Differences in Mental Health Engagement and Follow-up among Black and White Patients after Traumatic Injury

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Abstract

Background: Severe injury necessitating hospitalization is experienced by nearly three million U.S. adults annually. Posttraumatic stress disorder (PTSD) and depression are prevalent clinical outcomes. The mechanisms by which programs equitably promote mental health recovery among trauma-exposed patients are understudied. We evaluated clinical outcomes and engagement among a cohort of Black and White patients enrolled in the Trauma Resilience and Recovery Program (TRRP), a stepped-care model to accelerate mental health recovery after traumatic injury.

Methods: TRRP is a four-step model that includes (1) bedside psychoeducation about mental health recovery following traumatic injury; (2) a text-messaging symptom tracking system; (3) a 30-day post-injury mental health screen; and (4) referrals to mental health services. Data describe

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1550 patients enrolled in TRRP within a Level I Trauma Center (M_{age} = 40.86; SD = 17.32), 611 of whom identified as Black (74.5% male) and 939 of whom identified as White (67.7% male).

Results: Enrollment in TRRP was nearly universal (97.9%) regardless of race or injury mechanism. Enrollment and usage of the text-message system was statistically similar between Black (35.7%) and White (39.5%) patients. TRRP re-engaged Black and White patients at a similar rate at the 30-day post-injury follow-up. However, Black patients were more likely to report peritraumatic distress at the bedside and clinical elevations in PTSD and depression on the 30-day screen. Referrals were more likely to be accepted by Black patients relative to White patients with clinically elevated symptoms.

Conclusion: Enrollment and engagement were comparable among Black and White patients served by TRRP. Data provide preliminary evidence to suggest that TRRP is feasible, acceptable, and engages patients in mental health follow-up equitably. However, research is needed that includes careful measurement of social determinants of health and long-term follow-up examining initiation, completion, and benefit from treatment.

Level of Evidence: Level III, Therapeutic

Keywords

Annually, nearly three million U.S. adults sustain injuries requiring hospitalization.[1] Posttraumatic stress disorder (PTSD) or depression is experienced by more than 20% of traumatic injury patients within a year of injury.[2] Racial disparities exist in psychosocial outcomes, with national statistics indicating higher lifetime prevalence of PTSD and lower likelihood of mental health treatment seeking among racial and ethnic minority groups relative to Whites.[3] These findings underscore the critical need for mental health programs in trauma care that are equitable in access and quality.

Most trauma centers do not have mental health programs despite tremendous need,[4,5] and equity in mental health care among trauma patients is understudied. Research has uncovered disparities in mechanism of injury, outcomes, and treatment seeking.[6–8] For example, Black individuals have greater risk of violent injury (e.g., physical assault, gunshot wounds) compared to White individuals, who are more likely to experience unintentional injury (e.g., car crashes, serious falls).[9,10] Systemic and structural barriers that disproportionately expose Black communities and other historically marginalized racial and ethnic groups to harmful social conditions such as poverty, racism, educational and occupational disadvantages, and community violence account for these differences[11–13] and raise risk for violent trauma and adverse outcomes. Adverse social conditions also may encumber mental health treatment seeking and engagement among Black and other systematically disadvantaged populations,[14–16] leaving depression, PTSD, and other diagnoses untreated. This may help to explain why Black individuals experience a higher prevalence of PTSD relative to other racial and ethnic groups,[3,17] and highlights the need for systemic and person-centered interventions that enhance equity in screening and promotion of mental health recovery.[4,18]

Stepped-care models are a viable means to facilitate mental health care after trauma.[19,20] Stepped-care models are systems of delivering treatment so that the most effective, least resource-intensive services are delivered first, "stepping up" to intensive/specialist services only as needed. Stepped care models that address PTSD and functional outcomes after injury reduce psychosocial impairment through risk screening, targeted services, and treatment when symptoms persist.[21] These models have high acceptability, cost-efficiency, and adaptability, which may enhance potential to promote health equity and access to care. We launched the *Trauma Resilience and Recovery Program (TRRP)* in 2015 in our trauma center, a multidisciplinary, evidence-based stepped care model that has been found to be acceptable and successful in engaging patients in mental health services.[22,23] TRRP includes: (1) bedside education and enrollment in mental health follow-up; (2) an automated text messaging system to support symptom self-monitoring and mental health recovery; (3) a 30-day screen to identify patients who exceed clinical thresholds for PTSD and/or depression; and (4) referral to mental health treatment for patients with elevated screens.[23]

Evaluation of TRRP and other mental health programs is needed with respect to equity in mental health access and service engagement among traditionally underserved patients. Thus, we examines clinical outcomes and patient engagement among Black and White trauma patients at each step of our model. The overarching goal of this line of research is to identify strategies that may promote or fail to achieve equitable trauma care and uncover opportunities to improve equity in access and quality of care.

Method

This paper examines differences between adult Black and White patients aged 18 and over in TRRP engagement in our American College of Surgeons-verified Level I trauma center in the southeastern US. Data on overall patient engagement in TRRP are described elsewhere.[23] We limited our comparison to Black and White patients because we did not have adequate sample size in other underserved and minority populations (e.g., racial/ ethnic minority groups, sexual and gender minority groups) to explore group differences. This study conforms with the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) Equator Network guideline and a complete checklist has been uploaded as Supplemental Digital Content (SCD Table 1).

