Engaging Veterans Seeking Service-Connection Payments in Pain Treatment (PILOT)

NCT03307967

Study Protocol and Statistical Analysis Plan

3/16/22

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Background

Many Returning Post-9/11 Veterans Have MSD and Could Benefit from Non-Pharmacologic Pain Care.

Military personnel carry heavy packs, move heavy equipment and undergo intense physical stresses; a high proportion of them will develop musculoskeletal disorders (MSD) involving chronic pain. Chronic pain is widely prevalent in Veterans and is one of the most common reasons for outpatient healthcare utilization.(1) In recent years, returning Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) post-9/11 Veterans with injuries have faced the prospect of decades of chronic pain.(2, 3) By seven years after deployment, approximately 17.5% of post-9/11 Veterans in VA treatment were diagnosed with back disorders and 17.0% were diagnosed with joint conditions,(4) higher rates than in comparable U.S. population cohorts.(5) Back pain, followed by neck or joint pain, is the most common cause of chronic non-cancer pain in Veterans.(6)

To decrease morbidity and mortality, a growing body of research and expert consensus support a multi-modal pain treatment strategy.(7, 8) In this bio-psycho-socially-oriented model, evidence-based non-pharmacologic treatment modalities are incorporated alongside pharmacologic treatment.(9) Multiple studies have demonstrated the effectiveness of non-pharmacological pain management in improving chronic pain outcomes, including, for example, physical therapy,(10-12) cognitive behavioral therapy,(13, 14) yoga,(15, 16) and mindfulness based stress-reduction,(17-19) and therefore guidelines now stress the importance of a multi-modal approach.(7, 20) In part to reduce prescribing of risky opioids, the availability of such multi-modal therapy at VA facilities was mandated by the 2013 Opioid Safety Initiative.(21)

Veterans with MSD Are at High Risk for Substance Misuse and Need Early Intervention.

Veterans(22) and other people(23) with painful MSD are at high risk for developing alcohol and other substance use disorders.(24, 25)

Iatrogenic factors have contributed to the risk for substance use among Veterans. The opioids prescribed to treat painful MSD carry the potential for aberrant use and eventually misuse. A remarkably high proportion, 64%, of post-9/11 Veterans with *chronic* non-cancer pain have been prescribed opioids,(6) and Veterans prescribed opioids have worse outcomes than those not prescribed opioids.(26) The base rate of substance use disorders in post-9/11 cohorts is high,(27-30) and baseline substance use is a risk factor for going on to use more substances. The causality is bidirectional, in that substance use disorders predispose people to incurring injuries,(31) and are overrepresented in Veterans with pain-related comorbidities(27, 32, 33)

Early intervention is needed for Veterans who have chronic pain and are at risk for substance misuse or are already engaging in it. Individuals with chronic pain and SUD have worse pain-related outcomes(34) and worse addiction-related outcomes,(35) than those without comorbid pain, supporting the need to intervene early to prevent this comorbidity. Restrictions on opioid prescribing may come too late to alter the neurobiological changes associated with long-term opioid treatment for chronic pain.(36-38) These neuroplastic changes endure long after opioid treatment is withdrawn and are thought to play a key role in facilitation of transition to chronic pain. Early engagement of Veterans with chronic pain into multi-modal non-pharmacological treatments has the potential to arrest the development of risky or disordered substance use and help those already misusing substances to reduce or stop this problem behavior. Furthermore, since substance use is strongly associated with treatment non-compliance in numerous settings, early interventions that reduce risky substance use have the potential to improve pain treatment outcomes by increasing Veterans' pain treatment adherence. In this proposal, although measured separately from non-pharmacological pain treatments, substance use treatment is facilitated because it is a component of pain treatment.

Compensation Examinations as a Unique Opportunity to Engage Veterans in Multi-modal Pain Care.

As of 2015, there were 971,117 post-9/11 Veterans already receiving service-connected compensation. Many of these Veterans interact with service-connection examiners at VA facilities, but they interact as claimants, not as patients. When Veterans end their military service and begin the transition to civilian life, they are encouraged to file claims for physical or psychological conditions that may be related to their military service. Veterans are encouraged to file claims during demobilization, at Veterans' resource fairs to publicize services available to Veterans, and at Veterans Service Organizations that offer assistance with the claims process.(39) The claim is processed at the VA but does not involve clinical care.

Many of these claims are for MSD. As of 2015, there were 559,999 post-9/11 Veterans being compensated for back or neck conditions, and 596,250 for limitation of flexion in joints (Veterans often have more than one involved body part).(40) In 2015 alone, 313,052 new Veterans began receiving disability compensation, of whom approximately 31% were under age 35.

Examinations to determine Veterans' compensation are important because: (1) they are often conducted when Veterans are in some degree of pain or crisis associated with their disorder; (2) significant financial remuneration is at stake; and (3) Veterans judged to have a service-connected condition will receive *priority* care at the VA for it, typically for life. The compensation examiner has a responsibility to the agency that decides claims, the Veterans Benefits Administration (VBA), to obtain information so the claim can be adjudicated. Therefore, as in forensic evaluations, compensation examiners are taught to tell Veterans that the purpose of the examination is to evaluate the disability claim and not to provide treatment. Although the examiner's role might be complicated by

him/her making a treatment recommendation, having another clinician explain available treatments is not. The failure to offer treatment can be alienating.(41)

Considerable public pressure has developed to improve the process of evaluating compensation claims such that this process includes approaches to engage Veterans in treatment. In testimony to the House Committee on Veterans Affairs, Linda Bilmes called for early intervention approaches that interface with the compensation examination process for returning post-9/11 Veterans: "VBA should shift its focus away from claims processing and onto rehabilitating and reintegration of Veterans."(42) Congressional hearings in June 2011 addressed "Bridging the Gap Between Care and Compensation for Veterans,"(43) the very topic of this proposal. One of the witnesses cited our group's editorial advocating engagement of Veterans in treatment when they apply for service-connection.(44)

Motivational Interviewing to Engage Veterans with MSD in Non-Pharmacological Pain Treatment.

Motivational interviewing,(45) a person-centered, brief psychotherapeutic approach, helps people resolve ambivalence toward positive behavioral change and strengthen their commitment to it.(46) Multiple meta-analyses have shown that MI improves treatment outcomes across a variety of behavioral domains in both medical and non-medical settings, including for substance use and treatment engagement.(47-49) MI can be delivered in person or by telephone. Telephone-based MI has been used successfully to address substance use and other risky behaviors in a variety of populations.(50-56) It has been shown to significantly increase initiation and retention of post 9/11 veterans in both VA and non-VA mental health treatment, with a secondary effect of significantly and durably decreasing their marijuana use.(57)

Notably, MI has been found to effectively improve chronic pain treatment engagement and outcomes, especially when more than one MI session is employed.(58, 59) Specifically, Habib et al(59) found that a 2-session assessment and feedback intervention based on MI, in comparison to a standard 2-session assessment and educational control interview, significantly improved the rates in which patients with chronic pain attended a series of pain management workshops. Similarly, Friedrich et al(58) showed that patients with chronic low back pain attended more physical therapy sessions and had reduced disability and pain levels when the physical therapists had been trained to use strategies consistent with MI during the patients' visits. MI is well-aligned with expert recommendations for patient-centeredness and shared decision-making in chronic pain management.(60-63) Furthermore, the VHA National Center for Health Promotion and Disease Prevention has endorsed the use of MI "to elicit and increase Veterans' own intrinsic motivation to participate in healthcare decisions and change health behaviors that are key to improving health and maintaining their well-being."(64) We propose to use MI to engage post-9/11 Veterans with MSD in multi-modal non-pharmacological pain management treatments. A recent meta-analysis of MI for chronic pain management concluded that MI is a promising approach for promoting engagement in treatments for chronic pain conditions and underscored the need for well-designed randomized controlled trials to determine the effectiveness of MI within musculoskeletal health.(65)

MI-based SBIRT for Pain Management to Engage Compensation-Seeking Veterans with Chronic Pain.

SBIRT is an approach to identify and briefly intervene with patients with risky substance use in settings not typically associated with addiction treatment.(66, 67) The Brief Intervention in SBIRT usually is based on MI. SBIRT is efficacious for reducing unhealthy alcohol(68, 69) and tobacco use,(70-72) although less well established for decreasing illicit drug use(73, 74) or improving drinking outcomes for people with severe alcohol dependence.(75, 76) According to our pilot data, most Veterans meeting criteria for the proposed study are likely to have episodic risky drinking rather than drug use and are not likely to have alcohol dependence (see Preliminary Studies section).

Our group developed SBIRT for Pain Management (SBIRT-PM) to promote engagement in multi-modal non-pharmacological pain management among compensation-seeking Veterans with chronic pain. In SBIRT-PM, a counselor meets with the Veteran after the compensation examination to address the presenting MSD complaint. A counselor rather than the compensation examiner delivers SBIRT-PM to allow the Veteran to engage in a confidential discussion without concern about how it will impact the compensation claim. The counselor addresses Veterans' motivation for multi-modal pain care, and explains how pain can be managed using a variety of non-pharmacological pain management services. The counselor spells out how those services can be accessed at VA.

Using permissive language about how pain is commonly self-medicated with substances, the counselor transitions to inquiries about use of prescription and non-prescription substances. The counselor then attempts to motivate Veterans to change their behavior if they are misusing substances. Thus, SBIRT-PM addresses the Veteran's presenting pain complaint first and nascent substance use subsequently.

