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Dear Clinicaltrials.gov:

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Sincerely,

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A Comparative Effectiveness Trial of an Information Technology Enhanced Peer-Integrated Collaborative Care Intervention for US Trauma Care Systems: Study Protocol

I. Background. (**RQ-1**, Identify Gaps in Evidence, **PC-1** Engage people representing the population of interest and other relevant stakeholders in ways that are appropriate and necessary in a given research context.)
Physical injury, with and without traumatic brain injury (TBI), constitutes a major public health problem for US civilian and veteran trauma-exposed patients.[1-3] Each year in the United States, over 30 million individuals present to acute care medical emergency department and trauma center settings for the treatment of traumatic injury; annually 1.5-2.5 million Americans are so severely injured that they require inpatient hospitalization.[1,2,4] Estimates suggest that approximately 1.5-3.5 million American youth and adults experience TBI annually.[5,6] Traumatic injury is a leading cause of death for individuals under the age of 45, and accounts for approximately 12% of medical expenditures nationally and 9% of the burden of disease internationally.[3,7,8]

Injured trauma survivors constitute a "high need" patient population with multiple complex medical and mental health comorbidities, including posttraumatic stress disorder (PTSD).[9,10] Highly prevalent comorbidities include PTSD, depression and associated suicidal ideation, and chronic medical conditions such as hypertension, coronary artery disease, diabetes, and pulmonary disease.[11-14] A series of US prospective cohort investigations suggest that between 20-40% of physically injured trauma survivors may go on to develop symptoms consistent with PTSD after hospitalization for injury.[15-20]

After injury, PTSD and related comorbidities are associated with a broad profile of functional impairments, including diminished physical function and inability to return to work.[18,19,21-24] In both TBI and non-TBI patient populations, PTSD and depression independently account for post-injury functional impairments.[25,26] PTSD and comorbidities are associated with increased health care and societal expenditures.[27-31]

Physically injured trauma survivors with multiple comorbidities are at risk for fragmented care transitions and recurrent emergency department visits and hospitalizations.[32-46] Literature review suggests that injured trauma survivors are a key vulnerable patient population with regard to care transitions, including recurrent emergency department visits and hospitalizations. Recent study team investigation suggests that an increasing burden of mental health, substance use and chronic medical condition comorbidities are associated with an increasing risk of recurrent emergency department visits and hospitalizations in injured trauma survivors after an initial index injury admission.[14,47,48]

A series of PCORI position statements, Institute of Medicine reports, and Agency for Healthcare Research and Quality (AHRQ) systematic reviews provide support for the development and widespread implementation of health care system interventions targeting injured trauma survivors at risk for mental and physical health comorbidities and associated post-injury emotional distress (i.e. severe post-injury concerns and PTSD), functional impairments, and fragmented health service utilization.[9,49-52] PCORI guidelines emphasize the importance of patient-centered care transition enhancements and health care system technological innovations.[9] Interventions considered responsive to the PCORI Health Care Systems announcement include multidisciplinary teams that incorporate peer interventionists and novel statewide electronic health records.[9] Institute of Medicine reviews of the top 100 priority health care topics for comparative effectiveness research rank comprehensive care coordination programs targeting care transitions in the top 25 topics, and PTSD and depression in the top 50 topics.[49,50] Recent AHRQ reports stress the importance of screening and intervention development for trauma exposed patients at risk for the development of PTSD and related comorbid conditions.[51,52] These combined reviews identify current gaps in the evidence that will be addressed by the findings of the current investigation **(RQ-1)**.

Peer interventionists are becoming a mainstay of treatment delivery for multiple health conditions across diverse US healthcare systems. The potential contribution of peer interventionists in the delivery of high quality patient-centered care has been espoused across disease conditions; literature documents completed and ongoing studies of peer interventionists for the care of multiple conditions beyond injury.[53-61]

However, unlike other areas of clinical medicine, acute post-injury interventions have yet to comprehensively integrate patient peer interventionists. Initial studies in the rehabilitation literature suggest that peer interventionists may aid care transitions after severe spinal cord and traumatic brain injury.[62-65] Literature review, however, revealed no large scale, acute care medical comparative effectiveness trials that have integrated injured peer interventionists into multidisciplinary teams.

Collaborative care interventions hold promise for the integration of peer interventionists into multidisciplinary teams in the treatment of injured patients. Derived from the chronic care model, collaborative care interventions hold promise for the integration of treatment for patients with multiple chronic conditions within trauma care systems.[47,66-71]

A large body of research now has established the effectiveness of collaborative care in reducing depressive, anxiety, and pain related symptom presentations in primary care settings.[70,72-76]

Prior study team investigations document the effectiveness of collaborative care treatment models targeting reductions in posttraumatic concerns, PTSD symptoms, functional limitations, and related comorbidities for injured patients treated within trauma care systems.[47,67,68,71] Two recent trials have demonstrated the effectiveness of collaborative care treatment models that included front-line MD, nursing and social work providers in reducing PTSD symptoms and improving physical function.[67,71] These prior investigations document enhanced post-injury quality of care processes including enhanced care linkages and adherence to pharmacotherapy regimes.[47,67,68,71] Literature review revealed few collaborative care intervention trials in primary care settings and no comparative effectiveness trials in acute care settings that have integrated peer interventionists.[77]

The study team is currently involved in the widespread implementation of collaborative care interventions across US acute care medical trauma care systems.[78] A growing body of literature supports the potential for the widespread implementation of peer-integrated collaborative care interventions across US trauma care systems, should effectiveness be established by comparative effectiveness trials. Recent meta-analyses of over 70 collaborative care intervention trials conducted in general medical settings suggest effect sizes of approximately 0.25 for mental health symptoms (confidence interval 0.18-0.32).[72,79] Collaborative care interventions conducted in acute care medical settings targeting PTSD and related comorbid conditions have been shown to have greater effect sizes of approximately 0.34.[67,71] A number of civilian and military health care systems have adopted collaborative care intervention programs as standard practice; Current Procedural Terminology (CPT) codes now support the delivery and billing of collaborative care interventions in primary care settings.[80-82] Members of the study team are currently conducting a 25 site effectiveness-implementation hybrid cluster randomized trial designed to assess the impact of a national roll-out of collaborative care for US trauma care systems.[78] This national implementation study, however, does not incorporate peer interventionists into multidisciplinary teams.

Information technology innovations, including the Emergency Department Information Exchange (EDIE), can support the feasible and widespread implementation of peer-integrated collaborative care interventions for US trauma care systems.[44-46,83-85] In the study team's recently completed PCORI funded comparative effectiveness trial, EDIE was used to track emergency department utilization at the population level.[48] For the current trial, the EDIE system allows collaborative care team members to implement multisite electronic health care record innovations, such as the creation of care plans that can be viewed by emergency departments statewide.

Over the past two decades, the study team has completed a series of patient-centered investigations that provide key background for the current investigation; the study team began this work by asking large groups of injured patients, "Of everything that has happened to you since your injury, what concerns you the most?" (Measure Outcomes that People Representing the Population of Interest Notice and Care About, **RQ-6**)[69,86] In an initial 2001 study, a series of brief open-ended questions that allowed patients an unconstrained opportunity to describe their posttraumatic illness experiences were developed.[69,86] One or more posttraumatic concerns were readily elicited from 100% of randomly sampled injured trauma survivors and were easily followed over the course of the year after injury.[69,86] These open-ended concern responses were reliably coded into six content domains that included physical health, work and finance, social, psychological, medical and legal concerns. In a subsequent study, the patient-centered posttraumatic concern outcome assessment was extended to include concern severity.[86]

Between 2013-2016, study team members, including Co-Principal Investigators Douglas Zatzick, MD and Peter Thomas, JD, completed a PCORI-funded comparative effectiveness trial; this previous trial has established collaborative team engagement momentum upon which the current trial builds (**PC-1**).[47,48,87] Patient and peer stakeholder partners Peter Thomas, Mary Lou Walen, Stella Sieber, Scott Shields, Harry Teter and Heidi Hotz all participated in the development and roll-out of the prior PCORI funded trial. As has occurred or is proposed for the current investigation, member of this stakeholder gave input into the selection of research questions, the planning of the study, study implementation and monitoring and the dissemination of study results at policy summits.

The prior PCORI comparative effectiveness trial employed a social work staffed care transition intervention to successfully reduced the percentage of any severe post injury concerns endorsed by injured patients.[48] The prior PCORI funded comparative effectiveness trial randomized 171 acutely injured trauma survivors with high levels of emotional distress (i.e., ≥ 3 post-injury concerns and high levels of PTSD symptoms) to a care transition intervention (n=85) and nurse notification (n=86) conditions. A key intervention element was the elicitation and addressing of injured patients'

most immediate post-injury concerns. Care transition intervention patients demonstrated clinically and statistically significant reductions in the percentage of severe post-injury concerns when compared to nurse notification patients longitudinally (Wald Chi Square=11.29, $P< 0.05$).

As recommended by the study team patient stakeholder partners, including Peter Thomas, Patient Co-Principal Investigator, the study team conducted an additional study of an injured peer care transition intervention (**PC-1**). Seventy percent of patients participating in the prior trial endorsed wanting peer interventionists as part of their care transition team. Study team members trained Mary Lou Walen as a peer support interventionist. Training materials from the study team's care management intervention and American Trauma Society Trauma Survivors Network materials were integrated into the training.[88] The injured peer interventionist was supervised as the primary care transition case manager in a pilot study with 4 injured patients. The peer interventionist met with patients by the bedside in the hospital, and in outpatient clinics as well as talking over the phone as injured patients transitioned back to the community. The peer elicited and addressed concerns and provided care management navigation services. The patients rated their satisfaction with the peer as either satisfied or very satisfied. These preliminary data suggested the feasibility and acceptability of integrating a patient peer into a post-injury multidisciplinary team intervention framework.

Summary of evidence gaps and the potential for the investigation to address those gaps (RQ-1). Collaborative care models are well established as a gold standard intervention for treating combined mental health and chronic medical conditions in acute and primary care medical settings. Peer interventions are becoming a mainstay of treatment delivery for multiple health conditions across diverse US healthcare systems. As study team patient stakeholders have voiced, acute care medical trauma center settings have yet to comprehensively integrate patient peer interventionists into the multidisciplinary teams that currently care for injured patients. Institute of Medicine, PCORI and the Agency for Healthcare Research and Quality reviews support the need for comparative effectiveness trials of health care system interventions targeting high need injured patients with multiple complex mental health and medical comorbidities who are at risk for fragmented post-injury health service utilization.

II. Significance. (**RQ-3**, Identify Specific Populations and Health Decision(s) Affected by the Research, **PC-1** Engage people representing the population of interest and other relevant stakeholders in ways that are appropriate and necessary in a given research context, **RQ-6** Measure Outcomes that People Representing the Population of Interest Notice and Care About.)

