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Healthcare utilization and mental health outcomes among nonfatal shooting assault victims

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ABSTRACT

Victims of nonfatal shooting (NFS) assaults suffer from emotional and physical trauma; however, little is understood about clinical care utilization patterns among victims. This study examines the healthcare utilization and mental health outcomes before and after an index NFS victimization. A longitudinal dataset of police and clinical data were linked at the individual level to define a cohort of NFS victims with one or more clinical encounter in the 24-months preceding an index NFS injury (N = 2,681) in Indianapolis, Indiana between 2005 and 2018. Mental health was defined using ICD diagnosis codes from any emergency department, inpatient, or outpatient encounter and clinical care utilization was the number of unique encounters within the 24-months preceding and following an index NFS injury. Multivariable logistic regression was conducted to examine factors associated with a mental health diagnosis in the post injury period. Analyses were conducted in October 2021-March 2022. Overall clinical care utilization (Mean: pre = 277.7 (SD 235.3) vs. post = 333.9 (SD 255.1), $p < 0.001$) and mental health prevalence (14.4% pre vs. 18.8% post, $p < 0.001$) increased in the 24-months following an index NFS compared to the prior 24-months. Preinjury mental health utilization increased the odds of receiving a mental health diagnosis in the 24-months following an index NFS injury – particularly for Black victims (Odds Ratio 1.69, 95% CI 1.01, 2.85). The findings indicate missed opportunities within the healthcare system to connect NFS victims with needed mental health services, as well as the importance of premorbid connection to mental health care.

1. Introduction

Firearm violence is a leading public health issue in the United States due to its significant toll on morbidity, mortality, and healthcare costs (Howell, 2013). In the US, approximately 34,538 fatal and 85,694 nonfatal firearm injuries occur annually with nonfatal shooting (NFS) assaults occurring at rates three times higher than fatal firearm assaults (Kaufman et al., 2021; Hipple and Magee, 2017). NFS assault victimization disproportionately affects young, Black males, and largely occurs in economically disadvantaged communities. NFS victimization is associated with multiple physical and mental health conditions. NFS victims frequently suffer from limited mobility, chronic pain, and routinely live with retained bullets in their body that require ongoing medical care, frustration, and stress (Lee, 2012; O'Neill et al., 2020; Lee, 2013). NFS victims often experience poor behavioral health outcomes such as posttraumatic stress disorder (PTSD), depression, substance use disorder, and are most at risk of suffering from repeat violent injury and subsequent death (Carter et al., 2015; Cunningham et al., 2015; Rowhani-Rahbar et al., 2015). Higher rates of NFS are also associated with adverse health outcomes at the community level compared to fatal shootings, contributing to the continued trauma and health disparities among marginalized individuals, families, and communities (Wintemute, 2015; Beard et al., 2017; Semenza, 2021; Semenza and Stansfield, 2021). Given the significant physical and mental health impact of firearm injuries a number of studies have attempted to quantify the healthcare cost and healthcare utilization patterns of firearm injuries

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but few have addressed how NFS victimization may change clinical care utilization patterns and mental health outcomes.

A growing body of literature demonstrates notable changes in clinical care utilization and mental health care utilization before and after nonfatal firearm injury, these studies are limited however due to differences in methodologies and populations. For instance, using health care claims data from five states, patients of all firearm injuries demonstrated an increase in health care costs, healthcare utilization, and mental health related visits in the six months post injury compared to the prior six-month period. The proportional increase is mental health visits was lower than overall utilization which may suggest disparities in access to mental health services among nonfatal firearm victims – particularly for Black victims (Ranney et al., 2020). Similar changes in mental health utilization were found in a study of pediatric nonfatal firearm victims using Medicaid MarketScan claims over six years. For example, youth with lower preinjury utilization had more mental health utilization post injury and youth with higher preinjury utilization had less mental health utilization post injury (Pulcini et al., 2021; Retraction. Acad Emerg Med., 2021). Similarly over one-third of pediatric nonfatal firearm victims had a mental health diagnosis prior the firearm injury and over a quarter were diagnosed with a new mental health condition in the year following firearm injury. The most prevalent diagnoses were for trauma, substance-related, impulse and conduct behavior disorders during inpatient and outpatient visits.

