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Victims of Crime Recovery Program Decreases Risk for New Mental Illness

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Abstract

Mental illness is pervasive among trauma populations and is linked to worse outcomes and recidivism. The Victims of Crime Advocacy and Recovery Program (VOCARP) prospectively provides patient services such as educational materials, compensation, advocacy and mental health care to patients with physical injuries. The purpose was to assess for relationship between resource use and development of mental illness after injury. Two control groups: a random selection of patients who did not use VOCARP (n=212) and 201 patients with non-violent trauma were obtained. Over 22 months 1,019 patients utilized VOCARP. Of all 1,432 patients, 43% had preexisting mental illness, and 17% had a new or worsening mental illness after injury. Patients with VOCARP use had more preexisting mental illness (47% vs. 35%, $p<0.01$), particularly depression and stress disorders. Conversely, VOCARP use was associated with lower rates of mental illness post-injury (15% vs. 22%). Following injury, VOCARP users had more stress disorders (57% vs. 37%), but less depression (25% vs. 41%) and suicidal ideation (7% vs. 24%), all $p<0.05$. 113 patients (11% of 1,019) used mental health services, which was associated with lower recidivism for new violent injury (4.4% vs. 11.7%, $p=0.016$). On regression analysis, unemployment (OR: 0.61, $p=0.012$) and use of VOCARP services (OR: 0.54, $p=0.008$) were predictive of decreased risk for new mental illness. Mental illness is pervasive among patients with injuries resulting from violence. VOCARP programming appears beneficial for limiting risk of new mental illness after injury.

Introduction

Preexisting mental illness and psychiatric sequelae following traumatic injury have significant influence on recovery thereafter. Recently, rates of mental illness among trauma patient populations have become better established and are reportedly as high as 45%¹⁻⁸. Among patients with injuries resulting from violence, rates of mental illness may be more severe. In one meta-analysis of 16 papers reporting rates of psychiatric illness after violent trauma, Ophuis et al. reported that posttraumatic stress disorder (PTSD) rates were as high as 61% at 1-month post-injury⁹. Accordingly, some studies have indicated that violent injury and interpersonal trauma are major risk-factors for developing PTSD¹⁰⁻¹².

To address poor outcomes and high rates of recidivism following violence-related injury, over 30 institutions in the U.S. and Canada have established hospital-based violence intervention programs¹³. Despite a plethora of programs, examination of program efficacy has been limited to recidivism rates, cost-effectiveness, and subsequent rates of arrest and/or conviction within the criminal justice system¹⁴⁻²⁶. Among these programs, two institutions have attempted

to assess the prevalence of PTSD among participants in their violence intervention programs, with rates from 66-75%^{27,28}, and only two centers have explicitly ascertained use of psychiatric services as a component of their program analysis^{14,26}. Given the inadequate study of mental illness in relation to violent injury and intervention programs, further evaluation is necessary.

In March of 2017, our urban level 1 trauma center began offering resources for patients and families impacted by violence-related traumatic injury. The Victims of Crime Advocacy and Recovery Program (VOCARP) connects eligible patients with resources for education, financial compensation, referrals to internal and community-based resources, advocacy, legal consultation, and mental health resources. The purposes of this present study are to report the prevalence of mental illness among our violently injured population both before and after injury, and to evaluate the effects of utilizing VOCARP services on outcomes after violence-related traumatic injury.

Materials and Methods

Program Overview

Establishment of VOCARP at our urban level 1 trauma center was funded by the State of Ohio Office of Victims of Crime and the Ohio Attorney General's office, which are supported by federal funds received by the U.S. Department of Justice. The VOCARP program utilizes a team of social workers to identify patients sustaining violence-related trauma within our hospital system. Eligible patients are then offered a variety of resources including educational materials regarding victim rights, financial compensation, referrals to external and/or internal services, assistance with transportation, relocation or childcare, crisis interventions, victim advocacy, mental health resources and legal aid.

Patient Identification

Resources provided to patients sustaining violence-related injuries were offered by a dedicated team of five social workers. The social work team was available any time of day during the week to meet with patients. Eligible patients were identified using emergency department (ED) intake lists and from inpatient trauma and intensive care unit patient lists. Referrals for VOCARP services could also be made directly by providers within the hospital system. Subsequently, patients were approached in the ED, during admission, and at outpatient clinic visits. Here, they were provided with program information and offered available program services. Patients of all ages and all mechanisms of injury (secondary to intentional violent injury) were eligible. Given that this programming represented a change in standard of care within the hospital system, there were no exclusion criteria aside from violence-related

mechanism of injury. If qualified patients or staff were unavailable during these times to successfully approach such patients, they were offered services via phone call.