Program Description and Procedures

The steps of TRRP consist of in-hospital education, symptom self-monitoring, 30-day mental health screening, and mental health referrals when indicated.[23]

Step 1: In-hospital education and enrollment in TRRP.—A customized electronic medical record report generated daily from the hospital's trauma registry was used to identify patients admitted 24 hours after a traumatic injury. Patients were excluded if they were in police custody or had injuries that prevented participation (e.g., head or spinal cord injuries preventing verbal communication). Patients who had self-afflicted injuries or were actively suicidal also were excluded because alternative hospital-based services are in place to address their needs. Patients were approached at the bedside by a TRRP staff member and provided a brief overview of our program, administered a brief risk

screen (Peritraumatic Distress Inventory, described below), and provided education about post-injury mental health recovery (approximately 10–15 min). Staff members primarily were clinical psychology pre-doctoral interns, postdoctoral fellows, or master's-prepared clinicians under the supervision of licensed clinical psychologists.

Step 2: Automated text-based system to track mental health recovery.—

Symptom tracking via text-messaging systems is acceptable and feasible among traumatic injury patients following hospital discharge.[24,25] The goal is to increase emotional awareness and engagement in services downstream and to mitigate mental health symptoms.[26] Thirty (one per day) symptom-tracking texts were received by patients who enrolled in this step of TRRP. The system consisted of 10 symptom-tracking items (e.g., "During the past week, about how much of the time did you feel hopeless?") that were each administered 3 times on a rotating schedule over the 30-day post-discharge period (e.g., item 5 was administered on days 5, 15, and 25). The full list of items is reported elsewhere.[24] A basic text-based platform was used to ensure access by patients who had cellphones but not smartphones.

Step 3: Completion of telephone-based 30-day mental health screen.—A brief

(~15 min) mental health screen for symptoms of PTSD and depression was administered by TRRP staff via telephone approximately 30 days post-injury. Patients with clinically significant symptoms were provided basic psychoeducation about mental health symptoms, best-practice psychological treatments, and referral options. A 30-day timeframe is used because a high percentage of patients with elevated distress after trauma recover naturally without need for intervention; "watchful waiting" and self-monitoring (Step 2) is therefore an appropriate, evidence-based approach.[23] This is also consistent with PTSD diagnostic criteria such that PTSD cannot be diagnosed until a 30-day period post-event has passed.

Step 4: Referral to mental health treatment.—Mental health treatment referrals

were provided to patients with clinically elevated symptoms of PTSD and/or depression. Options included in-person or telehealth-based services with TRRP clinicians or referral to community agencies based on patient preference, geography, and waitlist. Patients who preferred telehealth treatment were asked if they owned telehealth-compatible technology and provided an internet enabled iPad if needed. Patients requiring services for other behavioral health conditions (e.g., substance use treatment) were referred to community-based mental health clinics.

Measures

Peritraumatic distress.—The *Peritraumatic Distress Inventory* (PDI)[27] is a 13-item self-report measure of distress during and shortly after a traumatic event (e.g., "I felt afraid for my own safety"). The PDI was administered in hospital at the bedside (Step 1). Items are rated on a 5-point scale (0=*Not at all true* to 4=*Extremely true*). Total scores range from 0–52; with a total score ≥ 23 indicating clinically elevated distress. The PDI demonstrated adequate internal consistency (α=.84).

Posttraumatic stress.—The *PTSD Checklist for DSM-5* (PCL-5)[28] is a measure of PTSD symptoms and severity administered at the 30-day phone screen (Step 3). The PCL-5 consists of 20 items assessing how bothered individuals have been by PTSD symptoms over the past month (e.g., "avoiding memories, thoughts, or feelings related to the stressful experience"). Items are rated on a 5-point scale (0=*Not at all* to 4=*Extremely*). Total scores range from 0–80; scores ≥ 33 indicate clinical significance. The PCL-5 demonstrated excellent internal consistency (α=.95).

Depression.—The *Patient Health Questionnaire* (PHQ-9)[29] is a 9-item measure to assess depression symptom severity over the prior two weeks (e.g., "little interest or pleasure in doing things"). The PHQ-9 is administered at the 30-day phone screen (Step 3). Items are rated on a 4-point scale (0=*Not at all* to 3=*Nearly every day*). Total scores range from 0–27; scores ≥ 10 indicate clinical significance. The PHQ-9 demonstrated adequate internal consistency (α=.91).

Data Analysis

Preliminary analyses were conducted to describe the sample (see Table 1). Next, we conducted a series of binary logistic regressions (see Tables 2 and 3) examining the extent to which race predicted: (1) injury mechanism, (2) clinically significant symptoms during admission and approximately 30 days post-discharge, and (3) patterns of patient engagement in TRRP and treatment modality preferences (i.e., in-person versus telehealth services).