A Veterans Integrated Service Network Hub-and-Spoke Model of SBIRT-PM Delivery.

The VA often employs the hub-and-spoke model to manage care across a geographically-dispersed healthcare system. The hub-and-spoke model allows for expertise concentrated in specific geographic areas to be available throughout the system. The Veterans Health Administration is divided into 18 geographical regions across the United States called Veterans Integrated Service Networks (VISN). VISNs are organized as hub-and-spoke networks in which a central administration oversees healthcare policy and service delivery of all medical centers in the designated region.(77) VISN 1 consists of eight VA medical centers and 50 outpatient clinics throughout the six New England states.

We will adopt a VISN1-wide hub-and-spoke network implementation system in which VA Connecticut Healthcare System will serve as the hub for SBIRT-PM delivery in all eight VISN1 medical centers. The hub will be the site for screening and identifying individuals appropriate for SBIRT-PM, delivering the intervention via telephone to Veterans throughout New England, and referring Veterans to site personnel who make pain management service referrals. This approach has the advantage of fitting the way in which many other clinical interventions and areas of expertise are delivered within VA. One widely used example of a hub-and-spoke model in VHA is SCAN-ECHO (Specialty Care Access Networks-Extension for Community Healthcare Outcomes). In these programs, "hubs" with experts in a particular area arrange teleconferences, trainings, and case consultation for providers in "spokes" or satellite sites. VA Connecticut is the site for a SCAN-ECHO program for pain management, and this model appears to be effective. Suggestive evidence of its effectiveness is that providers who participate in the pain SCAN-ECHO program have been significantly more likely to use physical medicine, anti-depressants, and anti-convulsant treatments, but not opioids.(78) Other examples are the VA Epilepsy Centers of Excellence to assure increased access to high quality of care for Veterans with epilepsy.(79) A hub and spoke model has the advantage of being more cost-effective compared to no network from a hospital(80) and societal perspective.(81) Hub and spoke systems allow for full-time personnel to specialize in the intervention and serve multiple sites, rather than requiring training of larger numbers of personnel at many sites.

The theoretical framework for implementation of SBIRT-PM in a hub-and-spoke model is Relational Coordination.(82) Relational Coordination refers to the quality of communication and collaboration across sites and is predictive of a team's or organization's ability to provide high quality care.(83-85) Hub-and-spoke networks function through collaborative relationships between individuals working across sites.(86) Information must flow effectively between members of the hub-and-spoke sites for care to be timely, coordinated and appropriate for the patient. In this study, we will first explore how relationships among clinical and administrative staff involved in pain care are coordinated at the sites during baseline semi-structured interviews early in the UG2 phase. Informed by what stakeholders tell us, we will then work to build Relational Coordination within our hub-and-spoke network to deliver SBIRT-PM.

Within the VA, there are financial incentives for VISN-wide initiatives, such as the one proposed, that bring Veterans into VA care. The formula for funding each VISN is essentially a capitated model of payment per Veteran, called the Veterans Equitable Resource Allocation (VERA). Each additional patient in the New England VISN generates a mean of $6500(87) (the median is considerably lower) and Veterans whose conditions are judged to be connected to their military service are, understandably, the highest priority Veterans for VA facilities to enroll. The VA as an organization depends on enrolling new Veterans as those from prior wars die or move to other regions. Beyond having the potential to improve care for Veterans applying for compensation for MSD-related claims, to the extent SBIRT-PM results in new Veteran enrollment, it could increase revenue into VISN1 and its medical centers. Therefore, our proposal includes a budget impact analysis, with the prosaic but crucial information as to how SBIRT-PM impacts the VISN bottom line. We will determine the cost and cost-effectiveness of SBIRT-PM because these data provide evidence for SBIRT-PM's value.

Specific Aims: UG3 planning phase

This proposal involves a pragmatic multi-site clinical trial of an early intervention with this at-risk population of Veterans: Screening, Brief Intervention and Referral to Treatment for Pain Management (SBIRT-PM). SBIRT-PM aims to engage Veterans applying for compensation with pain conditions in multi-modal non-pharmacological pain care and to motivate those who misuse substances to change this problematic behavior.

SBIRT-PM will be delivered centrally by telephone throughout the New England VA Healthcare System's (VISN1) eight medical centers using a hub-and-spoke network implementation strategy guided by a Relational Coordination Framework. Hub-based SBIRT-PM counselors will coordinate Veterans' engagement in non-pharmacological pain services through interactions with the extant spoke site personnel who refer Veterans to pain and/or substance abuse treatment. In this pilot trial, we will enroll five veterans from each of the eight medical centers in New England. Enrolled participants will be assessed at baseline and week 12. After baseline, they will be contacted by a study counselor and offered SBIRT-PM, a telephone-based initial session followed by up to three calls in a 12-week period to support Veterans engagement in non-pharmacological pain care.

Our first objective is to plan and prepare the multi-site pragmatic trial of SBIRT-PM vs. UC for implementation. The specific aims are to:

Aim 1: Secure VA Central IRB approval for the multi-site protocol (milestone: approved protocol).

Aim 2: Prepare SBIRT-PM for implementation at each site by (a) conducting key informant interviews about SBIRT-PM, (b) establishing procedures at the spokes to communicate contact information for Veterans applying for compensation to the study recruiter, (c) visiting sites to better coordinate SBIRT-PM between hub and spoke sites, and (d) piloting the intervention. Milestones for achieving these are completed interviews and qualitative thematic analysis of the transcribed interviews; site-specific recruitment procedures detailed in standard operating procedures; site visits completed; pilot SBIRT-PM with up to 10 Veterans per site; site-specific adjustments made to SBIRT-PM to facilitate pain treatment referrals.

Aim 3: Refine new outcome measures (milestones: worksheet for estimating costs; natural language processing algorithm to identify use of specific pain services).

UG3 2-year Planning Phase Milestones

To prepare for the pragmatic trial, we have pre-specified milestones that, if accomplished, will demonstrate our ability to transition to the UH3 phase. The timeline for initiation and completion for each milestone is presented in the table below, followed by a description of the procedures we will use to reach each milestone.

Month	Milestone
1-6	1. Obtain VA Central IRB approval for 2-phase study
1-2	2a. Establish SBIRT-PM investigative team meeting structure
2-6	2b. Establish procedures to communicate contact information of Veterans applying for compensation from spokes to the hub
2-12	2c. Establish procedures for communications between SBIRT-PM counselors at the hub and medical center staff involved in engaging Veterans in multi-modal pain care/substance abuse-focused treatment at each of the spokes
6-12	2d. Complete site visits
6-21	2e. Complete key informant interviews and surveys about relationships among staff involved in SBIRT-PM, pain management and service-connection examinations
6-24	2f. Veterans Engagement Board reviews SBIRT-PM intervention and implementation/provides feedback
6-18	3. Refine cost estimation methods
12-18	4. Hire SBIRT-PM counselors and establish Service Use Agreements between the hub and each of the spokes.
12-21	5. Train SBIRT-PM counselors, pilot SBIRT-PM in up to 10 Veterans per site, and incorporate adjustments into the intervention manual
19-24	6. Pilot pragmatic trial procedures and finalize standard operating procedures
1-24	7. Develop a new natural language processing algorithm that identifies use of non-pharmacological pain management services (validated against expert rating of chart notes)
21-24	8. Obtain IRB approval for revisions to pragmatic RCT based on UG3 phase

1. Obtain VA Central IRB approval for the multi-site protocol

To coordinate IRB review across the eight participating medical centers, we will use the VA Central IRB. Dr. Rosen's group is currently completing a two-site HSR&D funded-study of Veterans that is overseen by the Central IRB, and we are familiar with the Central IRB procedures and guidelines. The Central IRB has, as part of that study, already approved many of the procedures proposed for this study. Each of the proposed VISN1 sites already has the VA Central IRB on its Federal-wide Assurance and a Memorandum of Understanding with the VHA Central Office Human Research Protection Program. These pre-existing agreements expedite protocol review for multi-site trials being conducted within the VISN1 Clinical Trials Network (CTN). We will receive administrative support from the VISN1 CTN as part of our VA Central IRB application (see Letter of Support from Dr. Boden, the Scientific Director of VISN1 CTN).

2. Establish hub-and-spoke coordinated relationships

For the purposes of the trial, a research assistant based at VA Connecticut will obtain a list of potentially eligible participants from the "spoke" Compensation and Pension Services. That research assistant will contact, consent, and baseline assess eligible Veterans (detailed recruitment procedures are in the Human Subjects Section). Thereafter, Veterans' will receive phone-based SBIRT-PM over a 12-week period (see 3.C.3.6 for SBIRT-PM description) from the "hub" SBIRT-PM counselor.

Within VA, patients are assigned to Patient Aligned Care Teams (PACT), which function as integrated medical homes. Implementation studies have demonstrated that team-based care delivers more efficient and patient-centered interventions than assignment to providers working independently.(89, 90) VA PACTs arrange pain management for the large majority of patients with chronic pain.

Although each PACT includes multiple healthcare professionals, the core of the PACT is usually a primary care physician and a nurse care manager who care for the same panel of patients. Typically, the team's nurse care managers triage requests for pain care. The nurse care managers then arrange for the appropriate referral from the team prescribers, and follow up with patients by phone to communicate what care arrangements have been made.