Variables of Interest

Patients who utilized resources were prospectively collected from March of 2017 until December of 2018 and, electronic medical records were queried retrospectively for additional information related to demographics, medical comorbidities, and injury characteristics. Baseline information such as age, sex, race, ethnicity, marital status, current employment, and insurance carrier were documented. Mechanisms of injury (MOI) were also recorded and grouped into the following categories: gunshot wounds (GSWs), stab wounds, physical assault, sexual assault, domestic violence, human or animal bite wounds, motor vehicle and motorcycle collisions, and vehicular assault (including pedestrians struck or thrown from moving vehicles). Mechanisms unable to be encompassed by these categories were listed as "other" (n=21). Patient's psychiatric history was likewise collected based on the past medical history listed at initial presentation of injury and/or within the electronic medical record active problem list at time of injury. New mental illness after injury was defined as a novel condition or an exacerbation of a previous diagnosis. This was recorded using provider electronic medical record notes (e.g. in primary care, behavioral health or psychiatric care settings) which specifically established the new diagnoses or exacerbation of previous diagnoses as sequelae of the violence-related traumatic injury. Collection of this information was done retrospectively. Therefore, there were no specific parameters established for use of a specific questionnaire or structured interview to make a new mental health diagnosis. The diagnosis and treatment of new mental health conditions was at the discretion of the treating providers. If patients had a preexisting mental illness prior to injury without any documented exacerbation during or after recovery, they were recorded as having no new mental illness after injury.

Statistical Analysis

A random selection of 212 patients who did not use VOCARP resources during the study period (March 2017 - December 2018) and of 201 non-violence related trauma patients who were admitted during the same timeframe were gathered and represented the two control groups. Univariate analyses were conducted between patients who utilized VOCARP programming and those who did not. Independent sample t tests were utilized for continuous variables and all data was expressed as average with standard deviation (SD). Chi-squared or Fischer exact tests were employed for categorical variables where appropriate given sample size. Multiple logistic regression analysis

was performed to identify independent predictors of new mental illness. Variables included in analysis include age, sex, race, ethnicity, marital status, employment, insurance, mechanism of injury, hospital length of stay, mental illness (previous history), prior traumatic injury (violent or non-violent), complications, additional operations and use of VOCARP services. Analysis was performed using SPSS v. 25 software (SPSS Inc., Chicago, Illinois). Results were expressed with use of odds ratio (OR) and $p < 0.05$ indicated statistical significance in all cases.

Results

Over the 22-month study, 4,456 patients sustained violence-related traumatic injuries, with 2,717 patients (61%) determined to be victims of crime. 1,019 patients (23% of 4,456) utilized VOCARP resources. Compared to the randomly selected sample of 212 patients without VOCARP service use, those who used resources were more frequently male (56% vs. 71%) and less often married (12% vs. 41%), both $p < 0.001$, but were similar in terms of age, race, and ethnicity. Although patients did not differ in

Table 1: Demographics, mechanism of injury and hospital course stratified by non-violent traumatic injury versus violence-related traumatic injury (with and without service use).