Although these studies demonstrate changes in mental health utilization post nonfatal firearm injury, their findings have limitations. The most important limitation of existing analyses is a lack of population level data on nonfatal firearm victims and clinical care utilization, specifically the absence of all clinical care encounters – emergency department, inpatient, and outpatient encounters – from multiple healthcare networks irrelevant of insurance status. Prior studies have largely been restricted to pediatric nonfatal firearm victims which limits our ability to access differences in care in the adult population. In addition, most existing analyses lack the ability to define assault related nonfatal shootings due to inaccurate clinical coding (Magee et al., 2021; Donnelly et al., 2022). Assault related nonfatal shootings demonstrate higher mean healthcare costs per clinical visit compared to unintentional firearm injuries (Bongiorno et al., 2021), but differences in mental health care utilization may exist.

The primary objective of this study is to examine clinical care utilization and mental health outcomes in the 24-months preceding and following an index NFS victimization. Our secondary objective was to determine what factors, if any, are associated with mental health diagnosis in the 24-months following the index NFS victimization. This study is positioned to answer these questions and overcome prior limitations because we have reliable data, linked at the individual level, on nonfatal shooting assaults defined from police data and clinical data including emergency department, inpatient, and outpatient encounters. These data allow us to provide a rigorous examination of preclinical care utilization patterns, mental health outcomes, and sociodemographic data on post injury mental health utilization and outcomes. It is imperative to understand clinical care utilization and mental health outcomes among NFS victims to better identify opportunities for connection to mental health care.

2. Methods

This study utilized police and clinical records on nonfatal shootings between January 1, 2007 and December 31, 2016 and clinical data between January 1, 2005 and December 31, 2018. Nonfatal shooting incidents were obtained in collaboration with the Indianapolis Metropolitan Police Department (IMPD), which provides policing services for over 90% of Marion County, Indiana. Electronic health record data from a large regional health information exchange were accessed via the Indiana Network for Patient Care (INPC). The INPC is the largest regional health exchange and contains patient-level data on over 17 million clinical records. Clinical records include patient demographics, clinical encounters for all inpatient, outpatient, and emergency department visits and associated diagnoses codes from all five hospital systems within Marion County (Indianapolis), Indiana. This study approval was obtained by the Indiana University Institutional Review Board.

2.1. Study procedures

Deterministic and probabilistic record linkages of IMPD and INPC records used individual identifiers (e.g., name, date of birth, sex, social security number, zip code) as part of a larger study that examines health inequalities among a justice involved population. The matching process included multiple steps to ensure true matches. First, deterministic algorithms with different combinations of identifiers were determined, then multiple probabilistic algorithms defined the probability of a match and lastly, research team members independently reviewed the probabilistic matching algorithms and assigned a rank. The most conversative rank defined the match. Further details on the linkage processes have previously been published (Magee et al., 2021; Magee et al., 2021).

2.2. Study population

All NFS assault victims (n = 2,681) defined from IMPD and clinical data (Magee et al., 2021) with one or more clinical encounter in the 24-months preceding an index NFS were included in the study population. A NFS assault is defined as an interpersonal criminal assault in which a projectile weapon with a powder discharge caused a penetrating injury (Beaman et al., 2000). Accidental, self-inflicted and police involved shootings were excluded. An "index" NFS victimization was determined as the first injury during the study time window. Clinical care utilization was defined as having one or more inpatient, outpatient, or emergency department (ED) encounter. Victims without one or more clinical encounter in the preceding 24-months of index NFS assault were excluded to measure change in clinical care utilization.