American College of Surgeons' Committee on Trauma policy presence on the research team facilitates the understanding of nationwide implementation barriers and the integration of research results into regulations that guide US trauma center care. The College oversees the development of national policy mandates and clinical best practice guidelines that inform the integrated operation of US acute care medical trauma centers.[89,90] The study team has an established track record of using evidence derived from comparative effectiveness trials to inform College regulatory policy for alcohol screening and brief intervention mandates and PTSD screening and intervention best practice guidelines.[89,90]

Results of the prior PCORI trial[47,48] were presented at the study team-convened September 2016 policy summit; PCORI has summarized the summit proceedings as part of the "research-in-action" series;[87] the September 2016 summit, Co-Principal Investigator Peter Thomas and other study team patient stakeholders voiced the need for peer-integrated, multidisciplinary team, trauma care system interventions **(PC-1)**. The impetus for the current comparative effectiveness trial derives directly from our patient stakeholders' input while also integrating other key national policy and trauma care system stakeholder perspectives. American College of Surgeons regulatory policy has derived from comparative effectiveness trials that compare an active intervention (e.g., collaborative care) with a comparator that is widely implemented and considered a standard of care, thus informing the current two arm study design and choice of comparators.

Injured patients and their caregivers, front-line trauma center providers, and trauma care system policy makers need to better understand how peer-integrated interventions impact key post-injury outcomes **(RQ-6)**. The study team has selected key outcomes of great relevance to patients and their caregivers, front-line acute care providers and trauma surgical policy makers **(RQ-3).** The patient-centered outcome of posttraumatic concerns derives from patients' own concern narratives. Acute care medical emergency department/hospital health service utilization, PTSD symptoms and functional impairments have all been used in prior investigations that have influenced surgical policy stakeholders.[67,68,71] The current investigation seeks to answer the critical question, "Will a peer-integrated

multidisciplinary collaborative care intervention improve key outcomes of relevance to injured patients and their caregivers, as well as trauma center providers and policy stakeholders?"

III. Study Design. (**RQ-2** Develop a Formal Study Protocol, **RQ-4** Identify and Assess Participant Subgroups, **RQ-5** Select Appropriate Interventions and Comparators, **RQ-6** Measure Outcomes that People Representing the Population of Interest Notice and Care About, **PC-1** Engage People Representing the Population of Interest and Other Relevant Stakeholders in Ways that are Appropriate and Necessary in a Given Research Context, **IR-1** A priori, Specify Plans for Data Analysis that Correspond to Major Aims, **PC-4** Support Dissemination and Implementation of Study Results, **CI-I** Specify the Causal Model Underlying the Research Question, **SCI-2** Specify How Adaptations to the Form of the Intervention and Comparator Will be Allowed and Recorded, **SCI-3** .)

Design Overview. The overarching goal of this investigation is to develop and implement optimal peer-integrated collaborative care interventions for injured trauma survivors treated in US trauma care systems. Injured trauma survivors ≥ 18 years of age will undergo electronic health record (EHR) screening for high levels of emotional distress (i.e. severe post-injury concerns, PTSD symptoms).[91] Patients who are at risk on the EHR screen will be approached for informed consent. After informed consent is obtained, patients' posttraumatic concerns will be assessed and patients will be screened with the PTSD checklist;[92] patients with ≥ 1 severe posttraumatic concern and scores of ≥ 35 on the PTSD checklist will be randomized. A total of 424 patients will be randomized to peer-integrated collaborative care (n = 212) and surgical team notification (n =212) conditions. Intervention activity will continue for up to six months after the injury hospitalization, while follow-up continues for 12-months after the hospitalization. Emergency department use, patient concerns, PTSD symptoms, physical function and other outcomes will be assessed at 1-, 3-, 6-, 9- and 12-months after injury for all patients.

Specific Aims. This randomized comparative effectiveness trial aims to evaluate two readily implementable approaches to the delivery of transitional care for injured patients treated emergently in US trauma care systems. A multidisciplinary team collaborative care intervention that integrates front-line trauma center staff with peer interventionists will be compared with trauma surgical team notification of patient emotional distress with recommendation for mental health consultation. The collaborative care intervention will be supported by a novel emergency department health information exchange technology platform.

The primary aim of the investigation is to compare emergency department health service use, severity of patient concerns, PTSD symptoms and physical function for patients randomized to the two conditions. The study **hypothesizes** that patients receiving the peer-integrated collaborative care intervention, when compared to the surgical team notification condition, will demonstrate significant reductions in post-injury emergency department utilization as documented by EDIE data on the intent-to-treat sample. The investigation also hypothesizes the peer-integrated collaborative care intervention will be associated with significant reductions in the severity of post-injury concerns, as well as reductions in PTSD symptom levels, when compared to the surgical team notification condition. Improvements in physical function are also hypothesized for patients receiving the peer-integrated collaborative care intervention. Secondary analyses will assess the impact of traumatic brain injury, ethnic/racial diversity, and gender subgroup status on hypothesized treatment effects. **A secondary aim** of the study is to understand the care processes involved with the delivery of the peer-integrated intervention. **A final aim** of the investigation is for study team members to work with the American College of Surgeons' Committee on Trauma, board members of the American Trauma Society, and the PCORI Transitional Care Evidence to Action Network to better understand barriers to widespread implementation of study results. To facilitate this aim the study team will convene an American College of Surgeons policy summit in the final year of the contract.

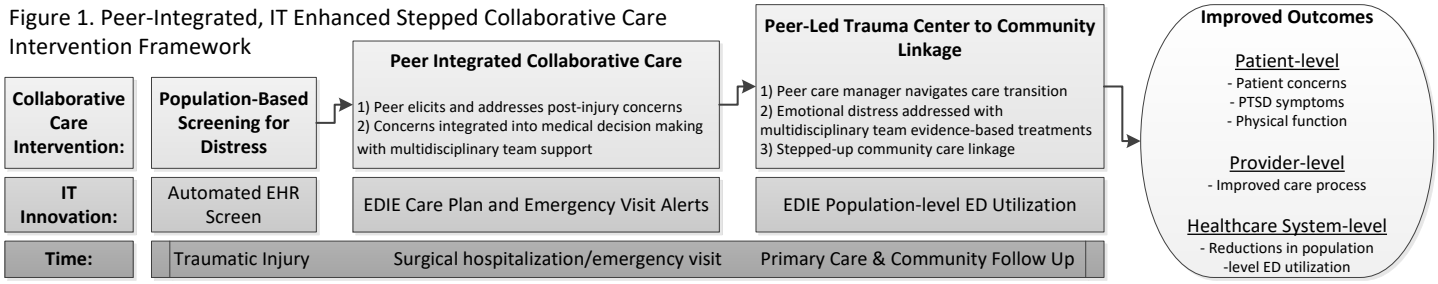
The project will be conducted in three Phases; in the first phase of the project, the project Co-Principal Investigators, Douglas Zatzick and Peter Thomas, convened the study team members with the goal of developing the peer intervention model. As in the prior PCORI study team project, patient, peer advocate and provider stakeholders will provide substantial input into all phases the project including input into the study design, review of study instruments and study protocols, development and implementation of the optimal peer intervention model, monitoring of the study as part of the data safety and monitoring board and planning and implementing the year 5 policy summit.

In Phase I of the study, input was obtained from stakeholders for the final selection of outcome assessments, review of recruitment and follow-up procedures, and refinement of patient and provider subject consent forms. A key focus of the Phase I treatment development activities was to obtain patient and other stakeholder input into the design and

implementation of an optimal peer intervention model. The Co-Principal Investigators have had a series of in-person and telephone discussions with injured peer, front-line provider, clinical researcher and trauma surgical policy maker stakeholders that will aim to better understand what study team members consider an optimal integrated peer intervention model **(PC-1)**. The randomized comparative effectiveness trial will be conducted in Phase II of the project. During Phase III of the investigation, in the final year of the contract, the Co-Principal Investigators, in collaboration with study team members Drs. Maier and Hoyt, will again convene an American College of Surgeons' policy summit **(PC-4).** The major goal of the summit will be to understand barriers to the implementation of study findings across US trauma care systems. As with prior summits, the planning will incorporate input from the Co-Principal Investigators, study team injured peer interventionists, front-line trauma center providers, and surgical policy maker stakeholders. As in Phase I, Rapid Assessment Procedures will again be employed to harness themes drawn from these multiple stakeholder conversations regarding potential barriers to widespread implementation of investigative results.[78,93-97]

The conceptual framework that links the peer-integrated collaborative care intervention with hypothesized treatment effects on key patient, provider and system level outcomes, in the context of study health information technology (IT) innovations is described in Figure 1.[9,37-39,41,44-46,48,98,99] The project follows guidelines for the conduct of comparative effectiveness trials developed by the PCORI Methodology Committee, including attempt to specify the causal modeling underlying the research question.[100] The peer-integrated collaborative care treatment model will bring together peer-led posttraumatic concern elicitation and care transition intervention elements with multidisciplinary (e.g., nursing, social work) team-supported, evidence-based psychotherapeutic and medication interventions targeting PTSD and related co-morbidities.

Figure 1. Peer-Integrated, IT Enhanced Stepped Collaborative Care Intervention Framework



The investigation will integrate injured peers as care managers with front-line acute care providers as part of a multidisciplinary team. In the hours, days, and weeks after injury, peer care managers will elicit patient post-injury concerns and target these concerns for amelioration while also working with other members of the intervention team to incorporate patient and caregiver preferences into medical decision making. Additionally, the peer will work to link injured patients' care from inpatient and emergency department settings to primary care and community services. Working with peers, front-line trauma center providers will simultaneously deliver evidence-based medication and psychotherapeutic elements to injured patients with high levels of PTSD and other symptoms. Evidence-based intervention elements will be delivered during routine post-injury patient encounters in trauma wards and emergency departments, in outpatient clinics, in community settings, and over the telephone.

A series of novel information technology features support the peer-integrated collaborative care intervention. The collaborative care treatment model begins with population-based screening for injured patients with high levels of emotional distress using a previously articulated 10-domain electronic health record screen.[91] The EDIE system allows collaborative care team members to implement electronic health care record innovations, such as the creation of care plans that can be viewed across sites.[83-85] EDIE also provides real-time work-flow integrated electronic alerts that allow collaborative team providers to be notified when injured patients make recurrent visits to the Harborview Emergency Department. Finally, EDIE allows the follow-up of population-level emergency department visits on the intent-to-treat sample. Furthermore, as in previous effective care transition interventions, injured patients will have 24/7 study team telephone and text access.[37,41,47]

The introduction of this peer-integrated, coordinated team activity into trauma center multidisciplinary teams may concurrently serve to not only enhance coordination between trauma and primary care and community settings but also improve outcomes of great relevance to injured patients and their caregivers including each patient's unique constellation of posttraumatic concerns **(RQ-6).** For front-line providers, supervised collaborative care intervention delivery may improve care processes, including fidelity to evidence-based counseling and medication treatments.[67,71]

Finally, from a trauma care system perspective, the peer-integrated collaborative care model may reduce unnecessary health service utilization.