	All Patients (N=1,432)	VOC Service Use?		Non-violent Trauma Control Group (N=201)	P-value*
		Yes (N=1,019)	No (N=212)		
Age (years) ± SD	36.6 ± 15.5	34.4 ± 13.7	36.2 ± 14.4	48.4 ± 19.5	0.085
Male	838 (58.5%)	567 (55.6%)	150 (70.8%)	121 (60.2%)	<0.001
Race					
Caucasian	606 (42.4%)	378 (37.1%)	78 (37.0%)	150 (74.6%)	1.00
African American	714 (49.9%)	553 (54.3%)	119 (56.4%)	42 (20.9%)	0.65
Other	111 (7.8%)	88 (8.6%)	14 (6.6%)	9 (4.5%)	0.41
Ethnicity					
Non-Hispanic	1313 (91.7%)	926 (90.9%)	193 (91.0%)	194 (96.5%)	1.00
Hispanic	119 (8.3%)	93 (9.1%)	19 (9.0%)	7 (3.5%)	1.00
Marital Status					
Single	1013 (70.7%)	800 (78.5%)	107 (50.5%)	106 (52.7%)	<0.001
Married/Significant Other	267 (18.7%)	119 (11.7%)	86 (40.6%)	62 (30.9%)	<0.001
Divorced	125 (8.7%)	86 (8.4%)	15 (7.1%)	24 (11.9%)	0.58
Widowed	27 (1.9%)	14 (1.4%)	4 (1.9%)	9 (4.5%)	0.53
Employment					
Employed	506 (35.4%)	356 (35.0%)	75 (35.4%)	75 (37.3%)	0.94
Unemployed	820 (57.4%)	638 (62.8%)	107 (50.5%)	75 (37.3%)	0.0012
Retired	62 (4.3%)	8 (0.8%)	8 (3.8%)	46 (22.9%)	0.0025
Student	41 (2.9%)	14 (1.4%)	22 (10.4%)	5 (2.5%)	<0.001
Insurance					
Medicaid	913 (64.1%)	687 (67.4%)	152 (74.2%)	74 (36.8%)	0.26
Medicare	98 (6.9%)	48 (4.7%)	9 (4.4%)	41 (20.4%)	0.86
BWC	39 (2.7%)	25 (2.5%)	0 (0%)	14 (7.0%)	0.014
Uninsured	187 (13.1%)	158 (15.5%)	17 (8.3%)	12 (6.0%)	0.0034
Commercial	63 (4.4%)	36 (3.5%)	9 (4.4%)	18 (9.0%)	0.55
Managed Care	125 (8.8%)	65 (6.4%)	18 (8.8%)	42 (20.9%)	0.29
Mechanism of Injury¹					
GSW	343 (27.9%)	265 (26.0%)	78 (36.8%)	-	0.002
Stabbing	78 (6.3%)	63 (6.2%)	15 (7.1%)	-	0.64
Physical Assault	544 (44.2%)	460 (45.1%)	84 (39.6%)	-	0.15
Sexual Assault	59 (4.8%)	42 (4.1%)	17 (8.0%)	-	0.021
Domestic Violence	91 (7.4%)	79 (7.8%)	12 (5.7%)	-	0.39
Human/Animal Bite	20 (1.6%)	20 (2.0%)	0 (0%)	-	0.035
MVC/MCC	27 (2.2%)	27 (2.7%)	0 (0%)	-	0.009
Vehicular Assault	48 (3.9%)	44 (4.3%)	4 (1.9%)	-	0.12
Other	21 (1.7%)	19 (1.9%)	2 (0.9%)	-	0.56
Hospital LOS (days)	3.6 ± 9.4	3.7 ± 10.1	3.4 ± 6.2	-	0.68

*P-values represent univariate statistical comparisons between VOCARP service users and non-users ¹Mechanism of injury does not include the additional non-violent trauma control group. VOCARP: Victims of Crime Advocacy and Recovery Program; SD: standard deviation; BWC: bureau of workers compensation. GSW: gunshot wound; MVC: motor vehicle collision; MCC: motorcycle collision; LOS: length of stay.

rates of employment, those who used VOCARP resources were more likely to be unemployed (63% vs. 51%, $p < 0.01$), secondary to fewer retired patients and students. Accordingly, patients who used VOCARP programming had higher rates of no health insurance (16% vs. 8%, $p < 0.01$). Patients with resource use also differed in terms of certain mechanisms of injury; they had fewer GSWs (26% vs. 37%) and sexual assaults (4% vs. 8%), both $p < 0.05$. See Table 1 for additional detail.

At the time of injury, 609 (42.5%) of all 1,432 patients had a preexisting mental illness. Patients with VOCARP use had more associated preexisting mental illness (47% vs. 35%, $p = 0.0014$). The most common diagnoses were depressive disorders ($n = 429$, 70%), anxiety disorders ($n = 257$, 42%), and bipolar disorders ($n = 131$, 22%). Rates of depressive disorders (72% vs. 62%) and stress disorders, such as posttraumatic stress disorder (PTSD), acute stress disorder (ASD) and adjustment disorder (21% vs. 12%) were both more prevalent among VOCARP patients, but this did not reach statistical significance ($p = 0.07$ and 0.08 , respectively). However, suicidal ideation or attempted suicide prior to injury was significantly lower among patients with VOCARP service use (8% vs. 22%, $p < 0.001$). See Table 2 for further information.