Results

We identified and attempted to approach at the bedside 1689 traumatic injury patients (of 6500 in the trauma registry) between the launch of the program in September 2015 and May 2018, 659 (39%) Black and 1030 (61%) White. Of these, we approached and formally enrolled 1012 patients (60%) at bedside (411 Black and 601 White patients). Another 538 patients (200 Black, 338 White) were enrolled informally via a process instituted early in 2016 in which we mailed a discharge letter to patients missed at the bedside with an option to "opt out" of TRRP 30-day follow-up screening. The average age among all enrolled patients (*n*=1550) was 40.86 years (*SD*=17.32) for Black patients and 50.01 years (*SD*=21.00) for White patients; most patients were male (74.5% Black; 65.7% White).

Table 1 describes mechanism of injury by race. Black patients were more likely to experience injuries as a result of gunshot wounds/stabbing (*b*=2.67, *p*<.001, *OR*=14.52, 95% CI=8.95–23.56) and less likely than White patients to experience injuries related to motor vehicle collisions (*b*=–0.45, *p*<.001, *OR*=0.64, 95% CI=0.51–0.79) and falls (*b*=1.07, *p*<.001, *OR*=0.34, 95% CI=0.24–0.49). See Table 2 for comparisons across all types of traumatic injury.

Step 1: In-hospital education and enrollment in TRRP services

Nearly all patients approached at bedside enrolled in TRRP (1012 of 1034; 97.9%) and there were no differences between Black and White patients (*b*=0.68, *p*=.17, *OR*=1.96, 95% CI=0.75–5.16). The PDI was completed by 656 patients at the bedside (64% and 65% of

TRRP-enrolled Black and White patients, respectively). Clinically elevated peritraumatic distress was reported by 68.4% of Black patients (n=180) and 56.7% of White patients (n=223), with mean distress scores being higher among Black (M=21.77, SD=12.66) than White patients (M=18.10, SD=11.54; b=0.63, p<.001, OR=1.87, 95% CI=1.33–2.62). Supplementary analyses addressing mechanism of injury indicated that Black (b=−1.42, p=.03, OR=0.24, 95% CI=0.07–0.89) and White (b=−0.77, p=.01, OR=0.46, 95% CI=0.25–0.85) patients who experienced serious falls had lower risk of clinically elevated peritraumatic distress, whereas Black patients who experienced penetrating trauma (e.g., gunshot wounds, stabbing) had the highest risk (b=0.60, p<.05, OR=1.82, 95% CI=1.01–3.31).

Step 2: Automated text-based system to track mental health recovery

As described in a previous analysis of patient engagement,[24] roughly two-thirds of patients enrolled in the text-messaging service. More than half of enrollees (57%) responded to at least one message and 30% responded to at least half of the messages. The average number of responses was 15.9 (SD=1.9) over the 30-day period. Retention was found to be high among engagers, as response rates were fairly consistent across the 30-day period: the average number of patient responses was 5.7 during the first 10 days, 5.3 during the second 10 days, and 4.9 during the third 10 days. Data indicated that 35.7% of Black patients enrolled and used the system *vs.* 39.5% among White patients, a non-significant difference.

Step 3: Completion of telephone-based 30-day mental health screen

We attempted to contact all 1550 TRRP-enrolled patients for the 30-day screening. Of these, the 30-day screen was completed by 242 of 611 (39.6%) Black and 377 of 939 (40.1%) White patients; there were no significant differences between the two groups (b=−0.06, p=.59, OR=0.94, 95% CI=0.76–1.17). Twenty-two (3.6%) Black and 81 (8.6%) White patients refused the phone screen, 14 (2.2%) Black and 29 (3.0%) White patients were ineligible (e.g., deceased, cognitive impairment, imprisoned), one Black and one White patient were unable to be screened due to a language barrier, and the remaining 332 (54.3%) Black and 451 (48.0%) White patients were lost to follow-up. Notably, engagement in the 30-day screen was considerably higher for patients who were approached at the bedside at Step 1 (45.4% among White patients and 43.8% among Black patients) *vs.* patients who were missed but sent letters post-discharge (31.6%, p=.001), but this did not vary significantly by racial group membership. Individuals who experienced penetrating trauma were less likely to be reached at 30 days (b=−0.61, p=.034, OR=0.55, 95% CI: 0.31–0.96) than patients who experienced other types of injuries. Completion of the 30-day screen was not associated with other types of trauma.

Positive 30-day screens for PTSD were identified for 102 (42.5%) Black patients and 83 (21.7%) White patients, and positive depression screens were identified for 99 (41.8%) Black and 116 (31.0%) White patients. Black patients were more likely than White patients to exceed clinical cut scores for PTSD (b=0.89, p<.001, OR=2.43, 95% CI=1.67–3.53) and depression (b=0.37, p=.04, OR=1.45, 95% CI=1.02–2.07). Table 4 describes 30-day screening results by mechanism of injury across racial groups.

Step 4: Referral to assessment and best practice mental health treatment

Treatment recommendations were accepted by most Black (87.3%, n=89) and White (71.7%, n=76) patients who screened positive for PTSD or depression on the 30-day screen, but Black patients with clinically elevated symptoms were more likely than their White counterparts to accept treatment recommendations (b=0.96, p=.01, OR=2.62, 95% CI=1.23–5.58). No differences were found in relation to mechanism of injury. Of those with clinically significant symptoms, 7 (6.4%) Black and 11 (9.4%) White patients reported that they were already receiving mental health care at the time of our call and, therefore, did not need a referral. Home-based telehealth services were preferred over office-based, in-person services, by the majority of Black (66.3%) and White (68.5%) patients who accepted treatment through our program. Race was not associated with preference for telehealth *vs.* office-based in-person services, p=.79.