IV. Selection of appropriate interventions and comparators (RQ-5). The two approaches to be compared are a peer-integrated collaborative care intervention versus trauma surgical team notification of patient emotional distress. The two approaches were selected, in part, as they can be feasibly implemented in the acute care medical context.[71,90,101] Also, the study team has an established track record of implementing screening and intervention procedures derived from comparative effectiveness trials through engagement of the American College of Surgeon as a stakeholder in regulatory policy.[89,90] Previous College policy relevant trials conducted by the study team have compared an active intervention (e.g., peer-integrated collaborative care) with a comparator that is widely implemented and considered a standard of care (e.g., trauma surgical team notification).[89,90] These prior successful College policy experiences inform the current choice of comparators. Below, the two approaches are described.

a. Peer-Integrated Collaborative Care Intervention. Previously injured peers will work alongside front-line acute care RN, MSW, MD, PhD, or other providers in the delivery of collaborative care. The peer-integrated collaborative care intervention is anticipated to last approximately six months from the time of the subjects' enrollment in the study. The collaborative care team may work to link injured patients' care from inpatient and emergency department settings to primary care and community services. Care coordination will include a series of intervention components that have been previously shown to improve acute care to primary care and community transitions. Injured patients randomized to the collaborative care intervention may be visited by the peer and/or other collaborative care team members while in the hospital. Peers/study team care managers will elicit and target for improvement each patient's concerns, needs, and preferences. Elements of the intervention may be delivered during routine post-injury patient encounters in trauma wards, emergency departments, outpatient clinics, community settings, over the telephone, through secure web-based audio/video conferencing (e.g., Zoom) or other electronic means. In prior investigations care management conversations derived from concern elicitation have spanned physical injury, work and finance, social (e.g., impact of injury on family and friends), legal, psychological and medical domains. Care managers are generally encouraged to discuss these topic areas with patients and then bring summaries of these discussions back to supervision meetings. For two topic areas that may derive from general concern discussions, psychotropic medication side effects and suicidal ideation/intent, peer case managers will receive specific training on the procedures for reporting back to the study team information derived from these specific topics. For psychotropic medication side effects, while peers may initially hear from patients about these symptoms, only MSW, MD, or other study team licensed providers will follow-up with formal psychotropic medication symptom assessments and recommendations.

The peer/care manager may ask about treatment preferences and schedule ongoing times to meet/call the patient. Whenever possible, with the injured patient's permission, family members and other primary post-injury caregivers will be incorporated into the care management intervention. The peer/care manager may also give the patient the study team's 24-hour/7 days per week telephone and text message contact number and encourage texts/calls for spontaneous questions, needs, and concerns. It is acknowledged that the study team may not always be able to immediately call or text patients back; in general, study team members will attempt to answer calls promptly, but response time may vary.

Collaborative care intervention team members may be trained in delivering evidence-based Motivational Interviewing (MI) and Cognitive Behavioral Therapy (CBT) elements during routine post-injury patient encounters in trauma wards, emergency departments, outpatient clinics, community settings, over the telephone, through secure web-based audio/video conferencing (e.g., Zoom) or other electronic means. A body of evidence supports the effectiveness of brief MI interventions targeting alcohol use problems. Flexibly delivered CBT interventions have been used to successfully target PTSD.

A novel information technology feature supports the peer-integrated collaborative care intervention. The Emergency Department Information Exchange (EDIE) system allows collaborative care team members to implement electronic health care record innovations, such as the creation of care plan notifications that provide the study team contact information for the care of individual patients that can be viewed across emergency department sites utilizing the system. EDIE also provides real-time work-flow integrated electronic alerts that allow collaborative team providers to be notified when injured patients make recurrent visits to an emergency department in the state of Washington, Alaska, California and Oregon.

Psychopharmacologic intervention, including the use of Serotonin Specific Re-uptake Inhibitor (SSRI) and Serotonin Norepinephrine Re-uptake Inhibitor (SNRI) antidepressants, are also recommended in the treatment of patients with PTSD and/or depression symptoms. The medication intervention component aims to initiate and ensure adequate follow-up of pharmacologic treatment targeting symptoms of PTSD and/or depression. Members of the study team may perform medication assessments, assessment of response to psychotropic medications, including side effects, medication recommendations to providers, and medication prescription in a number of settings including trauma inpatient wards, emergency departments, trauma surgery outpatient clinics, over the telephone, and in the community. For all psychotropic medication prescriptions, the collaborative care team will attempt to consult with inpatient, outpatient, or primary care providers with regard to medication recommendations. On occasion, when patient subjects have demonstrated symptomatic need/distress and cannot obtain timely prescriptions from a hospital, community or other provider study team members may prescribe psychotropic medication to patient subjects.

During Phase I intervention development, stakeholder input suggested that peers on the collaborative care team would initially perform as "Universalist" interventionists aiming to engage patients from diverse injury experiences and ethnic, cultural and linguistic backgrounds. The intervention team will also build in "stepped up" care procedures that facilitate linkages to more targeted peer experiences (e.g., amputee support groups, spinal cord injury programs). These stepped up referrals represent potential adaptations in the intervention condition that will be documented by the study team in REDCap notations **(SCI-3).**

Intervention Supervision (PC-1) A novel aspect of the intervention is that the peers will receive two types of supervision. The peers and other study team members will receive standard post-injury collaborative care clinical supervision delivered by Dr. Zatzick and potentially other study team members. These regular (e.g., weekly) supervisory sessions will review the progress of patients randomized into the protocol, the progress of the stepped care for intervention patients, and other topics. This regular caseload supervision will be facilitated by the study intervention data management tool (e.g., REDCap). This computerized data management system will be password protected and accessible only to study team members. As information is available in real time, the system can be used by intervention team supervisors to monitor and support the standardized implementation of the peer-integrated collaborative care management procedure.

The peers and potentially other study team members will also receive monthly peer/patient advocacy supervision from co-Principal investigators Peter Thomas, JD, and Douglas Zatzick, MD, or other members of the study Patient and Peer Stakeholder Advisory Group (e.g., Stella Sieber). Peter Thomas and other members of the Patient and Peer Stakeholder advisory group have prior experience conducting peer interventions/performing in the peer interventionist role. A likely form this supervision may take is the presentation of cases by one or more of the study peer interventionists (e.g., Mary Lou Walen) on the monthly stakeholder group call. Beyond patient case presentations, the experiences of the peers as interventionists will also be a key topic discussed on the calls.

b. Enhance Usual Care Control Condition. Trauma surgery team notification of patient emotional distress, with suggestions for mental health inpatient consultation (e.g., MD, PhD, MSW, addiction intervention, chaplaincy or other psychosocial consult service) will be the comparator condition. Surgical team notification of patient emotional distress with recommended mental health consultation constitutes a frequently employed, feasibly implemented comparator condition. Prior investigation documents that nationally between 50-80% of US acute care centers routinely provide mental health consultation for high levels of emotional distress (e.g., PTSD and depressive symptoms) and/or substance use (e.g., alcohol use problems).[101] Previous data collected at the Harborview level I trauma center demonstrates that of 207 patients with high PTSD symptom levels, 89% were seen by a social worker, 22% were seen by a chemical dependency counselor, 17% were seen by a clinical psychologist, and 8% were seen by a psychiatrist.[102] These multiple potential mental health referrals represent potential adaptations in the enhanced usual care control condition that will be documented in REDCap **(SCI-3).**

V. Study Procedures. (**PC-2** Identify, Select, Recruit, and Retain Study Participants Representative of the Spectrum of the Population of Interest and Ensure that Data Are Collected Thoroughly and Systematically from All Study Participants, **PC-3** Use of Patient-Reported Outcomes When Patients or People at Risk of a Condition Are the Best Source of Information for Outcomes of Interest, **IR 5** Provide Sufficient Information in Reports to Allow for Assessments of the Study's Internal and External Validity, **IR-6** Masking should be used when feasible, **MD-3** Record and Report All Reasons for Dropout and Missing Data, and Account for All Patients in Reports.)

Overview. Patients included in the study will be female and male survivors of intentional and unintentional injuries ages ≥ 18, who speak English and are admitted to the University of Washington's Harborview Level I Trauma Center inpatient surgical ward or emergency department for ≥ 24 hours. All injured patients will undergo electronic health record screening for high levels of emotional distress. A previously developed electronic medical record screen will be used to assess the population of admitted injured trauma survivors at risk for the development of PTSD.[91] The screen utilizes 10 data elements that are both associated with increased risk for PTSD and that are readily available in any robust EMR system; patients with ≥ 3 risk domains positive will be approached for informed consent. (see also Appendix). When the 10 data elements were used to predict scores on the PTSD Checklist of ≥ 35, the electronic medical record screen demonstrated adequate sensitivity (0.71), specificity (0.66), and area under the ROC curve (0.72).[91]

Inclusion Criteria. Patients determined to be at risk on the electronic health record screen will be approached for informed consent. After informed consent is obtained, patients will be screened for emotional distress; patients who score ≥ 35 on the PTSD checklist and endorse ≥ 1 severe posttraumatic concern will be randomized into the longitudinal portion of the investigation.[47,67,71] Prior to randomization, all patients will complete the full baseline assessment.

Exclusion Criteria. Patients will only be excluded if they required immediate psychiatric intervention (i.e., self-inflicted injury, active psychosis), or are determined to be too psychiatrically distressed to be randomized to the control condition without acute psychiatric/mental health intervention, are not Washington, Oregon, Alaska, or California State residents, or are currently incarcerated; patients that do not speak English will also be excluded from the protocol. The trial will only include English speaking patients as prior study team investigation has previously documented over 40 different languages spoken by Harborview patients making the translation of consent documents and scales in multiple different languages impractical.[103,104] Attempted consent for patients who are disoriented or delirious will be postponed; if a potential patient subject's combined score on the Glasgow Coma Scale (GCS)[105] is < 15 and/or questions 1 and 2 of Mini Mental Status Exam (MMSE)[106] is < 7, the baseline interview will be postponed. Patients whose most recent COVID-19 test was positive will also be excluded.

Non-Entry (MD-3). As in the previous PCORI funded projects, in order to document reasons for study non-entry, whenever patients decline participation, the recruiter will inquire as to why they did not want to participate. Answers will then be recorded verbatim; in prior investigation, patient reasons for refusal fell into one of 5 categories that included inconvenience, privacy concerns, not interested in the study, undo distress, and refusal without giving a reason.

Electronic Health Record 10 Domain PTSD Risk Factor Eligibility Screen. The study team will be accessing and obtaining PHI from Harborview electronic health records (EHR) for use in screening patient subjects. Each morning a study team member will review a list of all newly admitted injured patients with associated identifiable information and available 10 domain PTSD screening data. A computer algorithm or study team member will use the data collected from the EHR/Amalga to determine a patient's potential for study inclusion based on inclusion/exclusion criteria and the number of positive 10 domain PTSD risk factors. The 10 domain PTSD risk factor items pulled from the EHR are: 1) Gender (Female), 2) Race (non-White), 3) Insurance (Veteran insurance or no commercial insurance), 4) Treated in ICU during the injury admission, 5), BAC positive, or any substance disorder ICD from EHR, 6) Any psychiatric disorder ICD from EHR, 7) PTSD ICD from EHR, 8) Tobacco use, 9) Injury inflicted by another (i.e., intentional injury), 10) At least one prior hospitalization.