3. Measures.

3.1. Demographic Information

NFS victim sex, age, and race (Black, white, other) were gathered from police reports and clinical records. Victim age was calculated by using the date of index nonfatal shooting incident. Age categories were defined as: 0–14, 15–19, 20–24, 25–29, 30–34, and $\geq$ 35 years. Enrollment in Medicaid was defined as being enrolled in three or more months within the 24-months prior to index NFS using Medicaid claims data (Oddo et al., 2021).

3.2. Behavioral health utilization

The primary outcome was mental health utilization in the 24-months after the index NFS victimization. INPC clinical data defined mental health and substance use disorder diagnoses. All diagnosis codes per clinical encounter were coded based on Diagnostic and Statistical Manual (DSM) subgroups of ICD 9/10 diagnoses codes at time of inpatient, outpatient, or emergency department clinical encounter. Based on prior research of firearm injuries, eight categories for mental health were binary coded as: (1) psychosis disorder, (2) bipolar disorder, (3) depression disorder, (4) stress/post-traumatic stress disorder, (5) anxiety disorder, (6) disruptive behavior disorder, (7) neurodevelopment disorder, and (8) personality disorder (Oddo et al., 2021; Smith et al., 2020). Substance use disorder was defined using ICD 9/10 diagnoses codes at time of any clinical encounter (Magee et al., 2021). Mental health utilization was defined as having a mental health diagnosis during an emergency department, inpatient, or outpatient encounter.

3.3. Clinical care utilization

Clinical care utilization was defined as a unique clinical encounter by encounter id and encounter date when the victim was admitted for any clinical care in the emergency department, inpatient, or outpatient setting. We calculated the total number of clinical encounters per individual, defined as the sum of all emergency department, inpatient, and outpatient encounters. We removed the number of diagnoses to ensure we calculated the number of unique encounters not multiple diagnosis codes. We also calculated the total number of emergency department encounters, inpatient encounters, and outpatient encounters separately. Well visit was defined as an adult or pediatric wellness exam using ICD codes (Z000, V700, V708-V709, Z001, V201-V203).

3.4. Statistical analysis

Descriptive statistics were calculated for the cohort using demographic characteristics at the time of index NFS. We determined prevalence rates of mental health diagnoses in the 24-months preceding and following the index NFS victimization. Differences in mental health prevalence and clinical care utilization before and after index NFS victimization were evaluated with paired t-tests at a significance level of $p < 0.05$ and chi-square for categories of clinical care utilization. Lastly, multiple multivariable logistic regression models were conducted to examine which victim demographics, prior clinical care utilization and prior behavioral health diagnoses were associated with the odds of receiving mental health care post index NFS victimization. Interaction terms were individually included in the model to examine the relationship between preceding behavioral health care and race, sex, age, Medicaid status, and the odds of receiving mental health care post index NFS.

4. Results

There were 2,681 NFS victims with at least clinical encounter in the 24-months preceding the index NFS; 15% (n = 401) of which had a mental health encounter in the preinjury period. Victims were disproportionately Black (71.6%), 83.1% male, and 43.2% were enrolled in Medicaid in the 24-months preceding the index NFS (Table 1). Of those with a mental health encounter in the preinjury period, 65.6% were enrolled in Medicaid, 30% were between 15 and 19 years of age and 30% were 35 years and older. The mean number of clinical encounters increased post injury (pre = 277.7 (SD 235.3) vs. post = 333.9 (SD 255.1), $p < 0.001$). The largest increase was observed in the mean number outpatient encounters (pre = 198.1 (SD 142.9) vs. post = 255.9 (SD 186.7), $p < 0.001$), inpatient encounters (pre = 98.0 (SD 85.0) vs. post = 128.9 (SD 140.9), $p < 0.001$), whereas there was a decrease in the mean number of emergency department encounters (pre = 217.5 (SD 271.7) vs. post = 211.6 (SD 236.6), $p < 0.001$) in the 24 months following the index NFS. Mental health prevalence (14.4% pre vs. 18.8% post, $p < 0.001$), substance use disorder (10.5% pre vs. 15.5% post, $p < 0.001$), and co-occurring mental health and substance use disorder prevalence (5.59% pre vs. 7.80% post, $p < 0.001$) increased post NFS victimization. The most prevalent diagnoses post injury were depression disorders (6.60% pre vs. 10.4% post, $p < 0.001$), anxiety disorders (4.55% pre vs. 7.45% post, $p < 0.001$) and stress disorders (1.86% pre vs. 6.19% post, $p < 0.001$) (Table 2).