Working with the VA PACT structure, the SBIRT-PM counselors will facilitate Veterans connection with their teams, or initiate the process of getting Veterans not currently receiving VA-based primary care registered, so that consults for multi-modal care can be placed. The SBIRT-PM counselors and the nurse case managers will need to collaborate to engage Veterans in non-pharmacological pain management care over time. The coordination between the SBIRT-PM counselor and the people making pain management referrals may vary within and across the eight spoke sites. We have detailed six milestones below reflecting the establishment of hub and spoke relationships needed for SBIRT-PM. The relationships are among SBIRT-PM trial investigators, SBIRT-PM counselors, nurse case managers and other people who arrange pain treatment, and Compensation and Pension Clinic stakeholders. We will conduct a mixed methods formative evaluation to inform how we coordinate relationships between the hub and spoke sites and make site-specific adaptions to SBIRT-PM.

3. Establish SBIRT-PM investigative team meeting structure

Within the first two months of this project, Drs. Rosen and Martino will establish weekly investigative team meetings involving the core hub-based investigators (Rosen, Martino, Becker, Sellinger, Fenton) and Site-PIs. These meetings will focus on initiating the planning phase of the study and achieving the major UG3 milestones. To avoid the tedium of too-large conference calls, we will use suggested procedures such as familiarizing participants with each other, a written agenda, and respecting participants' time by only requesting their attendance when it is needed. In addition, we will establish separate cores to address specific areas requiring focused planning, with membership dictated by expertise and designated duties: 1) cost estimation methods (Barnett, Fenton); 2) mixed methods formative evaluation (Mattocks, Becker, Sellinger); 3) natural language processing algorithms (Zeng, Becker, Sellinger); and 4) SBIRT-PM adaption (Becker, Sellinger). Core meetings will occur on a biweekly basis, and Drs. Rosen and Martino will participate in each core.

4. Establish procedures to communicate contact information of Veterans applying for compensation from spokes to the hub

By month 6, each Site-PI will establish procedures for obtaining contact information for Veterans who have requested compensation for MSD. The requests for service connection examinations (VA Form 2507) are available at each site on Compensation and Pension Record Interchange (CAPRI) software, a platform for communication between the Veterans Health Administration and Veterans Benefits Administration. The software is used by the Compensation and Pension clinic's schedulers, administrators and examiners. Each site will designate someone to use the CAPRI software and its output to obtain and forward contact information for potentially eligible participants. Examination requests are also available via the Veterans Benefits Management Software (VBMS) and other platforms being beta tested as part of the automation of the claims process.

5. Establish procedures for communications between SBIRT-PM counselors at the hub and medical center staff involved in engaging Veterans in multi-modal pain care at the spokes

Each site PI, in collaboration with Co-Investigator Dr. Sellinger, will identify the nurse care managers and other personnel who arrange pain care treatment at the spoke sites.

In fact, though, each spoke medical center is, in turn, the hub for smaller community-based outpatient clinics throughout each state. Thus, although the survey of Medical Centers in our Preliminary Studies showed the availability of non-pharmacological modalities at all of the VISN1 Medical Centers, Veterans in, for example, rural areas in Maine may have difficulty accessing services at the hub site in Togus. These Veterans will be able to access services at the medical center (if reachable), the community clinic if it has them, or via a community provider paid for by the Veterans Access, Choice and Accountability Act (aka Veterans' Choice).

Therefore, The SBIRT-PM counselor will compile a table indicating how to access the treatment modalities available at particular locations throughout the VISN, including those non-VA resources that are accessible via the Veterans' Choice program. As important, the SBIRT-PM counselor will identify people to contact at each site for Veterans needing services. By month 12, each Site-PI will identify who the SBIRT-PM counselor should contact at specific regions for specific treatment needs. Examples of issues the SBIRT-PM counselor will have a 'go to' person to help with include clarifying eligibility for VA services (the eligibility office) and arranging a referral to a specialty pain treatment (the nurse care manager or other members of the primary care team). The Site-PI will also clarify the preferred modalities for sharing information among the SBIRT-PM counselor and PACT team member contacts.

6. Complete site visits

By month 12, one of the mPIs will have visited each medical center to facilitate Compensation and Pension, Primary Care, and medical center leadership support for the SBIRT-PM project. The mPIs will be accompanied by Dr. Sellinger who will meet with the staff involved in referrals and provision of non-pharmacological pain treatment, and those involved in substance abuse treatment referrals. As detailed below, Dr. Mattocks will complete site visits to conduct key informant interviews and obtain quantitative survey data about intra-facility relational coordination of key stakeholders and service providers. These visits will be coordinated with each Site-PI.

7. Complete key informant interviews and surveys about relationships among staff involved in SBIRT-PM, pain management and service-connection examinations

We will use a multi-phase, mixed methods approach to understand how to best coordinate the working relationships among staff involved in the SBIRT-PM project. Our approach will involve examining both co-occurring and sequential elements and look for convergence of the pragmatic trial's results and qualitative findings to isolate key factors that promote engagement in pain care management in the VA. Importantly, we will not collect any personally identifiable information about clinical and administrative staff who participate in the interview and survey. The different components of the mixed methods approach are bulleted below:

- Quantitative assessment. We will use the Relational Coordination Survey(79) to examine how clinical and administrative staff in Compensation and Pension and Primary Care communicate with each other about the treatment needs of compensation-seeking Veterans along seven dimensions (frequency, timeliness, and accuracy of communication, problem-solving, shared goals, shared knowledge, mutual respect). Respondents indicate the frequency in which each dimension exists in their setting on a 5-point scale (1 = never, to 5 = constantly). The mean of the individual scores serves as the overall RC score for each dimension within each spoke site. As noted previously, guidelines for conduct of compensation examinations emphasize their

evaluative, non-therapeutic nature, and we anticipate many sites having limited communication and shared goals about engaging Veterans in treatment when they are applying for service-connection. The survey will be administered prior to pilot intervention in the UG3 phase and again at the end of the UH3 phase. Up to 15 VA staff members at each site (total of 120) will be identified by Site PIs and invited to complete the survey online through VA REDCap.

- Development of Interview Guides (months 6-9). The interview will begin with a "grand tour" question designed to establish rapport and encourage the respondent to open up and describe his/her experiences. Based on the response to this opening question, probes will be used to understand specific details of those experiences. Probes are designed to elicit information pertaining to our conceptual framework, as well as unanticipated information that may be discovered in the course of qualitative interviewing.(91, 92) We will design and pilot test semi-structured interviews with key informants at our local facility before finalizing the interview protocol and scheduling the full qualitative sample. Building on our conceptual framework of Relational Coordination, the interview protocol will be designed to assess relationships among providers, care coordination, and communication between different providers within the VA system.
- Conduct Semi-Structured Interviews (months 10-15*).* For each VAMC included in the study, a site visit will be made and all staff participant interviews will be conducted in person or by phone by Dr. Mattocks or her team. From our prior experience, site visits are the best way to understand the unique nature of each VA environment and to form a meaningful rapport with the respondents. Pilot Veteran participant interview will be conducted by phone by Dr. Mattocks or her team. Taken together, we propose to interview the 10 pilot patients and 5 key informant staff members per facility across 8 facilities, for a total of 80 interviews with pilot patients and 40 key informant interview, which should allow us to reach thematic saturation.(93)
    - Veteran Participants: At each site, we will interview the patients serving as pilot SBIRT-PM participants (n= up to 10) and, using a semi-structured interview from our R34-funded study, ask them about 1) their perception of pain management services available in the VA prior to receiving SBIRT-PM, what might help them engage in multi-modal pain care, and their experience of the SBIRT-PM intervention.
    - Staff Participants: We will conduct in-depth interviews with Compensation and Pension and Primary Care providers and clinical administrators involved in the care of Veterans with chronic pain. These interviews will be used to assess the organization and coordination of pain management services at each site. In addition, we will describe SBIRT-PM to these staff members and ask them about what they see as potential facilitators and barriers to SBIRT-PM's implementation.
- Qualitative Analysis (months 16-21). All interviews will be digitally recorded for verbatim transcription by the Centralized Transcription Service Program in Salt Lake City, UT. Analysis of qualitative data will be conducted using ATLAS.ti, a qualitative data analysis software program allowing fluid "interaction" of data across types and sources. Initially, a top-level codebook for interviews will be developed by Dr. Mattocks and her research team based on the interview guide and the conceptual framework. The codebook will be elaborated upon based on emergent themes, and adjusted as interviews proceed. Interviews will be compared within each facility, within each sampling sub-frame, and across each of these groups. These multiple approaches and groupings are facilitated by the software program, which has the capacity to group data in multiple ways, allowing maximum flexibility in negotiating a complex narrative dataset. Interim findings will be reviewed by the entire research team monthly. Specifically, a summary for each type of participant (e.g., primary care and compensation and pension providers and administrators) will be created, outlining their responses to each domain of probes. Summaries will be reviewed periodically by the research team to develop consensus as to which domains necessitate in-depth explication (based on how robust the responses are). We will also analyze across transcripts to identify the most salient components of referral to pain management. We will categorize these components into critical components and ideal components (ideal for pain care engagement) and examine the range of factors that shape the quality of pain care at each facility. Specific factors common to at least ~25% of the data will be delineated by codes and will be compared and contrasted across the strata. Each factor will be characterized and associated with other relevant factors and overall experiences. Information relevant to adapting the implementation of SBIRT-PM will be shared with the SBIRT-PM research group.