Discussion

Disparities in mechanism of injury and psychosocial outcomes are well documented, but there is a paucity of research investigating equity in clinical outcomes and patient engagement within trauma related mental health programs. We aimed to examine equity in our clinical service and examined racial differences in clinical outcomes and patient engagement within our four-step model of mental health care. Results indicated that there were no differences in TRRP enrollment between Black and White patients (Step 1), nor were there differences in patient engagement in the text-based system that tracked mental health recovery (Step 2). Further, engagement in 30-day mental health screening differed based upon mechanism of injury; patients with violent injury (e.g., gunshot) were less likely to complete the screen. Engagement in post-discharge mental health screening did not differ as a function of race. Data also revealed that elevated mental health distress at the bedside was more likely to be reported by Black patients than White patients (Step 1), and similar differences were found on the 30-day screen (Step 3) with Black patients reporting greater mental health difficulties (i.e., PTSD and depression). Finally, mental health treatment recommendations were accepted by most patients who screened positive for PTSD or depression, with most preferring telehealth services (Step 4). Importantly, however, Black patients were 26% *more* likely than White patients to accept mental health treatment recommendations. Together, these data provide preliminary evidence to suggest that TRRP equitably engaged patients in mental health follow-up after traumatic injury.

Racial Differences in Trauma Type and Enrollment in TRRP Services

Consistent with previous literature,[17,30] we found that the mechanism of injury differed as a function of race. Specifically, Black patients were more likely to present with injuries resulting from gunshot wounds and stabbings, whereas White patients were more likely to experience injuries related to motor vehicle collisions and falls. Trauma mechanism was not associated with TRRP enrollment among Black or White patients. In fact, enrollment was roughly 98% across the sample regardless of trauma type or race.

Such success in enrollment may represent a byproduct of our bedside engagement strategy, which may reduce treatment seeking barriers, especially among marginalized populations,

by providing services in the context of ongoing care.[31] Indeed, bedside contact can facilitate opportunities to introduce mental health services and provide psychoeducation, while simultaneously creating space for providers to listen and quickly respond to patient concerns, build trust, and problem-solve without undue burden. This collaborative process can promote long-term engagement following discharge.[32] Notably, although Black patients were more likely to report elevated distress at first contact, they were equally likely to enroll in TRRP relative to White patients, which suggests that when opportunities to engage in treatment are equitable (i.e., absent of barriers), engagement disparities may decline.

Racial Differences in Engagement in Text-Based Symptom Tracking

A growing body of research has found that health-related text-messaging services and technology-based resources are feasible and well received in diverse populations[33,34] with engagement and use patterns being comparable across racial and ethnic groups. National data also suggest that Black adults are more likely than Whites to use smartphones to seek health-related information online.[35] This is consistent with our finding that use of the text messaging system did not differ as a function of race, and consistent with previous research demonstrating that digital mental health approaches may be useful for engaging trauma exposed patients in mental health symptom monitoring and recovery.[36] However, their potential to reduce racial and ethnic disparities in clinical outcomes is unclear and needs to be examined.

Racial Differences in Post-Discharge Mental Health Screen

Black and White patients completed their 30-day screen at comparable rates, with both groups having higher completion rates among patients who were successfully approached and engaged at bedside. Such findings indicate that bedside engagement strategies may have significant downstream benefits related to patient retention and follow-up. Long-term retention strategies start from the initial point of contact, which can directly influence the likelihood that patients return for follow-up visits, complete post-discharge screenings, and engage in other mental health care services after discharge.[23] Although these data are encouraging, it is important to highlight that long-term engagement for the 30-day screen was significantly lower among gunshot victims, a group that was disproportionately Black.

Victims of gun violence and other penetrating traumas experience high rates of PTSD after injury, and frequent and intensive mental and physical healthcare needs that can hamper adaptive recovery post discharge.[37,38] The recovery process for gunshot victims is further compounded by the fact that such individuals are often expected to return to the community where the injury occurred following discharge, with few structural, psychological, or emotional resources to support their reintegration, despite the increased risk for revictimization and reinjury.[39,40] Consequently, such individuals may need greater forms of support that exceed what was available to patients at the time of this work. Therefore, it is possible that our attempts to contact survivors of firearm violence were perceived as burdensome given the host of other challenges that these patients are tasked with negotiating post-discharge.

Such findings are critical for bolstering the efficacy and reach of TRRP moving forward and suggest that partnerships with hospital-based violence intervention programs (HVIPs) and community-based violence-reduction programs are warranted to reach victims of gunshot injury more equitably. HVIPs and community-based violence-reduction interventions that target individual (e.g., social support, socio-emotional functioning) and environmental (e.g., stable housing, unemployment) risk factors for reinjury may be particularly effective in reducing violence-related injury and revictimization.[41–43] These programs often employ credible messengers from communities impacted by violence that form trusting relationships with patients and may have greater ability to encourage and facilitate mental health service follow-up. Among the many services that HVIPs provide, helping patients secure mental health services is a key component of reducing violent injury recidivism.[44] More importantly, there is a greater need for community-based violence prevention programs, policies and community investments that can reduce the root causes of violence and decrease rates of violent injury.