In logistic regression predicting a mental health diagnosis in the 24-months following an index NFS, a preinjury mental health diagnosis increased the odds of a post injury mental health diagnosis by nearly 5 times (OR 4.99, 95% CI 3.81, 6.54) compared to victims with no prior diagnosis (Table 3) and having Medicaid insurance (OR 2.28, 95% CI 1.78, 2.90) increased the odds of a mental health diagnosis in the post injury period. Victims 0 – 14 years of age, and victims 35 years or older (OR 1.43, 95% CI 1.04, 1.97) had an increased odds of receiving a

Table 1
Characteristics of Nonfatal Shooting Victims with one or more clinical encounters and mental health diagnosis in the 24-months prior to index firearm assault injury, 2005–2018.

Measures	Clinical Care Utilization Two-year Before Injury	Mental Health Utilization Two-year Before Injury
	n = 2,681 %	n = 401 %
Demographics		
Race		
Black	71.6	64.6
White	20.9	26.2
Other	6.27	5.24
Unknown	1.27	3.99
Sex		
Male	83.1	81.1
Female	16.6	18.9
Unknown	0.37	0.00
Age Group		
0–14	3.17	6.48
15–19	20.5	29.4
20–24	20.8	13.9
25–29	16.5	10.2
30–34	11.8	9.98
≥ 35p	26.9	29.9
Unknown	0.41	0.00
Medicaid	43.2	65.6

Table 2
Clinical Care Utilization of nonfatal firearm assault victims, with one or more clinical encounters prior to the index event two years pre-and-two post index firearm assault injury.

	Two-year Prevalence Rates	Two-year Prevalence Rates	
Measures	Before Index Nonfatal Firearm Injury n = 2,681 victims %	After Index Nonfatal Firearm Injury n = 2,681 victims %	p – value (95%)
Clinical Care Utilization Mean (SD)			
# Of prior emergency department encounters	217.5 (271.7)	211.6 (236.6)	p < 0.001
# Of prior inpatient encounters	98.0 (85.0)	128.9 (140.9)	p < 0.001
# Of prior outpatient encounters	198.1 (142.9)	255.9 (186.7)	p < 0.001
# Of total clinical care encounters	277.7 (235.3)	333.9 (255.1)	p < 0.001
Behavioral Health Diagnoses			
Substance Use diagnoses	10.5	15.5	p < 0.001
Any mental health diagnoses	14.4	18.8	p < 0.001
MH/SUD diagnoses	5.59	7.80	p < 0.001
Psychosis diagnosis	2.95	3.77	p < 0.001
Bipolar diagnosis	2.61	3.62	p < 0.001
Depression diagnosis	6.60	10.4	p < 0.001
Stress diagnosis	1.86	6.19	p < 0.001
Anxiety diagnosis	4.55	7.45	p < 0.001
Disruptive behavior disorder diagnosis	4.48	2.87	p < 0.001
Neurodevelopment diagnosis	3.95	3.13	p < 0.001
Personality disorder diagnosis	0.97	1.75	p < 0.001

SD = Standard deviation.

Table 3
Logistic Regression Results for Mental Health Diagnoses in the 24 months following an index NFS, 2005–2018.