8. Veterans Engagement Board reviews SBIRT-PM intervention and implementation/provides feedback

We will involve the Veteran Engagement Board for the Pain Research, Informatics, Multi-morbidities, and Education (PRIME) Center of Innovation for Veterans at VACHS for our proposed project. The Board consists of six members and meets four times per year. Board members are Veterans who bring their unique military background, health conditions, and health consumer perspective to the research arena. Board members collaboratively discuss study protocols and provide researchers feedback on their research ideas, protocol implementation, and dissemination of research results and effective practices. We will involve the Veteran Engagement Board in both the UG3 and UH3 phases. For the UG3 phase, we will meet with the board members at month 18 to receive their feedback about our plans to implement SBIRT-PM in VISN1 medical centers and engage them electronically outside of meetings as needed.

9. Refine cost estimation methods

The methodology we will use to estimate the costs of delivering SBIRT-PM will be from the perspective of the providers (i.e., both the VISN and medical center) to increase the usefulness of the cost estimates to these real-world decision-makers.(94) We will not include research costs (e.g., participant reimbursements, assessment measurement) but rather restrict cost estimates to those associated with implementing SBIRT-PM at the different sites. Our cost methodology will follow the micro-costing steps recommended by Yates(94) and Zarkin et al.(95) We will first delineate relevant non-research activities (e.g., SBIRT-PM training, delivering SBIRT-PM, supervision, obtaining contact information for Veterans who have requested compensation for MSD, time spent by nurse case manager and primary care provider with Veterans to promote multi-modal pain care) and, for each identified activity, we will gather data on both the time spent by personnel in the activities and, as relevant, the space associated with each activity using a modified version of the Resource Allocation Worksheet developed for Project COMBINE.(96)

A key milestone for this stage will be to customize the Resource Allocation Worksheet so that it reflects this study's specific settings (i.e., "hub" counselors. Research assistants and "spoke" PACTs). This form will collect data on the total labor hours spent on each activity by the SBIRT-PM trainer, the counselor delivering SBIRT, and PACT members and the space used in conducting the activity. The labor costs of each activity will be equal to the product of the amount of time spent by each person on the activity and their fully-loaded wage (i.e., including fringe and overhead). To estimate space costs, the research assistant, in collaboration with the Site PI, will obtain the size of the rooms (in square feet) used for training, delivering SBIRT-PM, supervision, and interactions with members of the PACT for the purposes of promoting Veterans' multi-modal pain care. We will calculate in square footage an average space estimate for training and delivery of SBIRT-PM at the hub VACHS site, as well as for each spoke site where PACT coordination of multi-modal pain care will occur. In each case, we will multiply these domains by the annual rent per square foot for the medical center. We will obtain salary data (actual wage plus fringe rate for salary staff and hourly contract rate for contract staff) for the SBIRT-PM counselor and PACT members coordinating multi-modal pain care with Veterans in the study. We also will record all the direct material expenses related to the training and delivery of SBIRT-PM (e.g., manual, rating forms, recording device). The final Resource Allocation Worksheet, including ensuring access to all necessary cost data, will be finalized by month 24.

10. Hire SBIRT-PM counselors and establish Hub-Spoke Service Use Agreements.

We will hire two part-time SBIRT-PM licensed counselors in Year 2. These counselors will be credentialed and privileged at VA Connecticut. We will establish Service Use Agreements between VA Connecticut and spoke sites that will be modeled on the Telehealth Service Agreement (frequently used at VA Connecticut) that govern treatment by prescribing clinicians at hubs and non-prescribers managing patients at spokes. The agreements will specify (a) services provided by the SBIRT-PM counselors, (b) how they will communicate with the spoke personnel, (c) contacts and contact information at the hub and spoke, and (d) procedures for charting and handling emergencies. The agreement will be signed by the involved counselors (i.e. SBIRT-PM counselor and site-PI or his/her designee) and the Service Chief for the counselors' service. At VA Connecticut, the Service Chief is the Mental Health Service Line Chief. At spokes, the signing official may vary depending on the Site-PIs' clinical administrative reporting line.

11. Train SBIRT-PM counselors, pilot the intervention, and incorporate adjustments into therapy manual

Dr. Martino will train two counselors at VA Connecticut (the hub) in SBIRT-PM. He will use well-established methods used to train MI-based brief interventions to counselors in several other multi-site clinical effectiveness and counselor training trials.(97-101) In brief, this will entail an 8-hour experiential workshop and SBIRT-PM manual review, followed by supervised pilot cases at each of the sites, incorporating fidelity rating-based feedback and coaching based on the review of audio recorded telephone sessions using the Independent Tape Rater Scale.(102) Dr. Martino will conduct the supervision and meet with the counselors on a biweekly basis during the preparation phase. Beyond developing their SBIRT-PM proficiency, Dr. Martino will discuss with the counselors their efforts to coordinate Veteran referral to and engagement in non-pharmacological pain management services with primary care providers. In addition, he will track the minutes counselors spend conducting the session to determine the optimal length when delivered by telephone instead of in-person (as was done in the completed SBIRT-PM trial). Dr. Martino will log observations generated from supervision and his session reviews to inform adjustments to SBIRT-PM delivery, including the coordination of relationships between the counselors and site providers and administrators. He will share these observations with the SBIRT-PM research group.

We will pilot SBIRT-PM with up to 10 Veterans at each site (total up to n=80) who meet trial eligibility criteria. We will qualitatively assess the Veterans' reactions to the intervention within each site, as described above. This information will be used to adjust SBIRT-PM prior to trial implementation. All data will be shared with the SBIRT-PM research group, where ongoing revisions to the SBIRT-PM therapy manual will be made.

12. Pilot pragmatic trial procedures at each site and finalize standard operating procedures

Recruitment, informed consent, baseline and 12-week follow-up assessment methods will be piloted with the 10 pilot SBIRT-PM Veterans at each site. In addition, we will pilot both the nail sample and blood spot collection procedures to allow the research team to determine which approach is the most feasible for gathering drug/etoh use metabolites in the UH3 Phase. Data management and quality monitoring systems will be tested. Any problems with trial procedures will be corrected. The Project Director will draft all trial standard operating procedures, which Drs. Rosen and Martino will review and edit before final approval.

13. Develop a new natural language processing (NLP) algorithm that identifies use of non-pharmacological pain management services with a positive predictive value of at least 0.7 (validated against expert rating of chart notes)

To comprehensively identify pain-related treatment delivered to study participants, we will validate and extend existing natural language search algorithms, using previously-described procedures, to identify current use of a comprehensive set of pain treatments including those *not covered by the existing algorithms*. Those modalities will be drawn from a review of modalities used by Veterans for pain treatment and those offered in VISN 1 (see Preliminary Studies). Algorithm development will be informed by our prior experience with this study design. We will design algorithms to maximize positive predictive value (at the expense of sensitivity) to avoid the risk of including false positives that are not randomly distributed (e.g., refused treatment referrals). The NLP extraction target will be current use of the modality. Particular attention will be paid to excluding pain discussions that do not represent treatment because they were obtained in the course of routine medical history reviews. Algorithm development involves extracting relevant snippets that mention a particular pain treatment, establishing a valid classification system for current use of that pain treatment, and optimizing the machine learning algorithm to identify current use of that treatment.

Extracting relevant snippets: In brief, terms related to each of the pain treatments (i.e. therapy keywords) will be generated by the investigative team. For example, for physical therapy, terms might include "physical therapy," "PT," or "physical therapist." A simple algorithm will identify these terms, along with the 10 preceding and 10 following words. By our observation, a 20-word window is sufficient to capture most of the relevant context, and also allows for fast review of multiple records. The algorithm will be modified using Boolean terms (e.g. physical NOT physical exam). We will refine the search terms and extract 20+ word snippets using the Voogo clinical data search engine.

Establishing a valid classification system for use of a pain treatment modality: Drs. Rosen and Sellinger will develop annotation guidelines for classifying snippets as representing current service use (e.g., of physical therapy services as no/yes/probably). One challenge is that the documentation of temporal information varies in specificity. We will classify the temporal information into several categories based on the onset and duration attributes. For instance, usage with a non-specific past start and end time (e.g., "patient used physical therapy before") will be considered to be past usage, usage with no specific past start but no end time (e.g. "patient has been going to a physical therapist") will be considered current for the time of documentation, usage with specific start and end time will be considered current for the time it specified, etc. We will also develop annotation guidelines for VA and non-VA service use. The annotation guidelines will be revised and then tested on 100 snippet samples until a kappa of 0.85 or the highest obtainable with serial refinements of annotation guidelines is reached between the two experts.

The accuracy of NLP in identifying use of a particular modality may be dependent upon the search terms used. Modeling similar terms separately vs. modeling them in combination may produce different results. We will explore these results by annotating different combinations of search terms to see what items or combination of items best identifies use of a modality.