Racial Differences in Acceptance of Mental Health Treatment Referrals

Treatment referrals were accepted by most patients who screened positive for PTSD and/or depression regardless of race, signifying that TRRP has strong potential to link high-risk patients to mental healthcare services. We also found that patients preferred telehealth services, with over half of all patients enrolled indicating preference for home-based telehealth treatment relative to in-person service recommendations. Patients' preferences for telehealth may be driven, in part, by perceptions that it is less demanding on time, travel, and cost, which may be particularly important considerations as individuals are recovering from traumatic injuries.[45]

Importantly, and counter to literature suggesting that Black individuals may be less likely to seek mental health services, we found that Black patients were 26% more likely than White patients to accept treatment recommendations. Differences in treatment recommendation acceptance may reflect greater interest in mental health services among Black compared to White patients. However, it will be important to examine barriers and facilitators to treatment acceptance as well as engagement and completion of treatment once referred. These data provide promising preliminary evidence to suggest that the approach used to engage patients in TRRP can enhance access to mental health services among historically underserved populations.

Limitations

Limitations are as follows. First, we did not collect information regarding pre-injury symptoms; therefore, it is possible that the peritraumatic and 30-day follow up differences in mental health symptoms may have been correlated with pre-injury mental health status, cumulative lifetime trauma exposure, and/or other underlying mental health conditions. This is particularly relevant for racial and ethnic minority populations who are exposed to trauma across the life course at disproportionate rates and report higher rates of trauma related symptoms compared to non-minority populations.[10,46] Second, our analyses were limited to comparisons between Black and White patients, in part, because these data were collected with relatively small patient subsamples in the context of a clinical service

that did not include careful measurement of key drivers of risk and social determinants of inequity (e.g., racism, poverty, cumulative trauma, community violence, socioeconomic status). Equity in access, engagement, and clinical outcomes need be examined in relation to these drivers as well as among a more representative sample of underserved populations (e.g., racial/ethnic minority groups, sexual and gender minority groups, rural populations) to more accurately identify structural targets that may reduce inequities. Third, we did not have the resources to collect long-term data relating to treatment initiation, completion, or mental health trajectories beyond the 30-day screen. Thus, although we have provided compelling evidence to illustrate that TRRP enrollment is associated with high interest in mental health services, the extent to which patients follow through with accepted referrals remains unclear, as does the extent of clinical improvement after receiving services. Fourth, contact rates at Step 3 were modest because there was limited staffing for our service during the period of study. This limited our statistical power and confidence in generalizability to our full population of patients.

Conclusion

We found comparable enrollment and engagement in mental health follow-up services among Black and White patients served by our Level I trauma center. Black patients had higher rates of peritraumatic distress at the bedside and clinically elevated symptoms via the 30-day screen, but also that Black patients with clinically elevated symptoms were more likely to accept treatment recommendations than White patients with clinically elevated symptoms. The structure of our program appears – at least initially – to be feasible and acceptable in promoting equitable access to mental health services after injury. However, because we did not collect data more than 30 days post-injury, little is known about whether these findings carry forward to treatment initiation, completion, and benefit. Research is needed to examine the long-term impact of TRRP and other mental health programs as they relate to reach, efficacy, health equity, and quality. It will also be important to examine the effects of early screening and intervention on patients' mental health and engagement in care using mixed methods approaches, as well as develop implementation strategies to integrate violence intervention initiatives that address the multifaceted needs of survivors of violent injury including facilitation of mental health services follow-up, and ultimately aim to prevent repeat trauma and violence. Future work should focus on developing interventions that prevent the inequitable experience of trauma and violence, and buffer the impact of cumulative trauma and geographic and systemic factors that may play a role in mental health disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Source of Funding:

References

1. WISQARS (Web-based Injury Statistics Query and Reporting System) Injury Center. CDC. Published July 1, 2020. Accessed October 12, 2021. https://www.cdc.gov/injury/wisqars/index.html

2. Zatzick D, Jurkovich GJ, Rivara FP, Wang J, Fan MY, Joesch J, et al. A national US study of posttraumatic stress disorder, depression, and work and functional outcomes after hospitalization for traumatic injury. Ann Surg. 2008;248(3):429–437. [PubMed: 18791363]

3. Roberts AL, Gilman SE, Breslau J, Breslau N, Koenen KC. Race/ethnic differences in exposure to traumatic events, development of post-traumatic stress disorder, and treatment-seeking for post-traumatic stress disorder in the United States. Psychol Med. 2011;41(1):71–83. [PubMed: 20346193]

4. Love J, Zatzick D. Screening and intervention for comorbid substance disorders, PTSD, depression, and suicide: A trauma center survey. Psychiatr Serv. 2014;65(7):918–923. [PubMed: 24733143]

5. Guess KE, Fifolt M, Adams RC, Ford EW, McCormick LC. Life after trauma: A survey of level 1 trauma centers regarding posttraumatic stress disorder and acute stress disorder. J Trauma Nurs. 2019;26(5):223–233. [PubMed: 31503192]