Baseline Interview and Further Eligibility Screening. The study team member will then administer the study eligibility screening questions on the baseline interview which includes concern and posttraumatic symptom assessments to each consenting subject. The concern assessment asks each subject "Of everything that has happened to you since you were injured, what concerns you the most?" Subjects will then be asked to rate the severity of each concern on a scale from one to five with one being not at all concerning and five being extremely concerning. Subjects will also go through the PTSD Checklist – Civilian Version (PCL-C) for DSM-IV. Subjects will screen into the randomized portion of the study if they have ≥ 1 severe posttraumatic concern and ≥ 35 on the PCL at the time of injury.

Randomization. After completing the baseline assessment, subjects are randomized to one of two active comparator conditions. A total of 424 patients will be randomized to either receive surgical team notification to initiate a mental health consultation (n =212), or receive a peer-integrated collaborative care intervention (n =212). Randomization will occur in a 1:1 ratio according to a computer-generated random assignment sequence in blocks of either 4 or 6 patients, prepared by the study biostatistician. After a patient has been randomized, a member of the study team will return to the hospital as soon as feasibly possible to inform the patient if he/she has been randomly assigned to the enhanced usual care or intervention condition.

Blinded telephone follow-up interviews. Patient-reported outcomes will be assessed at 1-, 3-, 6-, 9- and 12 months after the injury event by telephone interview. Telephone interviews have been found to be reliable and valid in the assessment patient reported outcomes for injured trauma survivors.[67,71,107] In order to minimize bias, the research assistants conducting the telephone follow-up interviews will be blinded to the patient's study group assignments **(IR-6).**

Follow-up Procedures. Injured trauma survivors admitted to safety net hospitals constitute a low-income, ethnoculturally diverse patient population that can present challenges for longitudinal retention in comparative effectiveness trials; the study team has developed specific methods to obtain high follow-up rates with this vulnerable patient population (**PC-2**).[108,109] In order to optimize retention of patients for follow-up interviews required for the patient-reported outcomes assessments, at the baseline interview patient subjects will be asked for phone numbers/addresses of at least two contact sources (e.g., friends or relatives). After a trauma, patient subjects sometimes relocate temporarily in order to receive better care, such as movement from independent living to a skilled nursing facility; many patients are also homeless. Therefore, in addition to contacting patient subjects through the information they provide during the initial baseline interview, the follow-up team will utilize several approaches to attempt to stay in touch with patient subjects across the study window. All the approaches described below are only attempted for patients who consent to these procedures. The approaches are**:** 1) Contacting other people in the patient subject's life, 2) Looking at hospital records. If the follow-up team is unable to reach a patient subject after repeatedly trying to contact them through the information provided, they may have the research coordinator review the hospital record for any updated contact information or 3) Conducting a public records search, or the use of social media. These follow-up procedures are further described below.

At the time of recruitment in the hospital, the study team will ask patient subjects for at least two pieces of contact information (the absence of sufficient contact information is exclusion criteria). One piece will need to be a phone number, while the second piece of contact information could include the patient's address, email address, social media (e.g., Facebook page) or any of the aforementioned pieces of contact information for a relative or friend (referred to as alternate contacts). In the event that the subject's contact information changes (a common event after injury admission); the follow-up team may reach out to these alternate contacts in an effort to get back in touch with the subject. Over the 12 months after the injury, the follow-up team may perform scheduling or check-in phone calls with subjects to ensure that the contact information on file is up to date. During these check-in calls or while scheduling upcoming interviews, study staff will confirm all contact information on file and ask for any new information relevant to the subject. After a trauma, patient subjects sometimes lose or change their phone numbers, or relocate temporarily in order to receive better care, such as movement from independent living to a skilled nursing facility. Therefore, in addition to contacting patient subjects through the information they initially provide at the baseline interview, the follow-up team may utilize several other approaches to try and stay in touch with subjects throughout the duration of the study. If the follow-up team is unable to reach a patient subject after repeatedly trying to contact them through the information provided, the study team may utilize the Harborview EHR or EDIE records for any updated contact or appointment information that may help to reach the subject. The follow-up team may also conduct a public records search to find new contact information. Examples of public records searches the study team may utilize include Google, the White Pages, public jail records, or other paid public record searches. The follow-up team will search for records or information on forums that are open to the public either for free or at a cost. If the follow-up team is given or finds a URL or a social media website (e.g., Myspace, Facebook, Google+, etc.) for the subject, they may view the profile information and status updates posted publicly. They may also attempt to contact a subject through these websites via private message from TSOS. They will only send this message if they are able to match at least two identifiers with information from public records or provided by the subject or their alternate contacts. This information may include: name, date of birth, email, phone number, links to other personal social media sites with two pieces of information (e.g., GoFundMe), injury event, or picture. Given that this is a local trial, there will likely be too much overlap to utilize information such as location or friends as one of the two required identifiers, so this would be considered supplemental information to ascertain a subject's social media page. Any messages will be sent to the subject's private inbox and will not be viewable to the public. The study team will not browse subjects' social media posts except to confirm the patient's identity to be able to send a private message to the subject.

End of Study Participation. While final EUC and intervention patient subject follow-up interviews take place for approximately 12 months post-consent, intervention activities with intervention patients are anticipated to conclude approximately 6 months after subjects consent into the trial. The team may need to exercise flexibility in the duration of

the intervention as specific situations may arise where intervention activities extend during the six to twelve month post-injury period (e.g., crisis intervention needed at eight months). The TSOS intervention will attempt to have a final intervention contact with all intervention patients. The objective of the final TSOS intervention contact is to negotiate a specific plan for ongoing care beyond the study. The study team will discuss strategies for maintaining treatment gains with each intervention patient. This means proper handoff of medication prescription management to a subject's preferred primary care or other medical provider, linkage to community resources, and psychotherapy referrals. Treatment maintenance may also include ongoing relationships with the subject's social support (e.g., family, friends, and other community support groups). EUC activities are expected to conclude at patient discharge from the hospital.

Once the 12-month follow-up interview has been completed, the study team will attempt to inform all patients of the end of their involvement with the research study. In some cases, the study team may be unable to contact subjects who have been lost to follow-up. Regardless of study condition assignment, a copy of the final outcome paper will be sent (e.g., mailed, emailed, faxed) to all study subjects when published. At the completion of their study participation, some subjects from this trial may be invited by the study team to join the team as potential injured peer volunteers.

CONSORT reporting guidelines **(IR-5).**[110] The study team will use the CONSORT reporting mechanism for the current trial. The study team has extensive experience reporting information necessary in manuscripts to assess study internal and external validity using the CONSORT guidelines (see Appendix for the completed prior study team PCORI trial CONSORT diagram). The CONSORT reporting mechanism facilitates the assessment of factors related to external validity (e.g., generalizability of study sample to target population and external population for sampling[111,112]) as well as factors related to internal validity such as differential follow-up rates across patients assigned to comparator conditions.[47,67,71,113] The consort diagrams will be evaluated at regular (e.g., monthly) intervals by the data quality core. Research assistants will maintain a real time recruitment log that will be used on a weekly basis to update the study team on recruitment and follow-up progression.

VI. Outcome Measures and Other Study Assessments. (**RQ-6** Measure Outcomes that People Representing the Population of Interest Notice and Care About, **PC-2**, Identify, Select, Recruit, and Retain Study Participants Representative of the Spectrum of the Population of Interest and Ensure that Data Are Collected Thoroughly and Systematically from All Study Participants, **IR-4** Document Validated Scales and Tests, **IR-6** Masking should be used when feasible, **SCI-3** Specify How Adaptations to the Form of the Intervention and Comparator will be Allowed and Recorded, **SCI-4** Plan and Describe a Process Evaluation, **SCI-5** Select Patient Outcomes Informed by the Causal Pathway.)

Overview. The measures and timing of administration are described with references provided that document established scale psychometric properties (Table 1). All assessments have been previously employed by the study team in prior acute care medical investigations. The study also has prior experience translating interviews to Spanish. The plan for the translation of the scales in to Spanish will be as follows: as outlined in the Phase I processes, the study team will elicit from the study team stakeholders, comments and approval of final interviews and measures to be administered; this will occur in English. Once these interviews and measures are finalized and IRB approved, the study team will begin the translation process, which we anticipate will occur from September 1, 2018 through November 30, 2018. After the translated materials have been vetted and approved, recruitment of Spanish speaking patients would begin on or before January 1, 2019.

Table 1. Patient-reported Outcome Measures Delivered during Specified Interview Time Points

Scale	Complete Interviews					
	Baseline	*1-month*	*3-month*	*6-month*	*9-month*	*12-month*
Glasgow Coma Scale (GCS)	✓	–	–	–	–	–
Mini-Mental State Examination (MMSE)	✓	–	–	–	–	–
Injury Event	✓	✓	✓	✓	✓	✓
Posttraumatic Concerns	✓	✓	✓	✓	✓	✓
Demographic Characteristics	✓	–	–	–	–	–
PTSD Checklist (PCL) (DSM-IV)	✓	✓	✓	✓	✓	✓

PTSD Checklist (PCL) (DSM-5)	✓	✓	✓	✓	✓	✓
Patient Health Questionnaire Depression (PHQ-9)	✓	✓	✓	✓	✓	✓
Medical Outcomes Study 12-Item Short Form Health Survey (MOS SF-12)	✓	–	–	–	–	–
Medical Outcomes Study 36-Item Short Form Health Survey (MOS SF-36)	–	✓	✓	✓	✓	✓
Alcohol Use Disorder Identification Test (AUDIT-C 3-item)	✓	✓	✓	✓	✓	✓
Self-Report Health Service Utilization - pre-injury	✓	–	–	–	–	–
Self-Report Health Service Utilization - post-injury (since last interview)	–	✓	✓	✓	✓	✓
Medications	✓	✓	✓	✓	✓	✓
Single Item Drug and Tobacco	✓	✓	✓	✓	✓	✓
NSCOT Cognitive Screen (NSCOT)	✓	✓	✓	✓	✓	✓
Pain (Single item from SF-36) - pre-injury	✓	–	–	–	–	–
Pain (Single modified BPI item) - current	✓	–	–	–	–	–
Patient Satisfaction with Care	✓	✓	✓	✓	✓	✓
Employment/Work Status	✓	✓	✓	✓	✓	✓
Willingness for Treatment	✓	–	–	–	–	✓
Website and Smartphone Application Acceptability	✓	–	–	–	–	–
Reactions to Research Participation Questionnaire (RRPQ 1 item)	✓	✓	✓	✓	✓	✓
Trauma History Screen - pre-injury*	–	✓	–	–	–	–
Stressful Life Events	–	–	–	–	–	✓
CBT Items	–	–	–	✓	–	✓
Technology Use and Healthcare Utilization	–	✓	✓	✓	✓	✓
Intervention Acceptability†	–	–	–	–	–	✓
Client Satisfaction Questionnaire‡	–	–	–	–	–	✓

Note: Potentially sensitive items are in **bold.**
*If the subject is unable to complete this measure at the time point listed, it will be asked at the subsequent time point.
†This measure is for intervention subjects only, but all subjects will be asked to complete item 1. Item 1 is used to ascertain which arm the subject was randomized to; and, for this reason, is only asked of the subject at the conclusion of study participation during the final interview.
‡This measure is for intervention subjects only.