Optimizing the machine learning algorithm to identify use of a pain treatment: We will then randomly select 500 text snippets containing terms per type of pain therapy from all retrieved notes from primary care and perform human review based on the annotation guideline described above. Annotation work will be carried out using the Visual Tagging Tool (VTT). This set of annotates data will be added to our existing set of annotated data (n=3000) and serve as the new gold/reference standard for machine learning and training. We will apply a machine learning algorithm, Support Vector Machine (SVM), to identify current use of pain therapy, optimizing for highest positive predictive values (PPV). Informed by our prior experience, we will use therapy keywords, n gram (n consecutive words), note type, and temporal information as features in the classification of current use. Temporal information will be extracted using a prior method developed and tested by Dr. Zeng.(103)

To assess the NLP performance, we will perform 10-fold cross validation, which partitions the entire annotated sample into 10 random sets with equal size, uses 9 sets for training and 1 for testing, and repeats 10 times. Our target PPV is >=90%, given that our current complementary and integrative health NLP algorithm reached a PPV of 89% on a smaller set of therapies. We will apply machine learning methods we trained using previously acquired annotated data such as Support Vector Machine and Random Forest, and will use an ensemble learning step called Stacking,(104) in which a learning algorithm combines the results of several other learning algorithms, if the separate programs' performance fails to reach the target positive predictive value.

Contingency Plan. As has been described in a survey of pain researchers,(105) a variety of approaches to characterize pain and pain treatments are employed, ranging from a person reviewing the medical record to the automated approaches in this application. Both the human and machine-conducted data extraction are only as good the reliability and validity with which what is to be extracted from the chart is defined. Thus, should the NLP algorithm not achieve acceptable positive predictive value for particular modalities, we will apply a hybrid approach to those modalities in which the NLP algorithm will be used to identify cases of possible use of a particular pain service, and extract the relevant text (and surrounding text) to be judged by pain experts on our team (Drs. Becker and Sellinger).

14. Obtain VA Central IRB approval for revisions to pragmatic trial based on UG3 phase

Any changes to the SBIRT-PM trial protocol based upon the experiences garnered in the UG3 planning phase will be submitted to the VA Central IRB for review and approval by month 21 to allow for timely implementation in the UH3 phase.

Study Settings.

The study will occur within the eight VISN1 VA medical centers (VAMC) located across six New England States. Each site provides MSD-related compensation examinations, addiction/mental health treatment, and a variety of non-pharmacological pain treatments.

The medical centers are:

1. Bedford VAMC
2. Boston Healthcare System
3. Central Western Massachusetts
4. Connecticut Healthcare System
5. Maine Healthcare System
6. Manchester VAMC
7. Providence VAMC
8. White River Junction VA

Screening and Recruitment

Veterans:

The recruitment strategy involves first identifying Veterans scheduled for a compensation examination for an MSD by reviewing chart and Compensation Clinic information about Veterans scheduled for these evaluations. A research assistant at the hub site will exclude people whose records preclude post-9/11 military service and mail recruitment letters. These potentially eligible Veterans will be mailed a letter from the mPIs explaining the basics of the study and that a member of the research team will call to further explain the study. A toll-free phone number will be included in the letter that Veterans can call to opt out of receiving the phone call or to express their interest in participating. Veterans who opt out will not receive any more study-related phone calls. A copy of the Study Information Sheet describing the study will be included with the recruitment letter.

At least four days after the recruitment letter is sent, research assistants will call Veterans up to three times to invite them to participate in the study. A four-day waiting period from the day the letter is mailed to the day of the call is sufficient to allow Veterans time to receive the letter in the mail, but not so long that Veterans are likely to have scheduled and completed their C&P exams before the recruitment call can be made. During this recruitment call, the research assistant will explain the study and further screen for eligibility. For eligible Veterans, the research assistant will conduct informed consent and baseline assessments during this phone call or subsequently. Although enrollment ideally occurs before the Compensation examination, Veterans will be allowed to enroll up to six weeks after recruitment letters are mailed. If a Veteran misplaces or has not received the Study Information Sheet, the Research Assistants will offer to mail another copy to the Veteran. The Veteran can choose to continue with the recruitment call or to wait until they receive the copy of the Information Sheet before continuing.

VA Staff:

Site-PIs and site coordinators will help identify clinical, administrative, Compensation & Pension, and Primary Care providers involved in the care of Veterans with chronic pain at participating VAs. Dr. Mattocks and her staff will email or call each provider using a standardized email/telephone script to describe the study and schedule interviews. Appended to the invitation will be a brief summary of the topics to be covered in the interview. After sending the recruitment email, we will make follow-up telephone call attempts on 3 separate days to schedule each interview. Informants who cannot be reached after 3 phone attempts will then be replaced by another informant, as available. Surveys will be administered through VA REDCap. Surveys will be emailed from site PI to VA staff email addresses and contain a unique survey link to complete the survey on the VA Intranet.

Natural language processing (NLP) algorithm for pain-related treatments:

Snippets of chart data will be identified that contain pain-related treatment keywords and surrounding text will be identified from electronic medical records from up to 10,000,000 (approximately number of Veterans with medical records). These snippets will be reviewed to identify approximately 700 snippets per pain treatment modality (100 for developing annotation and 600 for validating the algorithm using the developed annotation).

Enrollment

Veterans:

1. Voluntary informed consent will be obtained from all Veterans prior to participation.

2. A waiver of Documentation of Informed Consent (Form 112b) and a waiver of HIPAA Authorization (Form 103) will be obtained. This study is considered minimal risk and there are no procedures for which written consent is normally required outside the research context. Participants will receive a Study Information Sheet detailing the study. In an audio-recorded telephone call, a research assistant will go over all aspects of informed consent with potential participants. At the start of the call, the research assistant will verify the identity of the participant. Veterans will be provided with information about the SBIRT-PM intervention, how long it will last, the nature of study assessments, information about the collection of biological specimens, the examination of their electronic health care and VA data, and potential risks and benefits of study participation. Veterans will be reminded that they can withdraw from the study at any time without penalty. They will be given the opportunity to ask questions and then will be asked if they agree to participate.
3. Veterans who agree to participant will state so for the audio-recording. Audio-recorded consents will be stored on VA Network computers behind the VHA firewall.
4. Staff obtaining verbal consent will have completed a web-based course with post-test on Human Research Protections, and all will have had specific training by the mPIs in obtaining informed consent for this project. All staff obtaining consent will be authorized to do so by the VA Central IRB.

Following enrollment, the following steps will occur:

- Research assistant arranges for Veteran to make contact with the SBIRT-PM counselor
- Veteran receives SBIRT-PM over a 12-week period
- Weeks 12: Research assistant administers assessments by phone, including obtaining nail samples or blood spot samples.

VA Staff:

1. We will request a waiver of documentation of Informed Consent for VA Staff participants (Form 112b).
2. Research staff will describe the purpose of the survey and interview prior to administering these assessments. Participating VA staff members will be encouraged to ask any questions and have the option to discontinue participation without prejudice. They will be approached by people other than their direct supervisors.
3. After a brief reiteration of the study purpose, the interviewer will confirm consent to record the interview for transcription and analysis purposes before proceeding.

Inclusion and Exclusion Criteria (UG3)

Veterans

Inclusion criteria are:

1) Post-9/11 Veteran applying for MSD-related compensation, as ascertained from filed claim;
2) Reports a score of ≥4 (threshold for moderately severe pain) on the BPI's Pain Severity subscale (average of four pain intensity items);
3) Availability of a landline or cellular telephone for SBIRT-PM.

Exclusion criteria are:

1) Reports inability to participate during the study enrollment call;
2) Received three or more non-pharmacological pain treatment modalities (as previously categorized (111)) within the last 12 weeks from VA.
   Modalities include (1) primary care doctor visit for pain, (2) surgery for pain, (3)spinal cord stimulator, (4) injection for pain, (5) TENS, (6) Acupuncture/dry needling/Acupressure, (7) manipulation of spine or joints, (8) massage therapy, (9) yoga, (10) tai chi or Qigong, (11) Reiki, (12) Biofeedback, (13) education about how to cope with pain, (14) counseling for pain, (15) relaxation techniques for pain (such as guided imagery), (16) mindfulness or meditation, (17) hypnosis or hypnotherapy (18), exercises like strength training or stretches to help with pain.
3) Participation in another PMC3 study as evidenced by a research protocol alert for that study at the time the study invitation letter is mailed.

VA Clinicians and Administrators (UG3)

VA clinicians and administrators in Compensation and Pension and Primary Care will complete semi-structured key informant interviews and brief surveys to assess the organization and coordination of pain management services at each of the study sites.

These participants are invited by the investigators because they are employees at the study sites and have some clinical or administrative involvement with Veterans who have MSD.

SBIRT-PM Intervention.

SBIRT-PM involves a manualized, motivational interviewing-based 4-session telephone-delivered intervention over a 12-week period to motivate Veterans to engage in multi-modal non-pharmacological pain care and, for those with co-occurring risky substance use, also to change this problematic behavior. SBIRT-PM also includes coordination between the SBIRT-PM counselors and the PACT nurse case manager or primary care provider after the initial session to support these patient outcomes. SBIRT-PM will be delivered centrally from the VA Connecticut hub to the VISN1 medical centers by counselors trained in the approach (see subsection 3.C.2.9 describing counselor training procedures). All sessions will be audio recorded for the purposes of SBIRT-PM fidelity assessment and supervision.

Initial Session.

The initial session is conducted after the compensation examination for the presenting MSD complaint. The counselor begins by explaining the separation between any service-connection claim and the counseling, as we have done in prior studies. The counselor also explains the structure (4 sessions over 12 weeks), and focus (engagement in pain management services, changing risky substance use if it exists) of SBIRT-PM and then begins the interview by asking about the Veteran's MSD condition and experiences with pain, conveying understanding and compassion for the Veteran's experience. Next, the counselor explains how pain can be managed using a variety of pain management services, and how these services can be accessed at VA.