Following injury, 239 patients (17%) of all 1,432 patients had a mental illness after injury, with 50% being new diagnosis and the other 50% representing exacerbation

of a previous condition. Among patients with violence-related injuries ($n = 1,231$) regardless of VOCARP use, 201 patients (16%) had a new mental illness after injury. Of note, 475 patients (33%) with preexisting mental illness had no documented new or worsening mental illness after injury. Rates of mental illness post-injury were lower for patients with VOCARP use (15% vs. 22%, $p = 0.024$), with no statistically significant differences between rates of new versus worsening mental illness. The most documented post-injury diagnoses included PTSD or ASD ($n = 105$, 52% of 201), depression ($n = 58$, 29%), anxiety ($n = 43$, 21%), and suicidal ideation or attempts ($n = 21$, 10%). Patients with VOCARP resource use had greater associated rates of PTSD/ASD (57% vs. 37%, $p = 0.02$), and lower frequency of depression (25% vs. 41%) and suicidal ideation (7% vs. 24%) all $p < 0.05$, when compared to patients without VOCARP use. See Table 3 for greater detail.

Of the 1,019 patients who utilized VOCARP programming, 113 patients (11%) requested mental health services, including counseling, support groups, peer visits and referrals to external psychiatric resources. Compared to patients without mental health resource use, patients who used services had lower rates of pre-existing mental illness (35% vs. 49%) and higher rates of mental illness after injury (33% vs 13%), both $p < 0.01$. Patients who utilized mental health services also had lower associated rates of recidivism for new violent injury (4.4% vs. 11.7%, $p = 0.016$) (Table 4).

Table 2: Positive history of mental illness stratified by non-violent traumatic injury versus violence-related traumatic injury (with and without service use).

	All Patients (N=1,432)	VOC Service Use?		Non-violent Trauma Control Group (N=201)	P-value*
		Yes (N=1,019)	No (N=212)		
Pre-existing Mental Illness					
Yes	609 (42.5%)	479 (47.0%)	74 (34.9%)	56 (27.9%)	0.0014
Mental Illness Diagnoses					
Depression/Mood Disorder	429 (70.4%)	347 (72.4%)	46 (62.2%)	36 (64.3%)	0.07
Anxiety Disorder	257 (42.2%)	207 (43.2%)	21 (28.4%)	29 (51.8%)	0.10
Bipolar Disorder	131 (21.5%)	112 (23.4%)	14 (18.9%)	5 (8.9%)	0.46
Stress Disorder (PTSD, ASD, or Adjustment Disorder)	115 (18.9%)	100 (20.9%)	9 (12.2%)	6 (10.7%)	0.08
Schizophrenia	69 (11.3%)	61 (12.7%)	8 (10.8%)	0 (0%)	0.85
Panic Disorder	33 (5.4%)	32 (6.7%)	1 (1.4%)	0 (0%)	0.11
Suicidal ideation	62 (10.2%)	40 (8.4%)	16 (21.6%)	6 (10.7%)	<0.001
Personality Disorder	12 (2%)	8 (1.7%)	2 (2.7%)	2 (3.6%)	0.63
Agoraphobia	5 (0.8%)	5 (1.0%)	0 (0%)	0 (0%)	1.00
Obsessive Compulsive Disorder	6 (1.0%)	4 (0.8%)	2 (2.7%)	0 (0%)	0.19
Oppositional Defiant Disorder	11 (1.8%)	8 (1.7%)	3 (4.1%)	0 (0%)	0.17
Gender Identity Disorder	2 (0.3%)	2 (0.4%)	0 (0%)	0 (0%)	1.00
Conversion Disorder	1 (0.2%)	1 (0.2%)	0 (0%)	0 (0%)	1.00
Eating Disorder	1 (0.2%)	1 (0.2%)	0 (0%)	0 (0%)	1.00
Intermittent Explosive Disorder	2 (0.3%)	1 (0.2%)	0 (0%)	1 (1.8%)	1.00
Dissociative Disorder	1 (0.2%)	1 (0.2%)	0 (0%)	0 (0%)	1.00
Multiple Personality Disorder	1 (0.2%)	1 (0.2%)	0 (0%)	0 (0%)	1.00

*P-values represent univariate statistical comparisons between VOCARP service users and non-users. VOCARP: Victims of Crime Advocacy and Recovery Program; PTSD: posttraumatic stress disorder; ASD: acute stress disorder.

Table 3: Mental illness after injury stratified by non-violent traumatic injury versus violence-related traumatic injury (with and without service use).