The study team has selected outcomes of great relevance to injured patients, front-line providers and trauma care system policy stakeholders (RQ-6). In 2001, members of the investigative team randomly sampled hospitalized injured patients and allowed patients an unconstrained opportunity to describe their posttraumatic illness experiences.[47,69,86] One or more posttraumatic concerns were readily elicited from 100% of randomly sampled injured patients and concern narratives were easily followed over the course of the year after injury. The patient-centered concerns spanned six domains and a majority of patients endorsed their concerns as being severe. In a PCORI funded comparative effectiveness trial, reduction in the severity of any posttraumatic concern was a primary intervention target.[47] The study team has undertaken extensive psychometric work that documents that the severity of patient endorsed posttraumatic concerns mirrors the severity of PTSD symptoms and physical functional impairments over the course of the year after injury.[69,86] In the current comparative effectiveness trial, patient-centered posttraumatic concerns will again be a primary intervention outcome.

In one nationwide 69-site trauma center investigation, PTSD and depression made an independent "dose" related contribution to the key policy relevant outcome, the inability to return to work after injury hospitalization.[14] Other study team publications document that early high PTSD and depressive symptom levels after injury are associated with the later development of a broad spectrum of functional impairment.[24] In prior study team comparative effectiveness trials, collaborative care interventions have been shown to significantly diminish patient reported outcome assessments of posttraumatic concerns, PTSD symptoms and impairments in physical function.[67,71]

The study team has convened two prior policy summits in which published comparative effectiveness trial data was presented to an audience that included key trauma surgical policy, front-line provider, clinical investigator and patient

stakeholders; the comparative effectiveness trial data judged relevant by this diverse stakeholder audience included measures of trauma center and emergency department health service utilization,[83-85] PTSD, depressive and suicide related symptoms,[67,71,92,114] alcohol use problems,[13,107,115,116] and health related quality of life and physical function.[25,117,118] These outcomes are included in American College of Surgeons Resource Guide publications that guide care for US trauma care systems and will again be used in the current investigation.[89,90] Further descriptions of the primary study outcomes and other measures to be used in the study follow below.

a. Emergency Department Health Service Utilization. Emergency Department health service utilization will be assessed using the Emergency Department Information Exchange System (EDIE) developed by Collective Medical Technologies.[83-85] EDIE is a novel clinical informatics tool that aggregates in real time emergency department visits for the population of patients presenting to any Emergency Department in Washington, Alaska, California and Oregon. EDIE is currently integrated into the medical record at the University of Washington and Harborview Medical Center. For the purposes of the current trial, EDIE allowed population-based 12-month follow-up of all emergency department visits across Washington, Alaska, California and Oregon for the intent-to-treat sample of intervention and control patients. Recent study team investigations document the reliability and validity of EDIE emergency department assessments. [83-85] For intervention patients EDIE data on emergency department care plans and Harborview patient alerts will also be obtained.

b. Posttraumatic concern severity and domain.[69,86] As in prior study team investigations, the baseline and follow-up interviews will begin with the assessment of each patient's unique constellation of post-injury concerns; responses to the concern items will be audio-recorded. The concern question asks, "Of everything that has happened to you since you were injured, what concerns you the most?" Patients are allowed to express an unlimited number of concerns. Following each concern elicitation, patients are asked to rate the severity of the concern on a scale from one to five, with one being not at all concerning and five being extremely concerning. Based on prior study team investigation, a severe concern is defined as a concern rated as a 5 by the patient. Prior psychometric investigation by the study team documents that the severity of post-injury concerns mirrors the longitudinal trajectory of PTSD symptoms and functional impairments.[69,86] Procedures for the coding of posttraumatic concern domains were derived from previously described content analytic methods.[69,86] A previously developed code book describing concern domains and coding procedures will be used.[69,86] The initial concern question and its explanation constituted the unit of analysis. Raters will independently code each concern into one of the previously established concern domains; it is anticipated that for 424 patients across 5 time points raters will code approximately 5000 individual concerns. The frequency of patients reporting themes from one or more domains, along with the concern severity, will be tabulated. In prior investigations, the Kappa statistic was used to assess interrater reliability with values ranging from 0.77-0.78.[69,86]

c. PTSD Symptoms (PTSD Checklist). [92] The PTSD Checklist, a 17-item self-report questionnaire, will be used to assess PTSD symptoms.[92] The instrument yields both a continuous PTSD symptom score and a dichotomized diagnostic cut point for symptoms consistent with a DSM diagnosis of PTSD; the DSM-IV version will be used with 4 additional question criteria added so that either DSM-IV or DSM-V diagnostic criteria can be evaluated (see instrument appendix). A series of investigations have demonstrated the reliability and convergent and construct validity of the PTSD Checklist across trauma-exposed populations.[17] Cronbach's alpha for the 17 item scale in a prior investigation with injured trauma survivors by the study team was 0.92.[71] In a study of injured motor vehicle crash survivors, a correlation of 0.93 between the PTSD Checklist total score and the gold standard Clinician-Administered PTSD Scale diagnostic scale was documented.[17]

d. Physical Function and other Functioning and Quality of Life Outcomes (Medical Outcomes Study Short Form 36, MOS SF-36).[117,119] The investigation will use the SF-36 to assess functioning and quality of life outcomes. Eight domains are assessed, including physical function, pain, general health, role physical function, role emotional function, vitality, social function, and mental health. The SF-36 has established reliability and validity and the measure has been used extensively with traumatically injured populations.[96,117,118,120] The study team used the Physical Component Summary (PCS) sub-scale to assess post-injury physical function as a primary outcome. Cronbach's alpha for the MOS SF-36 PCS in prior investigations by the study team was 0.90.[67,96]

Other patient reported outcome assessments. The investigation will use the PHQ-9 to assess depressive symptoms. [114,121] The instrument yields both a continuous depressive symptom score and a dichotomized diagnostic cut point for symptoms consistent with a DSM-IV diagnosis of depression. The PHQ-9, item 9 asks specifically about suicidal ideation and/or intent. The PHQ-9 has established reliability and convergent and construct validity when used to assess patients

in general medical settings.[114,121] Cronbach's alpha for the 9 item scale in a prior investigation with injured trauma survivors by the study team was 0.97.[67,96] The investigation will use the Alcohol Use Disorders Identification Test three item version (AUDIT-C), a 10-item screening instrument for the early identification of problem drinkers,[115] to assess alcohol use problems. The AUDIT's reliability and validity are well established in traumatic injury populations and the scale has been widely used as a screening instrument in general medical settings.[115] Items assessing satisfaction with posttraumatic care will be used that are adapted from previous studies of care management interventions for patients in primary and acute care medical settings.[67,96,122]

Process of care assessments (SCI-4). Outpatient primary care, surgical and mental health visits, counseling visits and medication use will be assessed by patient self-report; these items have been adapted from studies of health service use in primary[122] and acute care medical settings. Items assessing patient subject satisfaction with posttraumatic physical and mental health care elements will be used that are adapted from previous studies of care management interventions for patients in primary and acute care medical settings.[67,96,122] Items specifically assessing intervention patients experience of the peer intervention will be included in the final 12-month interview. Patients' reactions to research participation will be assessed with an item from the reactions to research participation questionnaire. [123,124] Study team intervention logs will document the extent to which peer care managers met injured patients by the bedside and at outpatient surgical appointments and contacted patients over the telephone. Total provider time associated with the intervention will also be captured through study team intervention logging. For intervention patients the study team will complete end-of-study final case reviews that document key care processes hypothesized to be associated with study outcomes.

Electronic medical record data. The investigation will determine injury severity at baseline during the index admission from the electronic medical record International Classification of Disease (ICD-10) codes using the Abbreviated Injury Scale and Injury Severity Score.[11,125-127] Similarly, the presence of one or more chronic medical conditions will be ascertained using ICD-10 codes. Chronic medical conditions to be assessed include diabetes, obesity, epilepsy, HIV/AIDS, hypertension, carcinoma, disorders of blood coagulation and other chronic cardiac, pulmonary, liver, neurologic and renal conditions.[91] Mental health consultations across psychiatry consult, rehabilitation psychology, trauma social work, addiction intervention and chaplaincy services and other service **(SC-5)**, laboratory toxicology results, insurance status, length of hospital and intensive care unit stays, and other clinical characteristics will be abstracted from the electronic medical record.

Identification of Study Subgroups (RQ-4). Study subgroups will be identified through combined medical record and self-report data. Traumatic brain injury will be prospectively identified in the medical record through ICD-10 codes.[25,125,126] Race, ethnicity and gender will be assessed through patient self-report.[103,104]

Study Modifications Made in Response to the COVID-19 Pandemic, March -October 2020.

A. **Spanish speaking protocol summary and closure.**

Given challenges in recruiting a suitable injured Spanish-speaking peer, the team modified the plan for intervention delivery to use a translator to deliver the intervention to monolingual Spanish speakers (n=23, of which 11 were in the intervention arm and 12 were in the control arm). At the study COVID-19 recruitment pause in March of 2020, the team raised concerns about internal validity after noting significant differences in "peer dose" between the monolingual Spanish-speaking group of survivors and the rest of the study population (which included English speakers and bilingual Spanish speakers); peers were substantially less frequently involved in intervention activities for Spanish speaking patients when compared to English speaking patients. PCORI program staff and the DSMB agreed that further accrual of non-English speaking Spanish speaking patients should be discontinued. PCORI program also suggested a sub-analysis be conducted for the n=23 subgroup, including a dose response analysis and an analysis of Spanish speaking patients concern narratives. This academic product (e.g., manuscript, conference presentation) could highlight differences between the non-English speaking Spanish speaking group and the main study population. The academic product could also document specific challenges experienced by the monolingual Spanish-speaking group.

The overarching goal of this Spanish speaking sub-investigation was to assess the feasibility and acceptability of a culturally tailored intervention for monolingual Spanish-speaking injury survivors, delivered using a translator. The intervention was a sub-study contained within the larger comparative effectiveness trial. Non-English-speaking, Spanish-

speaking individuals were recruited and are being followed over the course of the year after their injury. At baseline in the trauma surgical ward, post-injury concerns were elicited and later transcribed and coded into concern domains. One-, 3-, 6-, 9-, and 12-month follow-up interviews reassess Spanish-speaking patients' post-injury concerns were reassessed. The follow-up assessments also reassess PTSD and depression symptoms, functional impairments, and health service utilization as patient reported outcomes. In addition, emergency department health service utilization is being followed for all patients, intervention and control, via the Emergency Department Information Exchange (EDIE) administrative platform.