6. Crutcher CL, Fannin ES, Wilson JD. Racial disparities in cranial gunshot wounds: Intent and survival. J Racial Ethn Health Disparities. 2016;3(4):687–691. [PubMed: 27294759]

7. Haider AH, Weygandt PL, Bentley JM, Monn MF, Rehman KA, Zarzaur BL, et al. Disparities in trauma care and outcomes in the United States: A systematic review and meta-analysis. J Trauma Acute Care Surg. 2013;74(5):1195–1205. [PubMed: 23609267]

8. Alber DA, Dalton MK, Uribe-Leitz T, Ortega G, Salim A, Haider AH, et al. A multistate study of race and ethnic disparities in access to trauma care. J Surg Res. 2021;257:486–492. [PubMed: 32916501]

9. McLaughlin KA, Alvarez K, Fillbrunn M, Green JG, Jackson JS, Kessler RC, et al. Racial/ethnic variation in trauma-related psychopathology in the United States: a population-based study. Psychol Med. 2019;49(13):2215–2226. [PubMed: 30378513]

10. Stephens KA, Sue S, Roy-Byrne P, Unützer J, Wang J, Rivara FP, et al. Ethnoracial variations in acute PTSD symptoms among hospitalized survivors of traumatic injury. J Trauma Stress. 2010;23(3):384–392. [PubMed: 20564368]

11. Loberg JA, Hayward RD, Fessler M, Edhayan E. Associations of race, mechanism of injury, and neighborhood poverty with in-hospital mortality from trauma. Medicine (Baltimore). 2018;97(39).

12. Williams DR, Collins C. Racial residential segregation: A fundamental cause of racial disparities in health. Public Health Rep. 2001;116(5):404–416. [PubMed: 12042604]

13. Sanders-Phillips K, Settles-Reaves B, Walker D, Brownlow J. Social inequality and racial discrimination: Risk factors for health disparities in children of color. Pediatrics. 2009;124(Supplement 3):S176–S186. [PubMed: 19861468]

14. Bernard DL, Calhoun CD, Banks DE, Halliday CA, Hughes-Halbert C, Danielson CK. Making the "C-ACE" for a culturally-informed adverse childhood experiences framework to understand the pervasive mental health impact of racism on Black youth. J Ch Adol Trauma. 2021;14(2):233–247.

15. Kawaii-Bogue B, Williams NJ, MacNear K. Mental health care access and treatment utilization in African American communities: An integrative care framework. Best Pract Ment Health. 2017;13(2):11–29.

16. Lester K, Artz C, Resick PA, Young-Xu Y. Impact of race on early treatment termination and outcomes in posttraumatic stress disorder treatment. J Consult Clin Psychol 2010;78(4):480–489. [PubMed: 20658805]

17. López CM, Andrews AR, Chisolm AM, de Arellano MA, Saunders B, Kilpatrick DeanG. Racial/ethnic differences in trauma exposure and mental health disorders in adolescents. Cultur Divers Ethnic Minor Psychol. 2017;23(3):382–387. [PubMed: 27786496]

18. Mersky JP, Topitzes J, Langlieb J, Dodge KA. Increasing mental health treatment access and equity through trauma-responsive care. Am J Orthopsychiatry. Published online 2021.

19. Zatzick D, Roy-Byrne P, Russo J, Rivara F, Droesch R, Wagner A, et al. A randomized effectiveness trial of stepped collaborative care for acutely injured trauma survivors. Arch Gen Psychiatry. 2004;61(5):498–506. [PubMed: 15123495]

20. Zatzick D, Rivara F, Jurkovich G, Russo J, Trusz SG, Wang J, et al. Enhancing the population impact of collaborative care interventions: mixed method development and implementation of stepped care targeting posttraumatic stress disorder and related comorbidities after acute trauma. Gen Hosp Psychiatry. 2011;33(2):123–134. [PubMed: 21596205]

21. Giummarra MJ, Lennox A, Dali G, Costa B, Gabbe BJ. Early psychological interventions for posttraumatic stress, depression and anxiety after traumatic injury: A systematic review and meta-analysis. Clin Psychol Rev. 2018;62:11–36. [PubMed: 29754102]

22. Ridings LE, Anton MT, Winkelmann J, Davidson TM, Wray L, Streck CJ, et al. Trauma resilience and recovery program: Addressing mental health in pediatric trauma centers. J Pediatr Psychol. 2019;44(9):1046–1056. [PubMed: 31298276]

23. Ruggiero KJ, Davidson TM, Anton MT, Bunnell B, Winkelmann J, Ridings LE, et al. Patient engagement in a technology-enhanced, stepped-care intervention to address the mental health needs of trauma center patients. J Am Coll Surg. 2020;231(2):223–230. [PubMed: 32335320]

24. Bunnell BE, Davidson TM, Winkelmann JR, Maples-Keller JL, Ridings LE, Dahne J, et al. Implementation and utility of an automated text messaging system to facilitate symptom self-monitoring and identify risk for post-traumatic stress disorder and depression in trauma center patients. Telemed J EHealth. 2019;25(12):1198–1206.