Measures	OR (95% CI)	OR (95% CI)	OR (95% CI)
Demographics			
Race			
Black	**0.60 (0.47, 0.76)**	**0.58 (0.46, 0.73)**	**0.53 (0.40, 0.69)**
Non-Black	Reference	Reference	Reference
Sex			
Male	0.86 (0.65, 1.14)	0.79 (0.60, 1.05)	0.85 (0.65, 1.13)
Female	Reference	Reference	Reference
Medicaid Enrolled > 3 months	**2.28 (1.78, 2.90)**	**2.30 (1.81, 2.92)**	**2.24 (1.75, 2.85)**
Age Group			
0–14	**1.82 (1.03, 3.22)**	**2.02 (1.15, 3.54)**	**1.81 (1.02, 3.18)**
15–19	**0.65 (0.46, 0.95)**	0.73 (0.51, 1.05)	**0.65 (0.45, 0.95)**
20–24	Reference	Reference	Reference
25–29	0.75 (0.51, 1.12)	0.71 (0.48, 1.06)	0.76 (0.51, 1.12)
30–34	1.14 (0.76, 1.72)	1.17 (0.78, 1.75)	1.15 (0.77, 1.72)
≥ 35p	**1.43 (1.04, 1.97)**	**1.49 (1.09, 2.05)**	**1.43 (1.04, 1.97)**
Preinjury - Clinical Care Utilization			
Mental Health Utilization	**4.99 (3.81, 6.54)**	–	**3.52 (2.29, 5.44)**
Wellness Visit	1.31 (0.93, 1.83)	**1.56 (1.12, 2.18)**	1.32 (0.94, 1.85)
# Of prior emergency department encounters	**1.04 (1.01, 1.07)**	**1.04 (1.01, 1.06)**	**1.04 (1.01, 1.07)**
# Of prior inpatient encounters	**0.94 (0.89, 0.99)**	0.95 (0.90, 1.01)	**0.94 (0.89, 0.99)**
# Of prior outpatient encounters	**1.03 (1.01, 1.04)**	**1.02 (1.00, 1.04)**	**1.03 (1.01, 1.04)**
Preinjury – Behavioral Health Diagnoses			
Psychosis diagnosis	–	**1.27 (1.11, 1.44)**	–
Bipolar diagnosis	–	1.15 (0.98, 1.34)	–
Depression diagnosis	–	**1.11 (1.01, 1.22)**	–
Stress diagnosis	–	1.03 (0.89, 1.19)	–
Anxiety diagnosis	–	1.10 (0.95, 1.27)	–
Disruptive behavior disorder diagnosis	–	1.04 (0.96, 1.12)	–
Neurodevelopment diagnosis	–	**1.11 (1.02, 1.23)**	–
Personality disorder diagnosis	–	**2.03 (1.09, 3.80)**	–
Substance Use Disorder	–	1.03 (0.97, 1.10)	–
Interactions			
Black & Pre mental health utilization			**1.69 (1.01, 2.85)**

OR = Odds Ratio | CI = Confidence Interval | Bolded values = $p < 0.05$|.
NFS = Nonfatal Shooting.

mental health diagnosis, whereas victims 15–19 years of age had decreased odds (OR 0.65, 95% CI 0.46, 0.95) compared to victims 20–24 years of age. Black victims had 40% lower odds (OR 0.60, 95% CI 0.47, 0.76) of receiving a mental health diagnosis compared to White victims, when adjusting for prior clinical care utilization (Table 3).

Victims with a diagnosis for psychosis disorder (OR 1.27, 95% CI 1.11, 1.44), depression disorders (OR 1.11, 95% CI 1.01, 1.22), neurodevelopment disorders (OR 1.11, 95% CI 1.02, 1.23), and personality disorders (OR 2.03, 95% CI 1.09, 3.80) in the preinjury period had higher odds of receiving a mental health diagnosis in the 24-months following an index NFS victimization when adjusting for victim demographics and clinical care utilization. To better understand post injury mental health utilization patterns, we included several interactions by preinjury mental health utilization, victim race, sex, age, and Medicaid status. Preinjury mental health utilization for Black victims (OR 1.69, 95% CI 1.01, 2.85) increased the odd of receiving a mental health diagnosis in the 24-months post index NFS when adjusting for age, sex, and prior clinical care utilization. No differences between age, sex, or Medicaid status on preinjury mental health utilization were observed on post injury mental health diagnosis.