The feasibility of this investigation with regard to obtaining and following patient-reported outcomes and EDIE data for this Spanish-speaking subgroup of patients will be assessed. Qualitative analyses include a content analysis of Spanish-speaking patients' concern narratives over time. Rapid assessment procedure informed clinical ethnography (RAPICE) analytic approaches will be used to review REDCap-documented intervention cases, as well as assess experiences from clinical team members' intervention activities with the Spanish-speaking subgroup. In particular, the experiences of Spanish-speaking patients with intentional injuries (i.e., domestic violence, stabbing), barriers related to US immigration policy, and related lack of funding/health insurance coverage for medical care related to their injury, and challenges in care linkages both pre- and post-COVID-19 will be explored in the case studies, and concern narrative.

COVID-19 related intervention modifications. All study peer in-person intervention activities were discontinued in March 2020 due to exposure health risks to injured peers as a result of the COVID-19 pandemic. After March 2020, all peer intervention activities became virtual. Although this intervention adaptation reduced the risk of severe COVID-19-related illness for injured peer interventionists, it also required that the study social worker increase their in-person intervention activity. Instead of the peer interventionists engaging patients in-person at the hospital or in outpatient clinics, the study social worker now conducts all in-person intervention activities and continues to support virtual peer intervention activities, including telephone and other virtual (e.g., Zoom and FaceTime) interactions, as well as delivery of psychotherapeutic elements.

VII. Data Management. (**IR-7** In the Study Protocol, Specify a Data Management Plan that Addresses, at a Minimum, the Following Elements: Collecting Data, Organizing Data, Handling Data, Describing Data, Preserving Data, And Sharing Data.)

A. Data Collection, organizing, handling, and preservation

1. REDCap and iPad Data Collection

The University of Washington (UW) Institute of Translational Health Sciences (ITHS) REDCap instance will be utilized for collection and storage of patient enrollment data, patient-reported outcomes, intervention and enhanced usual care delivery documentation, and the tracking of patients for follow-up assessments. The ITHS REDCap installation is configured to be completely HIPAA compliant. REDCap is safe-guarded and hosted in a physically secure UW data center. The installation is housed in the secure UW data center underneath the 4545 Building in Seattle, Washington, a location used for over a decade to house sensitive systems with extremely high rate of availability and without being compromised. The installation currently runs on two virtualized environments, one for the webserver and one for the database itself. Both environments are run on servers with data encrypted at rest. All web traffic to and from the REDCap installation are encrypted with the most current protocols available. All connections to the server are automatically encrypted by a 128 bit Secure Sockets Layer (SSL) encryption and the Operating System of each server is consistently patched and firewalled in accordance with UW Medicine Information Security Policy SEC05.04.

The REDCap support team strives to update the REDCap installation as often as possible with minimal interruption to service. Security fixes take priority over normal updates with new functionality. The entire REDCap installation is backed up daily to a secondary location. REDCap natively tracks any and all user activity and these logs are available to project owners and related roles on a project by project basis. IP logging happens on a server and network level, but these logs are not made public without a compelling reason. The UW Medicine IT security office regularly scans the REDCap installation for vulnerabilities and audits the REDCap support team on a yearly basis. Additionally, REDCap conducts comprehensive auditing to record and track access to the database and any data changes therein.

Project users must have a valid and current user ID to access the installation. This can be either a UW NetID or another associated identity via the InCommon Federation. Study team members will not share their usernames or passwords with any other team member or person outside of the study team, in accordance with UW policy. The individual REDCap user passwords will be different than the passwords used to log on to study iPads or computers; thus making this data entry system double-encrypted. Users can only gain access to a project in REDCap after they have been authenticated, added, and appropriate user rights have been assigned to them by the owner/administrator of the project. Project owners, generally, are responsible for who has access as well as the level of access to their project through the user rights mechanism.

2. University of Washington (UW) Medicine Computers and Servers

In addition to the use of REDCap to collect data, the study team utilizes UW Medicine secure servers for the storage and transmission of electronic or digital files of hard copy patient-reported outcomes, data downloaded from REDCap, other study data (e.g., Trauma Registry) and study-related documents. Access to these servers is available only through password-protected UW Medicine computers connected to the UW Medicine secure network in accordance with UW Administrative Policy Statement (APS) 2.6 Information Security controls and Operational Practices, and UW Medicine Compliance Policy COMP.102 Safeguarding the Privacy and Security of Protected Health Information (PHI). Data will be hosted on a MS SQL Server database, exchanged via a webserver, and stored on a secure UW server in accordance with UW Information Security Policy SP-01 Electronic Data Policy and SP-02 Computing Device and Systems Security Policy. Data transmitted through the server utilizes the Transport Layer Security (TLS) protocol, a cryptographic protocol that provides transmission security, derived from the SSL protocol. TLS and SSL encrypt the segments of network connections above the Transport Layer, using asymmetric cryptography for key exchange, symmetric encryption for privacy, and message authentication codes for message integrity. These servers are also in a physically secure data center with limited, and audited, access.

UW security analysts have the ability to drill down into detailed activity logs that are tracked, logged, and stored to see what data on the server was accessed by whom and when. These activity log files and audits will be able to track any IP traffic that reaches the UW server. Backups will be captured and stored in redundant copies in separate data centers which all share the same security controls of the main database.

3. UW Department of Psychiatry at Harborview Medical Center Research Offices

The study team has offices at the Patricia Steel Building on the Harborview campus. These offices are on a secure floor, requiring badge access. The study team has access to locked offices and file cabinets in this secure space for the storage of hard copies of documents and electronic equipment.

B. Data Description

1. Electronic Health Record (EHR)

The study will utilize a UW Medicine EHR data warehouse (Amalga) query to facilitate automated abstraction of PHI and the 10 domain PTSD risk factor screen data from the Harborview EHR for all newly admitted injury patients. The study team will be working with the UW Biomedical Informatics (BMI) Consult team to obtain data from the Harborview EHR. The BMI Consult team has the utmost regard for patient privacy and corresponding HIPAA laws. The UW data warehouse is hosted in a secure computing environment by UW Medicine (see UW Medicine Servers information above).

2. Patient Enrollment Log

The study team will document all patients that screen in or out of the study in an electronic log housed within REDCap or equivalent data capture method on a secure UW Medicine server (e.g., Excel). The enrollment log will contain a single form with variables abstracted from the EHR containing PHI such as hospital medical record number (MRN), patient name, birthdate, admit date, and gender. At the conclusion of the record retention period (March 1, 2029) the form containing identifiers will be deleted from the enrollment log database, thus severing the link between subject identifying information and de-identified study data. In addition to PHI and information from the EHR 10 domain PTSD risk factor screen, the enrollment log will also be used to track patient approach date and status (e.g., consented,

refused, excluded); if the patient was excluded, the reason for exclusion (e.g., active psychosis); overall study status (e.g., active, completed, withdrawn); and randomization assignment (for those patients that screen in to the study). This data will be obtained from the Harborview EHR, from interviewers' contact with patients, or from patient self-report and entered directly entered in to REDCap via secure login and password by a member of the study team. The team is aware that at times, due to technical issues or lack of Wi-Fi access, the enrollment logging procedures may require the team to take alternative measures (e.g., computer/iPad or paper logging) for subsequent entry into REDCap.

3. Patient-Reported Outcomes (PRO)

The baseline and follow-up study assessments for collecting patient-reported outcomes (PRO) may be completed using various methods. PRO data will typically be obtained from the patient during in person or telephone interviews with a study team member (e.g., research coordinator or research assistant) who will enter the patient's responses directly in to REDCap. The study team member will log in via user name and password to the REDCap web-based platform on a computer on the secure UW Medicine server or log in via user name and password to the REDCap application on an encrypted iPad. Subjects will also have the option of receiving an email link to the survey questions to complete follow-up interviews on their own directly in to the encrypted REDCap web-based platform. If a subject has received the email link from the study team they do not need a REDCap user name or login in order to access and complete the survey.

Alternatively, an encrypted PDF of the interview could be emailed to the subject to complete on their own. The study team could also use a hard copy paper version of the assessment to be completed by an interviewer in the hospital or convenient location, or the hard copy interview could be mailed or faxed directly to subjects for them to fill in own their own and return in a pre-paid, self-addressed envelope.

After receiving the hard copy interview back in the mail or an encrypted PDF sent back to a secure UW Medicine sponsored email, a member of the study team would then enter the responses from the hard copy or PDF into REDCap. Data collected in a hard format (e.g., on paper) will be stored in a locked cabinet in study office space. Regardless of the data collection method, interview responses will not be labeled with directly identifying information; instead, they will be labeled with the subject's study ID number to maintain confidentiality. As mentioned above, all data stored in REDCap is encrypted and safe-guarded behind firewalls.

4. TSOS Intervention and Enhanced Usual Care (EUC) Delivery Documentation

Data collected about the process of care, including TSOS intervention care management notes and EUC documentation will be obtained from encounters with the patient or their providers, or from the EHR or EDIE, and entered directly into REDCap. Due to the nature of these encounters, the data related to the intervention may contain identifying information or may have identifying information piped in or linked from the patient contact form (e.g., patient name, birthdate, address) and the provider contact form (e.g., provider name, position, phone number) within the project. Intervention specific logging will be accessible only to members of the intervention team granted permission by the PI in order to maintain the blinding of the follow-up interview team.

If limited by technological constraints, intervention study team members may need to take hard copy notes from encounters for subsequent entry into REDCap. As these hard copy intervention notes may contain identifiable information, they would be stored in a locked office or filing cabinet, separate from subject's de-identified study data.

5. Emergency Department Information Exchange (EDIE)

Collective Medical Technologies (CMT) owns and manages EDIE, which collects emergency department utilization data for patients across WA and OR state. The CMT servers, networks, and databases that house and transmit EDIE data are co-located in certified Data Centers with fully redundant systems and 24/7/365 security monitoring. CMT Data Centers are certified in, or have been audited against the following: SOC I, SOC II Type II and SOC III reporting; ISO/IEC 27000 Series; NIST 800-53; ITIL 3.0; HIPAA Privacy and Security & HITECH Rules; and Gramm-Leach-Bliley Act (GLBA) Interagency Guidelines.

CMT maintains a HITRUST Common Security Framework (CSF) certification to ensure they are compliant with HIPAA and all state and federal patient privacy protection laws. HITRUST CSF is a healthcare oriented security framework required to safeguard PHI which harmonizes the requirements of existing standards and regulations including HIPAA, HITECH, Peripheral Component Interconnect (PCI), and Control Objectives for Information and Related Technologies (COBIT). CMT undergoes a HITRUST CSF recertification process every two-years to ensure they continually meet

stringent health care industry standards in protecting PHI and managing risk. These safeguards include: intrusion prevention and detection; PHI transmission protection, external breach protection, malware protection, restricted physical and logical access; strong encryption, password and user account controls; and strict change management, software code, network security topologies and monitoring system review and approval.

