025, 9.137)	<0.001
Use of illicit/non-prescription drugs	Yes vs. No	0.613 (0.184, 2.041)	0.425
Drinking category	Light vs. Abstaining	0.734 (0.229, 2.350)	0.603
	Moderate vs. Abstaining	2.310 (0.969, 5.508)	0.059
	Heavy vs. Abstaining	3.038 (1.079, 8.551)	0.035
Count of all TBI	1 more TBI	1.039 (0.851, 1.267)	0.708
Number of follow up interviews	1 more follow up interviews	2.501 (1.389, 4.505)	0.002
Youngest age of any TBI (main)			0.302
Arrested prior to injury (main)			0.738
Interaction: (Youngest age of any TBI) X (Arrested prior to TBI)			0.984
Arrested=Yes: Youngest age of any TBI	1 year older	0.980 (0.946, 1.015)	
Arrested=No: Youngest age of any TBI	1 year older	0.980 (0.944, 1.018)	
Youngest age of any prior TBI=median age: Arrested	Yes vs. No	1.238 (0.591, 2.591)	
Injury severity (main)			0.285
FIM at discharge > median (main)			0.771
Interaction = Severity X (FIM at discharge>median)			0.095
FIM total at discharge > median: Severity	Moderate vs. Mild	2.193 (0.502, 9.581)	
	Severe vs. Mild	2.918 (0.732, 11.634)	
FIM total at discharge <= median: Severity	Moderate vs. Mild	2.462 (0.363, 16.714)	

	Severe vs. Mild	0.542 (0.103, 2.857)	
Severity=Mild: FIM total at discharge > median	Yes vs. No	0.752 (0.11, 5.125)	
Severity=Moderate: FIM total at discharge > median	Yes vs. No	0.670 (0.151, 2.976)	
Severity=Severe: FIM total at discharge > median	Yes vs. No	4.051 (1.666, 9.851)	
		Nagelkerke R^2	C index
		23.3%	80.8%

Note: FIM=Functional Independence Measure.