25. Davidson TM, Bunnell BE, Ruggiero KJ. An automated text-messaging system to monitor emotional recovery after pediatric injury: Pilot feasibility study. Psychiatr Serv. 2017;68(8):859–860.

26. Kauer SD, Reid SC, Crooke AHD, Khor A, Hearps SJC, Jorm AF, et al. Self-monitoring using mobile phones in the early stages of adolescent depression: Randomized controlled trial. J Med Internet Res. 2012;14(3):e1858.

27. Brunet A, Weiss DS, Metzler TJ, Best SR, Neylan TC, Rogers C, et al. The peritraumatic distress inventory: A proposed measure of PTSD criterion A2. Am J Psychiatr. 2001;158(9):1480–1485. [PubMed: 11532735]

28. Weathers FW, Litz BT, Herman DS, Huska JA, Keane TM. The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility. In: Annual Convention of the International Society for Traumatic Stress Studies, San Antonio, TX. Vol 462. San Antonio, TX; 1993.

29. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606–613. [PubMed: 11556941]

30. Sheats KJ, Irving SM, Mercy JA, Simon TR, Crosby AE, Ford DC, et al. Violence-related disparities experienced by Black youth and young adults: Opportunities for prevention. Am J Prev Med. 2018;55(4):462–469. [PubMed: 30139709]

31. Christian-Brandt AS, Santacrose D. Adapting PCIT to address mental health care disparities among underserved families impacted by pediatric illness: A case series of bedside PCIT. Clin Pract Pediatr Psychol. 2020;8(2):164–175.

32. Petrie M, Zatzick D. Collaborative care interventions in general trauma patients. Oral Maxillofac Surg Clin North Am. 2010;22(2):261–267. [PubMed: 20403558]

33. Doshi R, Aseltine RH, Sabina AB, Graham GN. Interventions to improve management of chronic conditions among racial and ethnic minorities. J Racial Ethn Health Disparities. 2017;4(6):1033–1041. [PubMed: 29067651]

34. Price M, Yuen EK, Davidson TM, Hubel G, Ruggiero KJ. Access and completion of a web-based treatment in a population-based sample of tornado-affected adolescents. Psychol Serv. 2015;12(3):283–290. [PubMed: 25622071]

35. Racial Anderson M. and ethnic differences in how people use mobile technology. Pew Research Center. 2015;30.

36. Price M, van Stolk-Cooke K, Brier ZMF, Legrand AC. mHealth solutions for early interventions after trauma: improvements and considerations for assessment and intervention throughout the acute post-trauma period. Mhealth. 2018;4:22. [PubMed: 30148137]

37. Greenspan AI, Kellermann AL. Physical and psychological outcomes 8 months after serious gunshot injury. J Trauma Acute Care Surg. 2002;53(4):709–716.

38. Vella MA, Warshauer A, Tortorello G, Fernandez-Moure J, Giacolone J, Chen B, et al. Long-term functional, psychological, emotional, and social outcomes in survivors of firearm injuries. JAMA Surg. 2020;155(1):51–59. [PubMed: 31746949]

39. O'Neill KM, Vega C, Saint-Hilaire S, Jahad L, Violano P, Rosenthal MS, et al. Survivors of gun violence and the experience of recovery. J. Trauma Acute Care Surg 2020;89(1):29–35. [PubMed: 32118821]

40. Patton D, Sodhi A, Affinati S, Lee J, Crandall M. Post-discharge needs of victims of gun violence in Chicago: A qualitative study. J Interpers Violence. 2019;34(1):135–155. [PubMed: 27638688]

41. Branas C, Buggs S, Butts J, Harvey A, Kerrison E, Meares T, et al. Reducing violence without police: A review of research evidence. Publications and Research. Published online November 9, 2020. https://academicworks.cuny.edu/jj_pubs/349

42. Dicker RA, Thomas A, Bulger EM, Stewart RM, Bonne S, Dechert TA, et al. Strategies for trauma centers to address the root causes of violence: Recommendations from the improving social determinants to attenuate violence (ISAVE) workgroup of the American college of surgeons committee on trauma. J Am Coll Surg. 2021;233(3):471–478.e1. [PubMed: 34339811]

43. Bonne S, Hink A, Violano P, Allee L, Duncan T, Burke P, et al. Understanding the makeup of a growing field: A committee on trauma survey of the national network of hospital-based violence intervention programs. Am J Surg. Published online August 2, 2021.

44. 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):976–80. [PubMed: 23511134]

45. Gunter RL, Chouinard S, Fernandes-Taylor S, Wiseman JT, Clarkson S, et al. Current use of telemedicine for post-discharge surgical care: A systematic review. J Am Coll Surg. 2016;222(5):915–927. [PubMed: 27016900]

46. Pole N, Gone JP, Kulkarni M. Posttraumatic stress disorder among ethnoracial minorities in the United States. Clin Psychol Sci Prac. 2008;15(1):35–61.