On an approximately monthly basis, the team will obtain EDIE data for consented study subjects from either the UW EHR system (e.g., Amalga data repository) or the EDIE web-based platform. A list of MRN's for all new patients since the time of the previous EDIE data pull will be added to the query. The flat file (e.g., Excel) EDIE data output file will be saved directly on to the study team's shared drive housed on the secure UW Medicine server.

6. Trauma Registry

Harborview Medical Center collects, manages, and stores diagnostic, clinical care, and clinical outcome data for all patients admitted to Harborview with a trauma. This data is managed by the Trauma Registrar and maintained in accordance with RCW 70.168.060 and RCW 70.168.090. The Trauma Registrar is required by WA state law to protect information regarding specific patients and providers. Data elements involving identifying characteristics of individual patient's, providers', and the facility's care outcomes within the Trauma Registry must be kept confidential. The Trauma Registrar may release confidential information from the Trauma Registry in accordance with applicable laws and regulations (e.g., WAC 246-976-420). No other person may release confidential information from the Trauma Registry without express written permission from the registrar. Requests for Trauma Registry data reports are only approved on an official request form submitted by qualified agencies or individuals, consistent with applicable statutes and rules.

The study team will use the Trauma Registry to compare the demographic and injury characteristics of patients included in the trial with the characteristics of those patients who were admitted during the active recruitment period of the trial but were not included as study subjects. Additionally, some clinical variables of interest are only available in the Trauma Registry (e.g., injury severity). At the end of the trial, the study team will request a data pull from the Trauma Registry for all patients (consented and non-consented) admitted to Harborview during the active period of recruitment. The study team is requesting a waiver of consent and a HIPAA waiver in order to obtain Trauma Registry data for non-consented patients. This data may include ICD 10 codes and PHI such as admit date and demographic information that is associated with identifiers. The link between identifiers and de-identified data for consented and non-consented patient data from the Trauma Registry will be retained for the record retention period of six years after completion of the trial.

C. Data Sharing

An overarching goal of the TSOS Peer investigation with the Patient-Centered Outcomes Research Institute (PCORI) is to produce and disseminate information and resources that will facilitate the widespread implementation screening and intervention procedures for PTSD and related comorbidity throughout trauma care systems nationwide. The resource and data sharing plan is in concert with this overarching goal.

The final shared data set will include patient, and setting level demographic, clinical, EHR, and trauma registry data. Along with the data set, we will create a code book documenting all variables (e.g., common names for trauma registry variables, names for single questionnaire items, scoring rules for derived variables). After acceptance of the main manuscript for the study, which is anticipated to be 12-18 months after study completion, requests for access of data files will be considered. We will prioritize access to research groups that have a clearly articulated aim and rationale for how secondary data analyses will impact future policy and/or clinical practice for trauma care systems nationwide. Researchers requesting data will need to complete a request form outlining intended use of the data and agree to use the data for this intended purpose. Prior to data release, researchers requesting data will be required to sign a confidentiality agreement specifying that they will not identify any individual participant, that they will use secure technology to safeguard the data, and that they will destroy or return the data after their analyses are completed. The TSOS Peer investigative team will also require documentation of IRB approval from the host institution prior to release of the data.

We do not expect to make a public use data file available from the study given the nature of our sample and trauma care system context. Study participants may have substance abuse or other diagnoses that may be stigmatizing and may prefer that the conditions of the traumatic injury event remain entirely confidential. Although the data analytic files will not have direct identifiers (only study IDs), the possibility of deductive disclosure of subjects with unusual demographic,

injury, or clinical characteristics remains. In order to safeguard against the unlikely event of deductive disclosure, we will make the data files and codebook available to other researchers only on a case-by-case basis.

VIII. Data Analyses. (**IR-1** A priori Specific Plans for Data Analyses that Correspond to the Major Study Aims, **IR-2** Assess Data Source Adequacy, **IR-3** Describe Data Linkage Plans, if applicable, **IR-5** Provide Sufficient Information in Reports to Allow for Assessments of the Study's Internal and External Validity, **RQ-4** Identify and Assess Participant Subgroups, **MD-1** Describe in Protocol Methods to Prevent and Monitor Missing Data, **MD-2** Use Validated Statistical Methods to Deal with Missing Data that Properly Account for Statistical Uncertainty Due to Missingness, **MD-4** Examine Sensitivity of Inferences to Missing Data Methods and Assumptions, and Incorporate into Interpretation, **HT-1** Examine Sensitivity of Inferences to Missing Data Methods and Assumptions, and Incorporate into Interpretation, **HT-2** For all HTE Analyses, provide an analysis plan, including the use of appropriate statistical methods. **HT-3** Report all Prespecified HTE Analyses and, at Minimum, the Number of Post-hoc HTE Analyses, Including All Subgroups and Outcomes Analyzed.)
Overview. All primary statistical analyses will be conducted with the intent-to-treat sample. The primary purpose of the statistical analyses is to examine and compare trends in emergency department health service utilization, posttraumatic concern severity, PTSD symptoms, and physical function longitudinally between patients in the peer-integrated collaborative care intervention and patients in the surgical team notification arms of the study. The major outcome variables are the continuous and dichotomous assessments of EDIE derived emergency department health service utilization,[83] patient reported posttraumatic concerns,[69,86] PTSD symptoms (PTSD Checklist),[92] and physical function (Medical Outcomes Study Short Form 36 (MOS SF-36).[117,119]

The primary statistical analyses will test the hypothesis that patients randomized to the peer-integrated collaborative care intervention will demonstrate reductions in emergency department health service use when compared to patients randomized to the trauma surgery notification condition over the course of the 12-months after injury. Primary analyses will also assess whether collaborative care intervention patients demonstrate longitudinal reductions in posttraumatic concern severity and PTSD symptoms and improvements in physical function when compared to trauma surgery notification patients.

The study team will use mixed effects regression models to test these hypotheses for both continuous and discrete outcomes.[128-131] The investigative group has extensive experience with this analytic approach in the analyses of longitudinal data after injury.[20,24,47,67,68,71] In addition, these models will allow the use of covariates that model potential sources of non-response bias and time-dependent covariates. This type of model also allows the specification of random or fixed effects and the form of the serial correlation over time (if heterogeneity changes over time).

The effect of major interest will be the time by treatment group interaction term. For these models, repeated measurements of the baseline, 1-, 3-, 6-, 9-, and 12-month outcome assessments (i.e., EDIE documented emergency department utilization, concern severity, PTSD Checklist and MOS SF-36 Physical Components Summary (PCS) scale scores) will be the dependent variables. For all dependent variables, the study team will first fit models containing only time categories, intervention, and intervention by time interactions. The form of the dependent variables will determine the link function used.

The impact of including covariates in the model will be examined in planned sensitivity analyses (IR-5). As in prior study team investigation, sensitivity analyses will be used to assess the impact of key assumptions. Important injury and demographic characteristics, such as Injury Severity Score and age, will be entered into the models as covariates in planned sensitivity analyses. Prior to these analyses, the study team will examine baseline treatment group differences, using the appropriate statistics for the distribution of the variable. Although randomization should ensure balance between the two groups, it is essential to control for any known confounders in the design and analysis to prevent a biased assessment of the treatment effect. Any baseline injury, demographic, or clinical variables found to be statistically significant in this analysis will also be included as covariates in the regression models. Care processes will also be examined as part of the secondary data analytic plan.

Standards for preventing and handling missing data (MD-1, MD-2, MD-3, MD-4, MD-5). For the primary study outcome of EDIE emergency department data for the intent-to treat sample, prior investigation documents that the study team can attain 100% patient follow-up at all-time points; therefore, for the study primary outcome, no subject missing data is anticipated. For the primary patient-reported outcomes of posttraumatic concerns, PTSD symptoms and limitations in physical function, some attrition is expected in the study sample. Prior PCORI and NIH studies by the investigative group have consistently achieved follow-up completion rates ≥ 80% between 6-12 months post-injury for

patient reported outcomes.[20,24,67,68,71,113] The study team has developed a series of methods for proactively minimizing patient attrition in follow-up that often involve patient subject informed consent prior to implementation. These methods include obtaining multiple pieces of contact information at the time of the baseline interview, maintaining contact with the patient's social network, monitoring emergency department and hospital records for evidence of new patient contact information, conducting ongoing public records searches and conducting social media searches. Due to the nature of self-report data, members of the data quality core will monitor all data entered into REDCap for missing values. Item level missing data may be able to be re-captured if identified in a timely manner. The pattern of missing data will be examined throughout the study to determine if there are patterns of non-response that could be investigated in real time.

Missing data can contribute to biased estimations of treatment effects. Assumptions about the nature of missing data are crucial to the type of statistical analysis chosen. Full information maximum likelihood estimates from mixed effects regression models accommodate missing data that are missing at random (MAR). Missingness with MAR data allows dependence on previously observed outcome variables.[132-134] We will use logistic regression models to determine which, if any, demographic or clinical characteristics, including treatment group membership, are predictive of subject attrition. Any factors observed to explain trends in missing data would be used as covariates in our subsequent analyses. In past studies, no sources of consistent variation to explain missing data were found.[20,24,67,68,71,113] Based on our relatively low attrition rates and our inability to find consistent variation in past investigations, we believe that MAR is a reasonable assumption. However, we will perform a sensitivity analysis on our data using multiple imputations.[134-138] All patient data including data on outcome variables will be used to estimate imputation values in replicate imputed data sets. The missing values will be filled using a Markov chain Monte Carlo algorithm for multiple imputation procedure.[134,137,138]

Whenever patients decline participation or withdraw from the study, the study research assistant will inquire as to why the individual did not want to participate. The study team will also document when patients miss a follow-up interview but do not formally withdraw from the study. The prior study team PCORI funded investigation attained ≥ 80% follow-up at each time point for patients randomized to both conditions.[47] Twenty six percent of the 171 patients were missing one or more assessments at the 1-, 3- or 6-month time point. Regression analyses that systematically assessed patterns of missing data revealed that only gender was associated with missing assessments (61% of men versus 38% of women, $P < 0.01$).

Heterogeneity of treatment effects and subgroup analyses (HT-1, HT-2, HT-3, HT-4, RQ-4). Secondary analyses will also assess whether the intervention is equally effective in subgroups of patients with and without TBI, for male and female patients and for ethnoculturally diverse patients (e.g., White versus non-White and Hispanic patients) **(RQ-4).** As detailed in the PCORI 2012 Methodology Report (pgs. 65-68), the investigation will take a descriptive approach to all heterogeneity of treatment effect analyses.[139] There is some indication from the prior literature that for patient symptomatic, functional, and health service utilization outcomes, traumatic brain injury, gender and ethnic/racial status may impact treatment effects; however, this literature can be seen as inconclusive with regard to specific hypothesis.[25,103,104,140-145] Additionally, few prior investigations have been adequately powered to formally assess the impact of these 3 subgroups on hypothesized treatment effects. The current investigation is likely to be underpowered to assess the primary impact of traumatic brain injury, gender and ethnic/racial status subgroups on the primary study outcomes. Therefore, the analyses of treatment effect heterogeneity are to be considered descriptive.[139] Traumatic brain injury, gender, and ethnic/racial status will be tested as main effects and time by treatment by factor interactions to assess heterogeneity of treatment effects. The study will perform 3 sets of post-hoc heterogeneity of treatment effect analyses. These analyses will assess the impact of these 3 major subgroups on emergency department health service utilization, posttraumatic concern severity, PTSD symptom and functional limitation outcomes. Exploratory subgroup analyses may also incorporate Spanish speaking participants.