5. Discussion

Our study used police and clinical data linked at the individual level to assess overall clinical care utilization and associated mental health diagnoses among victims of NFS in the 24-months preceding and following an index NFS injury. Key findings indicate overall clinical care utilization and prevalence rates for mental health increased in the post injury period, compared to preinjury. Despite higher clinical care utilization postinjury, only one-third of victims received a mental health diagnosis suggesting missed opportunities within the clinical system for connection to mental health services. Additionally, having a mental health diagnosis prior to index nonfatal shooting injury increased the likelihood of receiving a mental health diagnosis in the postinjury period, and differences were observed by victim race and age.

Pre-victimization prevalence rates for mental health and substance use disorder were 15% or less for this cohort and 6% for co-occurring mental health and substance use disorder, with the most prevalent diagnoses being for depression, disruptive behavior disorder, and anxiety. Postinjury prevalence rates increased for both mental health and substance use disorder diagnoses by nearly 5%, while co-occurring mental health and substance use disorder increased by 2.21%. Like preinjury rates, depression and anxiety were the most prevalent, additionally, stress disorders (i.e., PTSD) increased after the index NFS by 4%. These rates are considerably lower than national estimates of 20.6% for the adult population, however, post injury co-occurring mental health and substance use disorder is nearly 4% higher than the national estimate (3.8%) (Illness NAoM. Mental Health by the Numbers. Published, 2021).

A contribution of this study is to highlight that having a mental health diagnosis prior to index nonfatal shooting injury increased the likelihood of receiving a mental health diagnosis in the postinjury period – particularly among Black victims. This is important given Black victims disproportionately represent shooting victims and differing perspectives on mental health stigma and obtaining mental health care exists among Black communities (Bringewatt and Gershoff, 2010; Cook et al., 2017; Wong et al., 2017). Additionally, many NFS victims report traumatic interactions with police and health care providers, due to aggressive questioning about the NFS event, blurred distinctions of police and healthcare workers and due to stigmatization by hospital personnel (Jacoby et al., 2018; Patton et al., 2019). These experiences can lead to mistrust in the healthcare system and impact victims desire to seek follow up care, unless they have a prior trusted provider.

Our findings also demonstrate older victims were more likely to be connected to mental health services post injury, whereas victims 15–19 years of age were less likely to receive a mental health diagnosis compared to victims 20–24 years of age. Pulcini and colleagues observed a similar decrease post injury mental health visits among youth but reasons for the decrease in mental health utilization post injury remains unclear (Pulcini et al., 2021). Such age disparities may speak to access to mental health services and parental decision making regarding when and if youth are connected to mental health services (Neufeld et al., 2021), as parents report not knowing when their child may need such services (Bringewatt and Gershoff, 2010). Whereas older victims are more likely to suffer from anxiety, depression and bipolar disorder (CfDCaPaNAoCD, 2008), and other chronic conditions (Maccarrone et al., 2021), and therefore may be connected with a healthcare provider

for needed services post NFS. Older victims may have experienced more cumulative trauma and respond differently to the NFS compared to youth and young adults (Atwoli et al., 2016). As suggested by Oddo and colleagues, these findings further support a need for age specific guidelines for mental health follow up as there are currently no established guidelines for mental health follow up for NFS victims (Oddo et al., 2021).

Clinical based programs currently exist to connect shooting victims with needed mental health services. For instance, Hospital-Based Violence Prevention Programs (HVIP) seek to optimize the unique window of time in the ED to connect victims to wrap around services with a goal of reducing repeat injury (Bell et al., 2018). HVIP programs demonstrate reductions in repeat injuries among program enrollees, however HVIPs do not focus solely on mental health services and over half of HVIPS programs report they do not have access to adequate mental health services for their program enrollees (Rosen et al., 2019; Bonne et al., 2022). Future research should partner with more specific mental health programs. For example, a Community Violence Response Team (CVRT), works in conjunction with the HVIP but focuses on providing free, ongoing mental health services outside the managed care system and follow up continues weekly until the patient engages in care or requests the follow up be stopped. Evaluation of the CVTR indicates an increase in mental health services and continued utilization for three-fourths of pediatric patients aged 0–21 years (Neufeld et al., 2021).