Table 1

Demographic Data, Clinical Outcomes, and Treatment Engagement of Enrolled Patients

	Black (n=611)	White (n=939)
Age: *M* years (*SD*)	40.86 (17.32)	50.01 (21.00)
Sex: *n* (%)		
Male	455 (74.5%)	617 (65.7%)
Female	156 (25.5%)	322 (34.3%)
Race: *n* (%)	611 (39.4%)	939 (60.6%)
Type of Traumatic Injury: *n* (%)		
Motor Vehicle Crash	303 (49.6%)	526 (56.0%)
Fall	49 (8.0%)	255 (27.2%)
Pedestrian vs. Auto	44 (7.2%)	53 (5.6%)
Gunshot Wound/Stabbing	168 (27.5%)	20 (2.1%)
Assault	19 (3.1%)	16 (1.7%)
Other	28 (4.6%)	69 (7.3%)
Outcome Measure: *M* (*SD*)		
PDI	21.77 (12.66)	18.02 (11.42)
PCL-5	27.62 (22.05)	18.45 (18.67)
PHQ-9	8.73 (7.63)	6.70 (6.71)
Clinical Significance: *n* (%)		
Peritraumatic Stress (PDI)	123 (47.7%)	120 (31.7%)
Posttraumatic Stress (PCL-5)	102 (42.5%)	83 (21.7%)
Depression (PHQ-9)	99 (41.8%)	116 (31%)
Accept Treatment Referral: *n* (%)		
Yes	86 (78.9%)	73 (62.4%)
No	13 (11.9%)	30 (25.6%)
Other Provider	7 (6.4%)	11 (9.4%)
Referral	3 (2.8%)	3 (2.6%)
Treatment Modality: *n* (%)		
Telehealth	57 (66.3%)	50 (68.5%)
In-person	24 (27.9%)	20 (27.4%)
No Preference	5 (5.8%)	3 (4.1%)

Table 2

Race as a Predictor of Type of Traumatic Injury

	B	**SE**	**P**	**OR**	**95% CI**
Traumatic Injury: Motor Vehicle Accident (0 = No, 1 = Yes)					
Race	−0.45	.11	< .001[*]	0.64	0.51–0.79
Traumatic Injury: Fall (0 = No, 1 = Yes)					
Race	−1.07	.18	< .001[*]	0.34	0.24–0.49
Traumatic Injury: Pedestrian and Motor Vehicle Collision (0 = No, 1 = Yes)					
Race	0.25	.22	.25	1.29	0.84–1.97
Traumatic Injury: Gunshot Wound/Stabbing (0 = No, 1 = Yes)					
Race	2.67	.25	< .001[*]	14.52	8.95–23.56
Traumatic Injury: Assault (0 = No, 1 = Yes)					
Race	0.54	.35	.12	1.72	0.86–3.44
Traumatic Injury: Other (0=No, 1=Yes)					
Race	−0.60	.24	.01[*]	.55	0.35–0.87

Note. Race (0 = White, 1 = Black);

[*]
statistical significance ($p < .05$).

Table 3

Race as a Predictor of Clinical and Treatment Engagement Outcomes

	B	SE	P	OR	95% CI
Treatment Engagement Outcome: Enrolled during Hospital Visit (0=No, 1=Yes)					
Race	0.68	.49	.17	1.96	0.75–5.16
Clinical Outcome: Significant Peritraumatic Stress (0 = No, 1 = Yes)					
Race	0.63	.17	< .001 *	1.87	1.33–2.62
Treatment Engagement Outcome: Contacted at 30-day Follow-up (0 = No, 1 = Yes)					
Race	−0.06	.11	.59	0.94	0.76–1.17
Hospital Contact	0.58	.11	< .001 *	1.79	1.44–2.24
Clinical Outcome: Significant Posttraumatic Stress (0 = No, 1 = Yes)					
Race	0.89	.19	< .001 *	2.43	1.67–3.53
Clinical Outcome: Significant Depression (0 = No, 1 = Yes)					
Race	0.37	.18	.04 *	1.45	1.02–2.07
Treatment Engagement Outcome: Accept Referral (0 = No, 1 = Yes)					
Race	0.96	.39	.01 *	2.62	1.23–5.58
Hospital Contact	−0.48	.43	.27	0.62	0.27–1.44
Treatment Engagement Outcome: Preference for Telehealth (0=In-person, 1=Telehealth)					
Race	−.11	.38	.79	.90	0.43–1.88
Hospital Contact	.50	.40	.21	1.65	0.75–3.61

Note. Race (0 = White, 1 = Black); Hospital Contact (0 = No Contact, 1 = Contacted in the Hospital);

*
statistical significance ($p < .05$).

Table 4

Percent of Patients with PTSD and Depression at 30-day Follow-up

	Black Patients	
Trauma Type (*n*)	PTSD (%, *n*)	Depression (%, *n*)
MVC	36.9 (48)	33.6 (45)
Fall	17.6 (3)	29.4 (5)
Ped vs. Auto	44.4 (8)	44.4 (8)
GSW/Stab	56.4 (31)	54.7 (29)
Assault	50.0 (2)	50.0 (2)
Other	63.6 (7)	63.6 (7)

	White Patients	
Trauma Type (*n*)	PTSD (%, *n*)	Depression (%, *n*)
MVC	24.3 (55)	34.4 (77)
Fall	8.7 (8)	15.9 (14)
Ped vs. Auto	45.0 (9)	42.1 (8)
GSW/Stab	66.7 (4)	60.0 (3)
Assault	25.0 (1)	50.0 (2)
Other	12.5 (3)	36.0 (9)