Sample Size and Power: Power analyses were conducted using the RMASS program.[146] Parameters used in ascertaining power including effect sizes were derived from prior study team investigations.[47,67,71]

i. Emergency Department Utilization. The primary health care system intervention target will be group differences in emergency department utilization. In the prior PCORI funded investigation, at 3-6 months post-injury, 30% of nurse notification patients versus 17% of care management patients had one or more emergency department visits (13% difference across groups), at 6-9 months post-injury, the differences were 31% nurse notification versus 21% care management (10% difference across groups), and at 12 months post-injury, the differences were 30% nurse notification

versus 22% care management (8% difference across groups).[47] With the 100% follow-up rate provided by EDIE, the probability of a 2-tailed type I error set at 5%, correlation between observations of 0.7, and a similar pattern of emergency department visits as seen in the prior PCORI investigation with 424 total patients (n = 212 in each arm), the power is ≥ 0.80.

ii. Severity of posttraumatic concerns. In the prior PCORI investigation, at the six month post-injury time point, 74% of nurse notification patients endorsed 1 or more severe concerns versus 52% of care management patients at the six month post-injury study endpoint, for a 22% absolute difference between the two groups.[47] For patient-reported outcomes such as the endorsement of one or more severe posttraumatic concern, 20% 12-month attrition is anticipated. With 20% 12-month attrition, 424 patients, the probability of a 2-tailed type I error set at 5%, correlation between observations of 0.7 and a similar pattern of endpoint posttraumatic concern reduction as seen in the prior PCORI investigation (22% reduction in the endorsement of any severe post-injury concern), the power to detect differences in posttraumatic concern severity will be ≥ 0.80.

iii. PTSD symptoms. In prior comparative effectiveness trials conducted by the study team, at the 12-month time point, collaborative care patients demonstrated a mean PTSD Checklist score of 37.4 (95% Confidence Interval = 34.0-40.7) and usual care patients demonstrated a mean PTSD Checklist score of 42.5 (95% Confidence Interval = 39.3-45.7).[67] Projecting these differences to the current investigation, with 20% 12-month attrition, 424 patients, the probability of a 2-tailed type I error set at 5%, correlation between observations of 0.7 and an anticipated effect size = 0.34, the power to detect differences in PTSD symptoms will be ≥ 0.80.

iv. Physical function. In prior comparative effectiveness trials conducted by the study team, at the 12-month time point, collaborative care patients demonstrated a mean MOS SF-36 PCS scale score of 43.7 (95% Confidence Interval = 41.0-46.5) and usual care patients demonstrated a mean MOS SF-36 score of 41.2 (95% Confidence Interval = 38.5-43.9).[67] Projecting these differences to the current investigation, with 20% 12-month attrition, 424 patients, the probability of a 2-tailed type I error set at 5%, correlation between observations of 0.7 and an anticipated effect size = 0.26, the power to detect differences in physical function will be will be ≥ 0.67.

Aim 1. Additional COVID-19 Exploratory Analyses

The first step in the COVID-19 secondary analyses was to compare the baseline demographic and clinical characteristics of the pre- and post-COVID19 cohorts. The core aim of this analysis is to assess whether one impact of the pandemic has been to change the demographic, injury and clinical characteristics of study participants over time.

Next, informed in part by the RAPICE COVID-19 qualitative studies that the team had undertaken during the trial, it was decided to dichotomize the cohort into patients that did or did not have any follow-up assessment during the COVID-19 pandemic initiation in March 2020. In order to explore differential patterns of treatment response introduced by the COVID-19 pandemic, mixed effects regression models that included the 3-way interaction of treatment, by time, by COVID-19 cohort were performed. These regression models also incorporated comparisons of both intervention and control group effects, as well as isolated comparisons of pre- and post-COVID intervention group effects, at each time point.

IX. Additional Considerations Related to the Incorporation of Standards for Complex Interventions. (**SCI-1** Fully Describe the Intervention and Comparator and Define Their Core Functions, **SCI-2** Specify the Hypothesized Causal Pathways and their Theoretical Basis, **SCI-3** Specify How Adaptations to the Form of the Intervention and Comparator will be Allowed and Recorded, **SCI-4** Plan and Describe a Process Evaluation, **SCI-5** Select Patient Outcomes Informed by the Causal Pathway, **CI-1** Specify the Causal Model Underlying the Research Question.) The peer integrated collaborative care intervention constitutes a complex intervention as it has both multiple components and multiple casual pathways; additionally the intervention is complex in its targeting of a heterogeneous patient population and in its multifaceted adoption strategy for the acute care medical context.[147-149] Numerous aspects of the complexity of the intervention are articulated throughout the study protocol including: the conceptual framework underlying intervention effects, the occurrence of adaptations to the intervention and comparator condition, documentation of how adaptations to the intervention and comparator conditions will be recorded, description of process evaluations and outcomes anticipated to be impacted by the complex intervention (see **SCI** references throughout the study protocol and Figure 2). The intervention and comparator core elements are fully described according to previously articulated recommendations for

the explication of complex interventions in Table 2 below.[150]

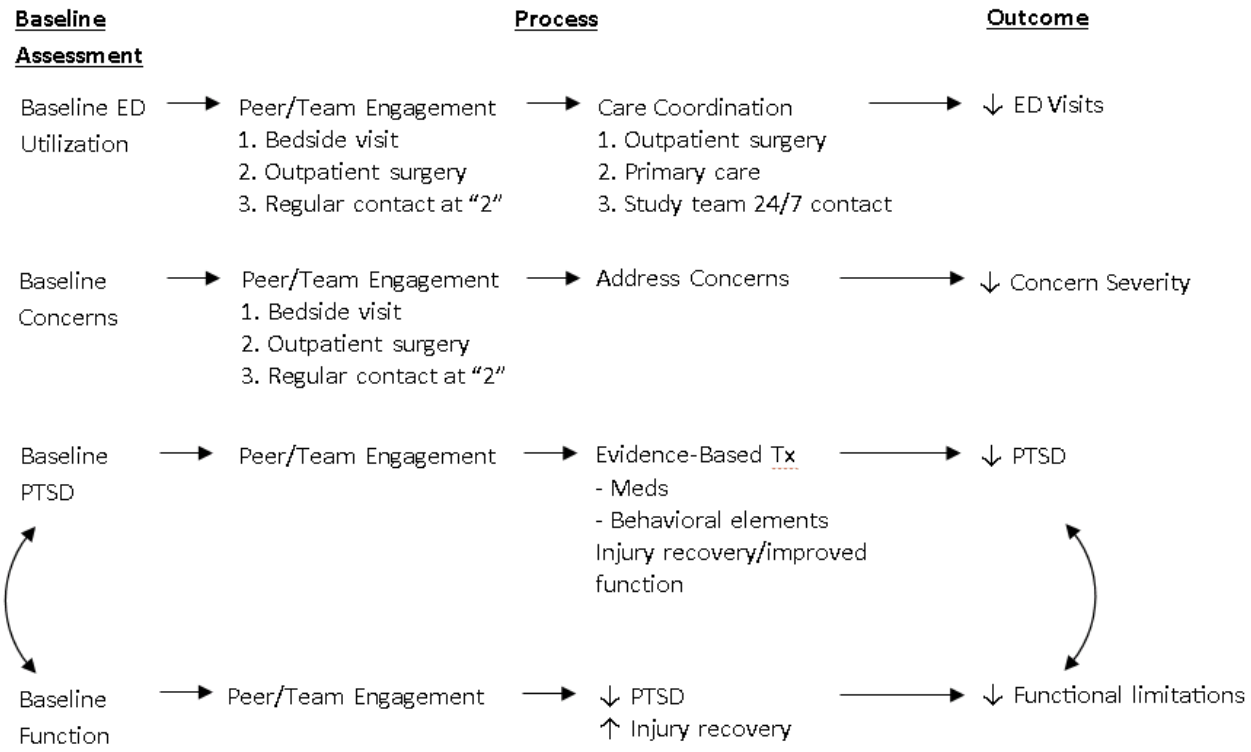
Table 2. Protocol Elements Received By Patients in the Patient-Centered Care Transition Intervention versus Enhanced Usual Care Control Study Arms

Patient-Centered Care Transition Service Intervention	Enhanced Usual Care Control
Research assistant (RA) elicitation of post-injury concerns in baseline interview	Research assistant (RA) elicitation of post-injury concerns in baseline interview
RA notifies nurse of patient post-injury concerns and levels of psychological distress	RA notifies nurse of patient post-injury concerns and levels of psychological distress
Randomization with allocation concealment	Randomization with allocation concealment
Not Received	Trauma surgery recommendation for mental health consultation (e.g., trauma social work, psychiatry consult, rehabilitation psychology, spiritual care, addiction intervention or other mental health service)
Peer interventionist and other study team members elicit posttraumatic concerns and target for improvement	Not received
Peer interventionist and other study team members provide care management between trauma center to primary care and community resources	Not received
Peer interventionist, Master of Social Work (MSW) interventionist, and other study team members (e.g., psychiatrist) provide evidence-based CBT & MI	Not received
Peer interventionist, MSW interventionist, and other study team members (e.g., research coordinator [RC]) administer symptom assessments (e.g., CESD, IES)	Not received
MD, RN, MSW or other licensed clinical provider team members perform suicide risk assessment and safety planning	Not received
MD, RN, MSW or other licensed clinical provider team members deliver pharmacotherapy symptom assessment	Not received
MD psychiatrist or appropriate trauma surgical providers (e.g., MD, PA, ARNP) recommend psychotropic medication prescription	Not received
MD, RN, MSW or other Harborview providers document intervention in EDIE record	Not received
Peer interventionist, MD, RN, MSW or other providers or study team members (e.g., RC) log intervention electronically (e.g., in REDCap)	Not received
MD, MSW, RN or other study team member (e.g., RC) provides 24/7 cell phone coverage	Not received
RA blinded follow-up telephone assessment of post-injury concerns and symptomatic and functional outcomes	RA blinded follow-up telephone assessment of post-injury concerns and symptomatic and functional outcomes

Note. CBT=Cognitive Behavioral Therapy; MI=Motivational Interviewing; CESD=Center for Epidemiologic Studies Depression Scale; EDIE=Emergency Department Information Exchange

Also, Figure 2 below further elucidates causal pathways broken out by each of the main study intervention outcomes including EDIE documented visits, Concern severity, PTSD symptoms and functional limitations.

Figure 2. Intervention Process and Outcomes



The study team has extensive prior experience describing the impact of intervention processes on study outcomes.[67,96,151] The study team will apply these previously developed approaches to understanding the processes by which the peer integrated collaborative care intervention impacts key study outcomes in the current comparative effectiveness trial.

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