The counselor explains pain management consistent with guidelines issued by the American College of Physicians,(112) calling for education, encouragement of self-management, and judicious use of non-opioid medications. The explanation is in the spirit of providing information, not an exhortation. The counselor describes how the goal of pain treatment is improving function ("helping you get back to doing things that are important to you") and that it may take a variety of different treatments to achieve this goal. The counselor further describes how pain is commonly associated with decreased activity, which in turn can contribute to other problems.

The counselor's explanation of the role of opioid medications paraphrases messages that primary care providers deliver to Veterans as part of Dr. Becker's safe prescribing approach.(113) The counselor explains that medications, including both opioid and non-opioid medicines, have an important place in some Veterans' pain treatment, and that Veterans benefit when pain medicines are prescribed and taken safely. The counselor reinforces the importance of taking opioid medicines as prescribed because there are risks of addiction and interactions with other substances (like alcohol). The counselor explains that judicious use of non-opioid medications improves pain treatment outcomes without these risks.

The counselor introduces the idea that non-pharmacological treatments can help manage pain, and explains what they are and how they work. These services may include: (1) treatment for the underlying ailment, (2) physical therapy (both at VA and as home exercise and stretching programs), (3) behavioral treatments like Cognitive Behavioral Therapy for chronic pain, (4) treatments for depression, PTSD, and/or other mental health problems that chronic pain may have aggravated, and (5) complementary and integrative health interventions available including chiropractor services, acupuncture, and yoga.

Throughout these discussions, the counselor seeks opportunities to motivate the Veteran to engage in multi-modal pain care using a variety of MI consistent approaches. If the Veteran commits to engaging in pain management services, the counselor develops a plan with the Veteran to initiate this process. For Veterans not enrolled in VA services, the counselor explains the procedures to obtain eligibility for VA care.

After motivating Veterans for engagement in pain management services, the counselor transitions to screening for substance use. The counselor explains that some people with chronic pain use various substances to help them cope with the pain and obtains the Veteran's permission to discuss this. The counselor then screens for substance use. If the Veteran reports no risky substance use, the counselor summarized the session, reiterates the plan, and schedules the next session. If the Veteran reports risky substance use, the counselor asks more about it and how the use is affected by the Veteran's pain. The counselor provides feedback about the risky substance use, including evidence that people who don't misuse substances have significant reductions in their pain compared to those who continue to do so. As with efforts to address the Veteran's interest in pain management services, the counselor uses MI consistent approaches to motivate the Veteran to stop or reduce risky substance use. Some Veterans will not want to pursue abstinence and, for them, a harm reduction approach will be taken, meaning the counselor and Veteran will negotiate a plan to use less of the problematic substance per occasion, or use on fewer days, but not necessarily strive for abstinence. The counselor will develop a plan with the Veteran about how to reach a goal of abstinence or reduced or less frequent use, including options for engaging in specialty addiction treatment services available at the VA. When mental health issues further complicate the Veteran's pain management and risky substance use, the counselor will also discuss these issues with the Veteran. In fact, some Veterans may insist on PTSD (or depression) treatment instead of substance abuse treatment, and, consistent with MI, Veterans will receive information about preferred available treatments, including if the Veteran prefers to first talk with the primary care provider about his or her addiction or mental health concerns.

Follow-up Sessions.

After the initial session, the counselor will have up to three 20-minute, mutually scheduled phone counseling sessions with the Veteran (about once per month for 12 weeks) to check on the Veteran's status in achieving the goals of the plan, and to gauge his or her continued motivation to receive pain treatment and reduce risky substance use, as indicated. An additional call during the 12-32-week period is permissible to re-motivate veterans to engage in available pain and substance use services in view of any healthcare system changes that occurred (see response to COVID-19 section below). These calls may be informed by information the counselor has obtained from the PACT providers or information in the electronic health record (e.g., seeing if a consult was placed, reviewing progress notes indicating engagement with services). Twelve weeks allows time for the Veteran to work with the counselor to resolve barriers to service engagement, consider other treatment options, and sustain motivation for and engagement in pain management and ancillary services. Moreover, meta-analyses and "dose-response" studies(114, 115) have suggested the benefit of several follow-up telephone sessions.

Coordination with PACT Providers.

The counselor will communicate with the PACT nurse case manager and primary care provider, or other point-of-contact about recommended pain treatment referrals primarily via the electronic health record. SBIRT-PM counselors will write progress notes that indicate the SBIRT-PM encounter and outcome of each session, including asking the provider to consider placing a consult for the Veteran's preferred services or discussing the Veteran's interest in services at the Veterans next scheduled appointment. SBIRT-PM counselors cannot place consults for services directly; only PACT providers or other licensed professionals working with the Veterans at their VAs can do so.

SBIRT-PM Clinician Supervision.

Dr. Martino will provide competency-based supervision to support the counselors' delivery of SBIRT-PM throughout the trial. This approach is consistent with the national VA Evidence-Based Practice training model,(116) which emphasizes extended post-workshop case-based supervision or consultation, including submission of audio recorded therapy sessions for treatment fidelity review, as an essential training component. Dr. Martino will meet with the counselors together on a 1-hour monthly basis to review their SBIRT-PM practice. For these supervision meetings, he will listen to and rate the counselors' SBIRT-PM fidelity for two sessions per counselor (one initial and one follow-up call) using the Independent Tape Rater Scale (102) for the purposes of feedback and coaching during supervision. In MI clinician training research, this approach and dose of supervision has been shown to sustain proficient practice.(117) The ITRS has two factors - fundamental and advanced motivational interviewing strategies, as well as a clinical consensus-based benchmark of adequate proficiency, namely, half of the 10 motivational interviewing consistent items being rated > 4 for both adherence and competence. We will report the mean factor scores for adherence and competence, as well as the percentage of sessions that meet adequate proficiency standards in the random sample as a reflection of our success in implementing SBIRT-PM during the trial. To support high-integrity implementation during the trial, Dr. Martino will review two sessions per counselor per month using the ITRS and provide feedback and coaching to the counselors in monthly supervision meetings. Should a counselor fall below an adequate level of performance on two consecutive sessions reviewed by Dr. Martino, he will review one session per week from that counselor and meet with the counselor individually for more intensive supervision until the counselor's proficiency reaches adequate or better standards once again.

We also will collect other data about SBIRT-PM implementation. Specifically, we will report the percentage of participants who received different "doses" of the intervention (i.,e., 0, 1, 2, 3, or 4 sessions). We also will track the percentage of each counselor's assigned Veterans who receive counseling and the percentage whose first counseling session is followed by a second. In our pilot, 80% of participants received the assigned counseling, and 55% of those who received any counseling had at least two sessions. If a counselor falls below 70% of participants receiving any counseling within 12 weeks or below 50% of a second session among those with a first, we will take the following steps: 1) compare that counselor's procedures to "best practices" by other counselors. Such best practices might include time of day Veterans are called, and the negotiation around scheduling the calls; and 2) contact the site PI to determine if sub-optimal engagement is a site-specific issue. Two examples of site-specific issues are cell phone reception and local VA hospital reputations. In very rural areas, poor cell phone coverage makes participation more difficult, and it may be more difficult to engage Veterans when the VA facilities in their local communities have a damaged reputation.

Finally, using the ITRS, we will independently rate a random sample of about 10% of the SBIRT-PM sessions (n = 220) for the counselors' adherence and competence in delivering the intervention to demonstrate the sessions were delivered as intended.

Study Evaluations

Assessments

Assessment Name/Domain	Data Source	Baseline	12-wk	Time to complete (mins)
Socio-demographic Characteristics	Self-Report	x		2
Psychiatric and Substance Use Diagnoses	VA EHR -structured data (e.g. clinic codes)	x		
Characteristics of Musculoskeletal Disorders	VA EHR, Service-connection exam	x		
Distance to nearest VA Facility	VA EHR		x	
Brief Pain Inventory	Self-report	x	x	5
PEG	Self-report	X	X	1
High Impact Pain questionnaire	Self-report	X	X	1
Opioid Medications Dispensed in Morphine Equivalent Daily Dose	VA EHR	x	x	
Non-opioid Medications Dispensed	VA EHR	x	x	
Pain Management Service Use—VA services	VA EHR -structured data (e.g. clinic codes)	x	x	
Pain Management Service Use---VA and non-VA services	VA EHR with Natural Language Processing	x	x	
Self-reported VA and non-VA service use	Self-report	x	x	3
ASSIST	Self-report	x	x	10
Prescribed Opioids or Stimulants	Self-report	x	x	2
Nail clippings for drug/etoh use metabolites	Biological	x	x	
Substance Use/Mental Health Treatment Service Utilization – VA services	VA EHR -workload data and clinic codes	x	x	
Self-reported VA and non-VA substance use service use	Self-report	x	x	3
AUDIT-C	Self-report	X	X	2
Prescribed Opioids or Stimulants	Self-report	x	x	1
PHQ-9 (depression)	Self-report	x	x	5
EQ-5D-5L	Self-report	x	x	5
Work Productivity and Activity Impairment Questionnaire	Self-report	x	x	2
Motivation for engaging in pain treatment	Self-report	X	X	1
COVID-19 questionnaire	Self-report	X	X	5
Total BL interview time = 48 minutes				

UG3 Preparation Assessments and End-of-Study Assessments

Measures Described Earlier in UG3 Stage of RCT preparation			
		UG3 preparation phase	End of UH3 Study
Qualitative Interviews of Stakeholders	Self-report	x	x
Post-intervention Interview of SBIRT-PM-treated Veterans	Self-report	x	
Relational Coordination Survey of Key Stakeholders	Self-report	x	x
Treatment Fidelity Measure: Independent Tape Rater Scale	audio recorded SBIRT-PM session ratings		x

Measures to Characterize the Sample.