Although our study is not able to determine need for healthcare versus access to health care, our findings do indicate NFS victims are accessing the clinical system both before and after an index firearm injury. Given that unhealed trauma can lead to future involvement in violence as both the victim and offender (Turner et al., 2019), and that youth trauma victims are at highest risk for long-term mental health readmissions (Parreco et al., 2018), it is imperative to identify other opportunities within the clinical system and community to better connect individuals with mental health services, if needed. Primary care and emergency department encounters may be an opportunity to screen and connect victims with mental health services (Rosen et al., 2019; Abaya et al., 2019; Ngo et al., 2019), however more research is needed to evaluate such programs (Roszko et al., 2016). There is also a growing body of research that demonstrates community exposure to firearm violence increases adverse mental health outcomes due to the trauma exposure (Vasan et al., 2021; Leibbrand et al., 2020). Therefore, it is also important to develop and maintain community partnerships to broaden the scope of mental health services for victims of firearm violence and work to connect victims with community groups who are providing mental health care within a setting that may be more comfortable for victims versus a hospital setting (Radez et al., 2021). Such services should also be expanded to the larger community who also suffer from adverse mental health and other health outcomes due to the high rate of firearm violence to help reduce health inequalities, unhealed trauma, and future firearm violence.

6. Limitations

This study has limitations. First, our study links police and clinical data that includes comprehensive inpatient and ED encounters with capture of most outpatient encounters, though some encounters may be missing or unmatched due to inaccurate data or smaller clinics that do not share data with the local health information exchange (Gichoya et al., 2012; Dixon et al., 2013). NFS victimizations not reported to police may be missing from our study, however, due to mandatory reporting laws (Gupta, 2007), police data provide more complete records than clinical data (Magee et al., 2021; Kaufman et al., 2019; Post et al., 2019), Secondly, other health conditions may influence healthcare utilization patterns and we did not assess the number of diagnoses by race. Such encounters could be opportunities to screen and connect patients with needed behavioral health services, which is clearly a deficient given the low mental health prevalence among our cohort. A more severe injury may increase the need for postinjury care; however, injury severity score is maintained in trauma registry data which are limited, given not all NFS victims are included (Magee et al., 2021), therefore our use of police data allows us to examine the emotional impacts of less serious injuries (Schreier et al., 2005). Third, the index NFS victimization may not be the first NFS if the prior preceded our study period, though our data covers 10 years. Fourth, we limited our cohort to NFS victims with clinical care utilization within the preceding 24-months to assess differences before and after the index NFS, therefore our findings likely underestimate victims connected with care and mental health prevalence rates following the index NFS. There were 936 NFS victims with no clinical encounters within the 24-months before the index NFS but had 5,784 visits in the 24-months after and 7.36% had a mental health diagnosis. Fifth, there may be an increase in the family-wise error rate across the reported statistical analyses which was not controlled for, however, these findings are largely descriptive and preliminary (Perneger, 1998; Nakagawa, 2004). More rigorous statistical tests should be examined in the future and with different sources of data. Lastly, this study only covers one urban jurisdiction. These findings speak to the utility in combining administrative datasets and the need for a national NFS victimization dataset to further evaluate these relationships (Wardell et al., 2020).

7. Conclusions

Our study demonstrates overall clinical care utilization and mental health prevalence increased in the 24-months following an index NFS injury; however only one-third of victims had a mental health diagnosis in the post injury period. Additionally, having a mental health diagnosis prior to index nonfatal shooting injury increased the likelihood of receiving a mental health diagnosis in the postinjury period – particularly among Black victims. These findings indicate missed opportunities within the healthcare system to connect NFS victims with needed mental health services, as well as the importance of premorbid connection to mental health care.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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