	All Patients (N=1,432)	VOC Service Use?		Non-violent Trauma Control Group (N=201)	P-value*
		Yes (N=1,019)	No (N=212)		
Mental Illness after Injury					
Total	239 (16.7%)	155 (15.2%)	46 (21.7%)	38 (18.9%)	0.024
New	119/239 (49.8%)	69/155 (44.5%)	17/46 (37%)	33/38 (86.8%)	0.40
Worsening	120/239 (50.2%)	86/155 (55.5%)	29/46 (63%)	5/38 (13.2%)	0.40
Mental Illness Diagnoses					
PTSD/ASD	116 (48.5%)	88 (56.8%)	17 (37.0%)	11 (29.0%)	0.02
Depression	73 (30.5%)	39 (25.2%)	19 (41.3%)	15 (39.5%)	0.042
Anxiety Disorder	55 (23%)	37 (23.9%)	6 (13.0%)	12 (31.6%)	0.15
Suicidal Ideation	23 (9.6%)	11 (7.1%)	11 (23.9%)	1 (2.6%)	0.005
Adjustment Disorder	25 (10.5%)	9 (5.8%)	5 (10.9%)	11 (29.0%)	0.32
Panic Disorder	8 (3.4%)	6 (3.9%)	1 (2.2%)	1 (2.6%)	1.00
Schizophrenia	8 (3.4%)	6 (3.9%)	1 (2.2%)	1 (2.6%)	1.00
Bipolar Disorder	5 (2.1%)	3 (1.9%)	1 (2.2%)	1 (2.6%)	1.00
Personality Disorder	3 (1.3%)	1 (0.7%)	2 (4.4%)	0 (0%)	0.13

*P-values represent univariate statistical comparisons between VOCARP service users and non-users. VOCARP: Victims of Crime Advocacy and Recovery Program; PTSD: posttraumatic stress disorder; ASD: acute stress disorder.

Table 4: Rates of mental illness and recidivism among VOCARP users, as extrapolated based on use of mental health services.

	Use of Mental Health Services?		P-value
	Yes (N=113)	No (N=906)	
Pre-existing Mental Illness			
Yes	39 (34.5%)	440 (48.6%)	0.005
Mental Illness after Injury			
Total	37 (32.7%)	118 (13%)	<0.001
New			0.001
Worsening			0.001
Hospital Length of Stay (days)	16.9 ± 21.5	2 ± 5.7	<0.001
Recidivism for New Violent Injury	5 (4.4%)	106 (11.7%)	0.016
Time to Follow-Up (days)	282 ± 204.5	233.5 ± 213.6	0.022

VOCARP: Victims of Crime Advocacy and Recovery Program.

On multiple logistic regression analysis, statistically significant independent predictor for new mental illness after violence-related trauma include divorced or separated marital status (OR: 2.62), GSW (OR: 2.17), sexual assault (OR: 4.64), longer hospital length of stay (OR: 1.05), positive psychiatric history (OR: 1.85), and any complication after injury (OR: 2.13), all $p < 0.05$. Only two variables were associated with decreased risk for new mental illness: unemployment (OR: 0.61, $p = 0.012$) and used of VOCARP services (OR: 0.54, $p = 0.008$). All other factors including age, sex, race, ethnicity, insurance status and prior traumatic injury (either violent or non-violent) did not reach significance on this regression model (Table 5).

Discussion

Over less than two years at our urban level 1 trauma center, 1,019 patients chose to utilize various resources

designed for survivors of violence-related traumatic injury. This population likely represents the largest among violence-intervention programming literature. Furthermore, this work signifies a first attempt among violent trauma literature to not only document rates of pre-existing and post-injury mental illness, but also to examine the role available resources play in this intricate relationship between trauma and mental health.

Among general surgery and orthopedic trauma populations, there has been a recent push to quantify rates of mental illness among different patient populations and to understand the subsequent effect on outcomes. However, mental illness after violence-related traumatic injuries is somewhat less well established. This problem may be secondary to selecting or excluding certain mechanisms of injury. For example, some studies may only report psychiatric illness among specific etiologies, such as GSW victims or sexual assault survivors^{9,29}. Additionally, investigation of mental illness has largely been confined to rates of PTSD and ASD. In a meta-analysis of 16 studies among patients suffering violent injuries, Ophuis et al. observed PTSD rates as high as 61% at 1-month after injury and a range of 16.3% to 27.1% at 12-months post-injury⁹. To a lesser extent, this meta-analysis also included 5 studies reporting rates of post-injury depression which fluctuated between 3% and 35.3% depending on time-point. Of note, several of the studies excluded victims of domestic violence, child abuse, and/or sexual assault. Vella et al. similarly noted that 49% of 183 patients treated for GSWs met criteria for PTSD²⁹. To a larger degree, after conducting face-to-face interviews with 25 survivors of violence-related facial injuries, Wong et al. found that 80% of the patients met criteria for 2 or more psychiatric disorders³⁰.