- Socio-demographic Characteristics. A research assistant will collect socio-demographics (age, gender, race, ethnicity, marital status, education, employment status, legal status, and military history) from Veterans during baseline assessment.
- Medical Diagnoses. We will extract medical diagnoses from electronic health records and the VA Corporate Data Warehouse. We will identify psychiatric (e.g., depression, anxiety, Traumatic Brain Injuries,(120, 121) and PTSD(122, 123)) and substance use disorders in the EHR and VA Corporate Data Warehouse by their ICD-9 and 10 codes. We decided against more direct measures of psychiatric conditions (e.g. the PTSD Checklist) to minimize participant burden and reactivity. In order to increase the sensitivity of our detection of psychiatric conditions, we will extract the service-connection claims data from the Veterans Benefits Management System for study participants at the end of their study participation. New recipients of service-connection receive it for an average of 5.25 distinct claims,(40) and many Veterans file both MSD and claims for mental conditions at the same time. This will identify Veterans with psychiatric disorders who were diagnosed during their service-connection examinations but do not have a diagnosis in VA treatment records because they were not treated for their mental health condition.
- Characteristics of Musculoskeletal Disorders. We will determine the diagnostic group of MSD assigned to participants in the EHR by using ICD-9 or 10 codes. Major groups are back pain, neck pain, and osteoarthritis. Other categories will be combined as suggested by their frequency and co-occurrence with other MSD. These include non-traumatic joint disorders, osteoporosis, sprain and strain, traumatic joint disorder, spinal cord injury, fibromyalgia, rheumatoid arthritis, temporal mandibular disorder, lupus, gout, and MSD multimorbidity (more than one MSD diagnosed). The broad MSD groups will be considered as potential moderators of treatment effect in the analyses. In addition, compensation examiners complete a detailed, structured form, the Disability Benefits Questionnaire (DBQ), for each Veteran they evaluate. From these forms, we will extract structured notations of the examination findings. Finally, we will obtain the percentage service-connection awarded from the Veterans Benefits Administration System (VBMS) as it changes over the course of study participation (e.g. before and after the determination) and all delineate service-connected conditions.
- Distance to nearest VA Facility. We will calculate the distance from the Veterans' address, as indicated in the EHR, to the nearest VA facility using procedures developed by the Planning System Support Group.

Pain Measures:

- Brief Pain Inventory (BPI). The Brief Pain Inventory(124) (BPI) is a validated instrument to assess chronic non-cancer pain that yields two subscales. One measures pain severity (4 items on a 0-10 scale) and the other assesses pain interference with life activities (7 items on a 0-10 scale), both using a 24-hour recall period. BPI Pain Severity subscale will serve as our primary pain outcome for the trial; pain interference subscale will serve as a secondary outcome. The BPI is a reliable measure and responsive to change.(125) The BPI is endorsed by the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) group(126) as a preferred measure of pain-related functioning IMMPACT recommendations have specified a score change that would represent a minimally clinically important difference (i.e., 30% reduction in pain severity and 1-point reduction in pain interference), which will be used in our cost analyses.(127)
- PEG(128). The PEG is a 3-item scale assessing pain intensity (P), interference with enjoyment of life (E), and interference with general activity (G) during the past week. It has good reliability, constructive validity, and sensitivity to change and has been required by the NIH-DoD-VA Pain Management Collaboratory Coordinating Center as a common measure across funded protocols.
- High Impact Pain Questions(129): Three questions to determine the long-term impact of pain are being asked. "In the past 3 months, how often did you have pain?"; "Over the past 3 months, how often did pain limit your life or work activities"; "Are you not working or unable to work due to pain or a pain condition?". Answer choices consist of "never", "some days", "most days" or "every day" for the first two questions and yes/no for the third question.

Pain Treatment Services Received:

- Opioid Medications Dispensed. We will extract dispensed opioid medications and dosages from the patient's electronic medical record and convert them to morphine equivalent daily dose using the procedures from a published algorithm.(130) as adopted and operationalized by the PMC3 Phenotypes and Outcomes workgroup. Medications will be classified as opioids used to pain as follows:

  (1) All non-IV fills of:

  - a) Codeine
  - b) Fentanyl
  - c) Hydrocodone
  - d) Hydromorphone
  - e) Morphine
  - f) Oxycodone
  - g) Oxymorphone
  - h) Tramadol

  (2) All non-IV, pill/tablet pills of

a) Methadone

(3) All transdermal or buccal fills of

a) Buprenorphine

MEDD is calculated by assuming prescriptions were taken as directed. Total morphine equivalents are calculated by multiplying the quantity of each prescription by the strength of the prescription (milligram of opioid per unit dispensed). Standard conversion factors on the CDC website will be used to estimate the number of milligrams of morphine equivalents dispensed. Average daily morphine equivalent dose will be calculated by dividing total milligrams of morphine equivalents by days supplied. For prescriptions that apn a particular month, only dates during that month will be included.

The PMC3 Collaboratory recommends the following be collected, and we will collect and analyze them per their recommendations:

a. Number of opioids supplied
b. Days supplied
c. a/b x conversion factor = milligrams morphine equivalent daily dose (MEDD)
d. Mg MEDD at enrollment
e. Mg MEDD monthly during enrollment and at study completion.

- Non-opioid Medications Dispensed. We will extract dispensed non-opioid pain-related medications from the medical record. These medications will include topical analgesics, non-steroidal anti-inflammatory drugs, anticonvulsants, and antidepressants (specifically, selective serotonin and norepinephrine reuptake inhibitors and tricyclic antidepressants). The presence or absence of medications in each class will be the dependent measure.
- Pain Management Service Utilization-VA Records. The PRIME Center have an algorithm for identifying visits from the EHR involving pain treatment using workload information entered at clinic visits (e.g. diagnosis treated, procedure performed) and the type of clinic providing the treatment.
- Natural Language Processing-identified Pain Management Service Utilization-VA and non-VA service use. The development of an algorithm for use of specific pain management services is described in the UG3 stage. This identifies dates at which the Veteran has reported "current use" of specific pain management modalities. A specifier for VA and non-VA service use will be included if the UG3 stage data supports its validity.
- Self-Reported Use of Pain Treatment Services(129): The PMC3's phenotype and outcomes workgroup developed the "Use of nonpharmacological and self-care approaches" questionnaire to collect information about patients' use of 13 different pain treatments. The instrument was modified for this study to collect information over the past 3 months (instead of past year), and to include several additional categories. In order to assess costs of services as a result of counseling, we included questions asking, or each treatment received, if it was in an individual or group setting and if the treatment was done at home (self-care). We will also ask if the treatment was received at the VA or an "other" provider and the number of times in the past three months it was received. Categories include evidence-based and complementary and integrative modalities for pain available at VA sites and in the community, and include (1) over-the counter medications (2) opioid medications for pain (3) other prescribed medications for pain (4) ER/urgent care visits for pain (5) primary care doctor visit for pain (6) surgery for pain (7)spinal cord stimulator (8) injection for pain (9) TENS (10) Acupuncture (11) dry needling (12) Acupressure (13) manipulation of spine or joints (14) massage therapy (15) yoga (16) tai chi or Qigong (17) Reiki (18) Biofeedback (19) education about how to cope with pain (20) counseling for pain (21) relaxation techniques for pain (progressive relaxation, guided imagery, visualization, deep breathing) (22) mindfulness or meditation (23) hypnosis or hypnotherapy (24) walking to help with pain (25) exercises like aerobics, strength training or stretches to help with pain, (26) other treatments for pain

Substance Use Measures:

- ASSIST. Substance use will be measured over the last 3 months using Version 3.1 of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). After a screening question focusing on substances *ever* used, the ASSIST consists of seven questions about use of and consequences of use of each of ten classes of substances over the preceding three months (including nicotine). Scores are generated for each substance that are mapped to a three-point ordinal scale of severity.(131) As outlined in the World Health Organization's Manual describing the use of the ASSIST to guide treatment recommendations, the ASSIST ratings are scaled to represent no need for treatment, need for a brief intervention, and need for an intensive intervention. An advantage of the ASSIST is that these categories represent what clinicians consider a clinically important difference, in that they guide treatment recommendations. The items in the ASSIST have been shown to have good to excellent reliability for the substances assayed. The reliability of the individual ASSIST items,(132) and the ASSIST's concurrent validity compared to other more detailed assessments of substance use severity(133) have justified its adoption by the World Health Organization.(134) We will obtain additional specifiers for substances requiring further characterization: a specifier about use of vaping for tobacco products, a specification as to whether the Veteran is using legal or prescribed cannabis and specification about use of prescribed amphetamine.
- Prescription Opioid Misuse Two questions,(135) adapted from the CIDI(136) for use in a NIDA Clinical Trials Network study,(137) will be used to describe misuse of prescribed opioid medications: *"How often have you taken your pain medications in larger*

amounts than prescribed or for a longer period than prescribed?" and "How often have you used your pain medicines to get high, to relax, or to make you feel more alert?" The questions are asked about the preceding 4 weeks, with follow-up questions to clarify that the question refers to opioids only.