Table 5: Multiple logistic regression analysis to identify independent predictors for new mental illness following violent traumatic injury.

	New Mental Illness after Injury	
	Odds Ratio	P-value
Age	1.00	0.59
Male	1.20	0.39
Race		
Caucasian (ref)	-	-
African American	0.89	0.54
Other	0.62	0.42
Hispanic	1.07	0.90
Marital Status		
Single (ref)	-	-
Married/Significant Other	0.97	0.90
Divorced/Separated	2.62	0.001
Widowed	1.98	0.29
Employment		
Employed (ref)	-	-
Unemployed	0.61	0.012
Retired	0.58	0.47
Student	0.74	0.63
Insurance		
Commercial (ref)	-	-
Medicaid	1.34	0.55
Medicare	0.94	0.93
BWC	2.43	0.23
Uninsured	1.11	0.85
Managed Care	1.21	0.74
Mechanism of Injury		
Physical Assault (ref)	-	-
Domestic violence	1.51	0.20
Gunshot wound	2.17	0.002
Human/animal bite	-*	-*
MVC/MCC	1.78	0.29
Sexual Assault	4.64	<0.001
Stab	1.13	0.76
Vehicular Assault	1.54	0.39
Other	1.40	0.62
Hospital Length of Stay	1.05	<0.001
Prior Mental Illness	1.85	0.003
Prior Traumatic Injury		
Resulting from violence/crime	1.26	0.22
Non-violent trauma	1.28	0.19
Any Complication	2.13	0.012
Any Unplanned Surgery	1.05	0.89
Use of VOCARP Services	0.54	0.008

*N too small for analysis. MVC: motor vehicle collision; MCC: motorcycle collision; VOCARP: Victims of Crime Advocacy and Recovery Program.

Our results are generally in agreement with these findings, although we differ in our methodology for studying mental illness. Overall, among our violently injured population, we found that 639 patients (52% of 1,231) had a mental illness after injury. The majority represented no

change to their preexisting mental illness (n=438, 36%), while 201 patients (16%) developed a new condition or had an exacerbation of their previous condition. Frequency of new or worsening mental illness after injury was 8.5% for PTSD/ASD, 4.7% for depression, 3.5% for anxiety and 1.8% for suicidal ideation.

Higher rates of mental illness among trauma populations are concerning, given the risk for poor outcomes. In particular, psychiatric illness is a major risk factor for new traumatic injury recidivism^{2,8,31}. Accordingly, in a study of 1,709 patients with unintentional injuries, Wan et al. found that mental illness led to 4.5 times higher odds of injury recidivism². In the same study, the authors also showed that patients with mental illness had longer associated hospital lengths of stay and were less likely to be discharged home. Psychiatric illness, specifically depression and anxiety, are likewise implicated in worse results after injury such as poor functional outcomes and higher complication rates^{4,5,32-34}. Mental illness has also been connected to decreased patient satisfaction following orthopaedic trauma^{35,36}. In our study, we identified several independent predictors of new mental illness after injury on multiple logistic regression analysis including divorced or separated marital status (OR: 2.62), GSWs (OR: 2.17), sexual assault (OR: 4.64), hospital length of stay (OR: 1.05) and prior psychiatric diagnosis (OR: 1.85), all p<0.05.

Given the connection between mental illness and poor outcomes, specific interventions to address the psychiatric needs of trauma populations are essential. Although several violence-intervention programs have been established with evidenced reduction in violent injury recidivism, less has been accomplished in the arena of mental health. Despite this trend, two hospital-based intervention programs have reported use of psychiatric resources. In a 10-year study of 446 clients enrolled Wraparound Program, 51% of patients needed mental health services, and 85% of these patients had their need met by the program¹⁴. Accordingly, Juillard et al. noted facing challenges in delivering mental health services and the success they had in developing a relationship with a community-based organization that provides mental health resources. Another violence intervention program, Turning Point, reported that 11% of their 80 participants were recommended for a psychiatric evaluation, with the most common diagnosis being adjustment disorder (44%) and ASD (33%)²⁶. Loveland-Jones et al. also reported history of psychiatric disease among their population at 8.7%. Similar to Loveland-Jones et al., 11% of our intervention group (VOCARP users) utilized mental health services, which falls far below that of Juillard et al.: 51%. However, our rate of psychiatric history was far higher (43% overall compared to 8.7%).

This study has several limitations, the foremost being the lack of follow-up data for some patients; 298 patients

(20.8%) had less than 2 weeks of follow-up data available. This may have led to underreporting, particularly of new mental illnesses after injury, which required a diagnosis listed within the medical record. However, if patients had additional problems related to mental health or complications, it follows that they would likely follow-up with medical providers. Also, several institutions in the vicinity have linked hospital record systems, allowing for documentation of mental illness, recidivism, and other outcomes. Another limitation is the prospective but non-randomized design, as is seen in other violence intervention program literature. Subsequently, this could have introduced selection bias whereby patients with greater needs and at higher risk for mental illness, recidivism or poor outcomes elected to use services. VOCARP also represented an institution-wide transformation. Therefore, patients that were injured during the same timeframe but refused resources may have still benefited from a culture change within the hospital.

Mental illness represents a cumbersome barrier for patients recovering from violence-related traumatic injuries and is predictive of considerable morbidity thereafter. Among our study population, we observed drastically higher rates of mental illness, both preexisting and post-injury, when compared to national averages. Patients who utilized VOCARP services had higher rates of preexisting mental illness, but use of services was an independent predictor of lower odds of developing a new mental illness after injury. This preliminary investigation illustrates that programming for patients with violence-related injuries holds promise for decreasing the risk of psychiatric sequelae following injury.

References

1. Becher S, Smith M, Ziran B. Orthopaedic trauma patients and depression: a prospective cohort. *J Orthop Trauma* 2014;28:e242-246.
2. Wan JJ, Morabito DJ, Khaw L, Knudson MM, Dicker RA. Mental illness as an independent risk factor for unintentional injury and injury recidivism. *J Trauma* 2006;61:1299-1304.
3. Vranceanu A-M, Bachoura A, Weening A, Vrahas M, Smith RM, Ring D. Psychological factors predict disability and pain intensity after skeletal trauma. *J Bone Joint Surg Am* 2014;96:e20.
4. Muscatelli S, Spurr H, O'Hara NN, O'Hara LM, Sprague SA, Slobogean GP, O'Hara NN. Prevalence of depression and posttraumatic stress disorder after acute orthopaedic trauma: a systematic review and meta-analysis. *J Orthop Trauma* 2017;31:47-55.
5. Crichlow RJ, Andres PL, Morrison SM, Haley SM, Vrahas MS. Depression in orthopaedic trauma patients: prevalence and severity. *J Bone Joint Surg Am* 2006;88:1927-1933.
6. Kugelman D, Qatu A, Haglin J, Konda S, Egol K. Impact of psychiatric illness on outcomes after operatively managed tibial plateau fractures (OTA-41). *J Orthop Trauma* 2018;32:e221-5.
7. Weinberg DS, Narayanan AS, Boden KA, Breslin MA, Vallier HA. Psychiatric illness is common among patients with orthopaedic Polytrauma and is linked with poor outcomes. *J Bone Joint Surg Am* 2016;98:341-8.
8. Koleszar JC, Childs BR, Vallier HA. The prevalence of recidivism in trauma patients. *Orthopaedics* 2016;39:300-6.
9. Ophuis RH, Olij BF, Polinder S, Haagsma JA. Prevalence of post-traumatic stress disorder, acute stress disorder and depression following violence related injury treated at the emergency department: a systematic review. *BMC Psychiatry*. 2018;18(1):311.
10. Shalev AY, Gevonden M, Ratanatharathorn A, et al. Estimating the risk of PTSD in recent trauma survivors: results of the International Consortium to Predict PTSD (ICPP). *World Psychiatry*. 2019;18(1):77-87.
11. Joseph NM, Benedick A, Flanagan CD, et al. Prevalence of posttraumatic stress disorder in acute trauma patients. *OTA Int*. 2020;3(1):e056.
12. Rahtz E, Bhui K, Smuk M, Hutchison I, Korszun A. Violent injury predicts poor psychological outcomes after traumatic injury in a hard-to-reach population: an observational cohort study. *BMJ Open*. 2017;7(5):e014712.
13. National Network of hospital-based violence prevention programs. <https://www.thehavi.org/>. Accessed June 29, 2020.
14. Juillard C, Cooperman L, Allen I, et al. A decade of hospital-based violence intervention: Benefits and shortcomings. *J Trauma Acute Care Surg* 2016;81(6):1156-1161.
15. Smith R, Dobbins S, Evans A, Balhotra K, Dicker RA. Hospital-based violence intervention: risk reduction resources that are essential for success. *J Trauma Acute Care Surg* 2013;74(4):976-980.
16. Dicker RA, Jaeger S, Knudson MM, Mackersie RC, Morabito DJ, Antezana J, Texada M. Where do we go from here? Interim analysis to forge ahead in violence prevention. *J Trauma*. 2009;67(6):1169-1175.
17. Juillard C, Smith R, Anaya N, Garcia A, Kahn JG, Dicker RA. Saving lives and saving money: hospital-based violence intervention is cost-effective. *J Trauma Acute Care Surg*. 2015;78(2):252-257.
18. Aboutanos MB, Jordan A, Cohen R, Foster RL, Goodman K, Halfond RW, Poindexter R, Charles R, Smith SC, Wolfe LG, et al. Brief violence interventions with community case management services are effective for high-risk trauma patients. *J Trauma*. 2011;71(1):228-236.
19. Shibrú D, Zahnd E, Becker M, Bekaert N, Calhoun D, Victorino GP. Benefits of a hospital-based peer intervention program for violently injured youth. *J Am Coll Surg*. 2007;205(5):684Y689.
20. Gomez G, Simons C, St John W, et al. Project Prescription for Hope (RxH): trauma surgeons and community aligned to reduce injury recidivism caused by violence. *Am Surg*. 2012;78(9):1000-1004.
21. Bell TM, Gilyan D, Moore BA, et al. Long-term evaluation of a hospital-based violence intervention program using a regional health information exchange. *J Trauma Acute Care Surg*. 2018;84(1):175-182.
22. Becker MG, Hall JS, Ursic CM, Jain S, Calhoun D. Caught in the Crossfire: the effects of a peer-based intervention program for violently injured youth. *J Adolesc Health*. 2004;34(3):177-183.
23. Cheng TL, Haynie D, Brenner R, Wright JL, Chung SE, Simons-Morton B. Effectiveness of a mentor-implemented, violence prevention intervention for assault-injured youths presenting to the emergency department: results of a randomized trial. *Pediatrics*. 2008;122(5):938-946.
24. Cooper C, Eslinger DM, Stolley PD. Hospital-based violence intervention programs work. *J Trauma*. 2006;61(3):534-540.
25. Zun LS, Downey L, Rosen J. The effectiveness of an ED-based violence prevention program. *Am J Emerg Med*. 2006;24(1):8-13.
26. Loveland-Jones C, Ferrer L, Charles S, et al. A prospective randomized study of the efficacy of "Turning Point," an inpatient violence intervention program. *J Trauma Acute Care Surg*. 2016;81(5):834-842.