- Nail Collection and Measurement: Nail clippings will be assayed for metabolites of alcohol (ethyl glucuronide i.e. ETG), cannabinoids (carboxy-THC, native-THC), opioids (6-MAM, codeine, hydrocodone, hydromorphone, morphine, oxymorphone, oxycodone), Amphetamines (amphetamine, MDA, MDEA, MDMA, methamphetamine), Cocaine (benzoylecgonine, cocaethylene, cocaine, norcocaine) and Phencyclidine (PCP). The tests are highly specific. Samples are analyzed using an immunoassay technique (ELISA) and non-negative specimens are subjected to a gold standard confirmation technique (GCMS or other method, depending on drug class). Nail, like hair, traps biomarkers in keratin but has higher concentrations of neutral and acidic biomarkers because it has thicker keratin. In a study of hair and nails collected from the same people, the rate of Carboxy-THC (an acidic biomarker for cannabis) positives for cannabinoid at the SAMHSA-recommended cutoff was 46.7% for hair and 53.3% for fingernails and mean concentrations of the metabolite were five-fold higher in nails than in hair.(138) In a study in the journal Addiction of 606 college students,(139) nail ETG at the 8 pg/mg threshold proposed for this study detected high-risk drinking with a sensitivity of 1.0 and a specificity of .63. Receiver operating characteristic curves were significantly higher for ETG concentration in fingernails than in hair for detecting risky drinking. The biomarkers are incorporated throughout the nail plate from base to tip, by deposition of biomarkers from the capillary rich nail bed, thus allowing measurement by any nail clipping of sufficient weight. Biomarkers are thought to reflect 3-6 months of substance use history in fingernails, and toenails, which grow more slowly, reflect up to 9 months. The detection window (3-6 months) is close to the timeframe of the ASSIST (90 days), making cross-validation by the two measures reasonable.

  Approximately 100 mg of nail is required for analysis, which can be obtained from 2mm (a quarter's width) of nail from each of ten digits. Samples will be mailed from home and thus un-observed, and participants will be provided with kits for the nail clipping, and a financial incentive of $30 for providing each of the samples. We will also suggest Veterans set reminders to allow for growth before clippings are needed.

  To reduce the risk that Veterans pass off someone else's fingernails as their own, they will be asked if the nails are theirs, and paid regardless of whether they are. Specimen substitution when there are contingencies for positive urines occurs, but there is no incentive for such false reporting when payment is provided regardless of the sample results. The samples will be mailed in coded envelopes addressed to our group, further reducing the likelihood of submitting someone else's fingernails.

  Samples will be processed at the United States Drug Testing Laboratories (Illinois). After processing, samples will be destroyed following a standard storage period. Sample analysis uses fully validated methods that have been inspected and approved by the College of American Pathologists Forensic Drug Testing Program and the New York State Department of Health.
- Substance Use/Mental Health Treatment Service Utilization-VA Records. Visits from the EHR involving substance use and mental health treatment will be identified conservatively, using an algorithm involving workload information entered at clinic visits (e.g. diagnosis treated, procedure performed) and the type of clinic providing the treatment. The measure does not capture much substance abuse counseling in primary care settings, and in conjunction with other mental health treatment (i.e.PTSD treatment). For this reason, self-reported substance use service utilization will be collected (see below).
- Self-Reported Use of Substance Use Treatment Services: Using the same format as the pain treatment service use questions described above, we will inquire about *whether* each of a number of classes of treatments was received in the preceding 12 weeks (substance use counseling, day program, residential, ER/hospital, self-help, counseling at a medical visit, counseling at a visit for a psychiatric condition, opioid substitution, smoking cessation counseling, nicotine replacement therapy prescribed), how many times each treatment was received in a group/individual setting, and if the service was provided by the VA or other.
- Alcohol Use Disorders Identification Test (AUDIT-C)(140). This is an alcohol screen used to identify patients who are hazardous drinkers or have active alcohol use disorders (including alcohol abuse or dependence). It consists of three questions: "how often did you have a drink containing alcohol in the past year?", "how many drinks did you have on a typical day when you were drinking in the past year", and "how often did you have six or more drinks on one occasion in the past year". It is scored on a scale of 0 (no use) through 12. In men, a score of 4 or more is considered positive and in women, a score of 3 or more is considered positive.
- Prescribed Opioids or Stimulants: Certain prescribed medications will make fingernail testing results come up positive. To determine whether a positive nail toxicology result is due to illicit use or due to a prescribed medication, we will ask two questions: In the past 12 weeks have you been prescribed (1) opioid medications such as codeine, Vicodin, oxycodone, fentanyl, morphine, methadone, or suboxone? (2) Amphetamine-type stimulants such as Ritalin, Dexedrine, Adderall, Vyvanse, Concerta, or methylphyentidate?"

Other Measures:

- Patient Health Questionnaire (PHQ-9). The PHQ-9 is a well validated screening measure for depression(141) and will be used to identify probable depression as a covariate in analyses. It will also identify suicidal ideation, which if severe, will trigger the need for further assessment (detailed in Human Subjects).

- EQ-5D-5L(142). The EQ-5D-5L is a standardized measure of health status designed to provide a single index value of health for clinical and economic appraisals. It consists of five questions in the domains of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression
- Work Productivity and Activity Impairment Questionnaire-General Health (WPAI-GH Interviewer Versions)(143). This assessment measures the effect of general health and symptom severity on work productivity and regular activities during the past seven days. It consists of six questions. Q1 asks if currently employed. Q2 asked hours missed due to health problems, Q3 asks about hours missed for other reasons, Q4 asks about hours actually worked. Q5 asks the degree health affected productivity while working. Q6 asks the degree health affected productivity in regular unpaid activities.
- Motivation for engaging in pain treatment(144, 145). Motivation for change scale to include 3 items (analogue scale coded from 1 to 100) tapping patient likelihood to engage in pain services, recognition of pain treatments as important, and pain treatment motivation.
- COVID-19 questionnaire. These questions will assess participant infection status, and the effect that COVID-19 regulations have had on Veterans' access to pain treatment and substance use treatment.

Other Measures Collected in UG3 Phase and then again at the end of the UH3 Phase:

- Relational Coordination Survey. This survey, as previously described in the UG3 phase, will be administered post-trial to "hub" SBIRT-PM counselors and "spoke" clinical and administrative staff in Compensation and Pension and Primary Care to examine how pain care was coordinated to meet the treatment needs of compensation-seeking Veterans. The survey will again be administered online through VA REDCap. Attempt will be made to have the same staff members who completed the survey in the UG3 phase completed the survey again at the end of study. If VA staff are not available or interested in completing the survey again, site PIs will identify additional VA staff providers.
- Post-Trial Semi-Structured Qualitative Interview. At the end of the trial, using the same interviewing procedures noted in the UG3 phase, we will conduct in-depth interviews with "hub" SBIRT counselors and "spoke" clinical and administrative staff in Compensation and Pension and Primary Care to assess the organization and coordination of pain management services, given their experiences with SBIRT-PM implementation.

Data Analysis

To examine feasibility of enrollment, counseling participation, and pilot study retention, descriptive data (frequency counts, percentages, means, and standard deviations) were calculated. Descriptive data were also provided for study outcomes. Changes in BPI scores and the number of nonpharmacological pain treatments utilized from baseline to week 12 were calculated and examined using the Wilcoxon signed rank sum test, the nonparametric equivalent of the paired *t*-test. The percentages of participants with problematic substance use were compared between baseline and week 12 using χ^2 tests. The *p* values should be interpreted with caution given lack of a control group and limited statistical power. For qualitative analysis, transcribed interviews were analyzed using standard qualitative analysis methods by which 2 coders independently reviewed the transcripts, creating code definitions as concepts emerged inductively from the data. Codes were refined until a final coding structure was reached, capturing the major concepts in the data, which was then applied to all transcripts.

Analysis of Qualitative Data.

We hypothesize that implementation of SBIRT-PM will be associated with changes in the way staff interact with each other, how they think about pain treatment, and how they connect service-connection claimants to treatment. To test these hypotheses, we will compare results from the Relational Coordination Survey administered before the RCT with survey results from the same participants afterwards using paired-samples t-tests. The comparison of semi-structured interviews with stakeholders and staff before and after the RCT will involve describing differences in themes identified at the two timepoints.

Analyses of NLP Algorithms

We will identify the use of non-pharmacological pain modalities through self-report from the participants as well as two different approaches to the extraction of healthcare utilization data from electronic medical records. Medical record extraction of 1) Structured data - stop codes indicating use of these modalities, and 2) Unstructured data - domains identified in the application of the NLP method to the medical record data of study participants. Two independent researchers will identify words/snippets that suggest use of specific non-pharma modalities and rate enough snippets to have software reliably generate an algorithm to rate all patients included in the study on each modality (machine learning). As we expect false positive reports of use of a modality to be unlikely, identification of use during an assessment period by any of the three methods (self-report, medical record stop codes and NLP) will be considered use. The agreement between these different measures will be described by crosstabs.

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