27. Corbin TJ, Purtle J, Rich LJ, et al. The prevalence of trauma and childhood adversity in an urban, hospital-based violence intervention program. *J Health Care Poor Underserved*. 2013;24(3):1021-1030.
28. Purtle J, Harris E, Compton R, et al. The psychological sequelae of violent injury in a pediatric intervention. *J Pediatr Surg*. 2014;49(11):1668-1672.
29. Vella MA, Warshauer A, Tortorello G, et al. Long-term Functional, Psychological, Emotional, and Social Outcomes in Survivors of Firearm Injuries [published online ahead of print, 2019 Nov 20]. *JAMA Surg*. 2019;155(1):1-9.
30. Wong EC, Marshall GN, Shetty V, Zhou A, Belzberg H, Yamashita DD. Survivors of violence-related facial injury: psychiatric needs and barriers to mental health care. *Gen Hosp Psychiatry*. 2007;29(2):117-122.
31. Caufeild J, Singhal A, Moulton R, et al. Trauma recidivism in a large urban Canadian population. *J Trauma*. 2004;57:872-876.
32. Rosenberger PH, Jokl P, Ickovics J. Psychosocial factors and surgical outcomes: an evidence-based literature review. *J Am Acad Orthop Surg*. 2006;14:397-405.
33. Anderson JT, Haas AR, Percy R, et al. Clinical depression is a strong predictor of poor lumbar fusion outcomes among workers' compensation subjects. *Spine (Phila Pa 1976)* 2015;40:748-756.
34. Simske NM, Audet MA, Kim CY, Benedick A, Vallier HA. Mental illness is associated with more pain and worse functional outcomes after ankle fracture. *OTA Int*. 2019;2:e037.
35. Simske NM, Benedick A, Rascoe AS, Hendrickson SB, Vallier HA. Patient Satisfaction Is Improved With Exposure to Trauma Recovery Services. *J Am Acad Orthop Surg*. 2019;10.5435.
36. O'Toole RV, Castillo RC, Pollak AN, MacKenzie EJ, Bosse MJ; LEAP Study Group. Determinants of patient satisfaction after severe lower-extremity injuries. *J Bone Joint Surg Am*. 2008 Jun;90(6):1206-1211.