

# Goal-Directed Resilience Training to Mitigate Chronic Pain in Former Football Players

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## PROJECT TITLE AND NARRATIVE

### Goal-Directed Resilience Training to Mitigate Chronic Pain in Former Football Players

How can former football players overcome the physical pain that commonly results from years of intense training and performance? This pilot study seeks to test the efficacy of a resilience skills training intervention for former football players who experience chronic pain. Chronic pain threatens quality of life, and the culture of elite athletes is poorly adapted to the chronic condition of pain. Innovative strategies that are both culturally acceptable and effective are needed to address the needs of players who may have a reluctance to engage traditional treatment approaches.

## PROJECT ABSTRACT

Our overarching goal is to strengthen the capacity for former football players to maintain adaptive engagement in valued activities despite chronic pain. Responding to recent findings from the Harvard Football Player Health Study (HFPHS) that identified pain as a significant challenge, we propose a pilot study that tests a resilience skills training intervention with former football players who currently experience chronic pain. Our proposed study builds on previous work conducted at Morehouse School of Medicine engaging retired NFL players and ongoing resilience intervention research involving veteran and community-based populations. Specifically, we plan to test a novel Goal Directed Resilience Training (GRIT) in a subsample of Atlanta-based former players who have chronic pain and would benefit from resilience training. This pilot study has the potential to advance strategies to improve the wellbeing and functional status of former players impacted by pain.

## OVERVIEW AND BACKGROUND

1. Chronic pain is a national medical problem and priority as evidenced by the massive opioid epidemic. For former professional football players, chronic pain can be the dominant condition of life, degrading its quality in multiple domains. We propose to address chronic pain with a resilience skills training intervention to improve functions affected by pain, i.e., quality of life, personal relationships, and personal growth or development. The specific aim of this study is to test an intervention to decrease chronic pain and comorbid symptoms and improve a broader adaptive level of functioning through Goal-Directed Resilience Training (GRIT) for chronic pain. We hypothesize:
  - a. GRIT training intervention versus control training will be associated with reduced chronic pain and related symptoms of insomnia, anxiety, depression, improved emotional functions, and improved neurocognitive functions.
  - b. Improved self-reported physical health, quality of life, personal relationships, and personal growth will be evident for intervention versus control participants.

Although the body as internal environment is long recognized as such (*milieu intérieur* of Claude Bernard, 1865 in Gross 1998; interoception, Craig, 2009), our approach is innovative in treating pain as an internal interoceptive environment, one that is characterized by unpredictability and aversiveness. These two qualities also define extreme environments, be these extremes of weather or prisoner of war camps. Resilience, if thought of as a process as well as a state, buffers against the harshness of the environment, facilitating success and thriving in the midst of adversity. The engine that drives, maintains, and increases pain is unpredictability. The unpredictability of pain (in terms of intensity, timing, duration, physical and social context, etc.) makes it a powerful, variable, and often unstoppable force. We propose an interactive model of Environment x Biobehavioral Control in which chronic pain and resistance or resilience to pain are embedded. We believe this model explains the preliminary successes and points to the promise of our GRIT intervention.

Scientific Justification. Reciprocating dichotomies are described in a variety of neuroscience approaches, such as the predictive and reactive control systems (PARCS) of Tops (Tops, Luu, Boksem, & Tucker, 2014), voluntary and stimulus-driven actions (Hughes, Schütz-Bosbach, & Waszak, 2011), and others. The underlying dichotomy is fight-flight or stimulus-driven responding (e.g. a tiger jumping through the door of your room, you respond to the threat with fight-flight) and goal-directed responding (e.g. taking notes during a lecture which would be incompatible with saving

your life while the tiger is jumping through the door of the lecture hall). The particular contribution of our model is that it goes beyond dichotomies and considers all possible combinations in an interactive model of Environment x Biobehavioral control (ExBC). This model recognizes that goal-directed responding occurs not only in safe environments (e.g. taking notes during a lecture) but also in unpredictable environments (you dive under a table to avoid the tiger scene and continue note taking – real dedication here!) and that goal-direction can stop threat and pain. This capacity for goal-direction led to the development of Goal-Directed Resilience in Training (GRIT) for chronic pain.

Preliminary Activities. In 2010, Morehouse School of Medicine (MSM) hosted community huddles in 15 cities nationwide over 18 months and included private discussions with former NFL players and their families and community town-hall forums. We engaged nearly 400 former players and family members and nearly 1,800 community stakeholders to raise awareness about sports-related head injuries, dementia, depression, and other mental illnesses, developing trust within this community. Approaches that emphasize the development of strengths and capacities beyond the treatment of symptoms are culturally acceptable to former players.

The proposed GRIT intervention has been applied to pain and PTSD in veteran and civilian populations (Kent, Rivers, & Wrenn, 2015; Kent, Davis, Stark, & Stewart 2011). The unpredictability of the pain body environment evokes automatic **stimulus-driven responses** that displace and inhibit **goal-directed responses**. Through re-experience, GRIT trains goal-direction as a natural incompatible response to chronic pain. It consists of taking goal-directed responding from the predictable safe environment into dysfunction and pathology and thus transforming dysfunction into resilience. This approach can be applied to other unpredictable aversive environments: unpredictable aversive cultural experience (minority/marginalized social position), interpersonal stress (divorce), discrimination in health care that exacerbate and help maintain pain. The GRIT simulation process is indicated by the arrow in Figure 1.

Biobehavioral Control	Unpredictable Environment	Predictable Environment
Stimulus-Guided Response (Reactive)	<p><b>1. ACUTE THREAT, not safe</b> Threat can be stopped through fight/flight.</p> <p><b>ADAPTIVE REACTIVITY TO RESTORE HOMEOSTASIS</b> Responses are fast, here-and-now Learning is fast, one-trial Focus is narrow on threat</p>	<p><b>2. MALADAPTIVE REACTIVITY IN CHRONIC CONDITIONS, not safe</b> Symptoms cannot be easily stopped; are maintained by unpredictability.</p> <p><b>DYSFUNCTION</b> Person declines - pathology</p> 
Goal-Directed Response (Predictive)	<p><b>4. CHRONIC or ACUTE, not safe</b> Symptoms can be stopped through goal-direction and social relatedness</p> <p><b>RESILIENCE</b> Person grows - <i>eudaimonia</i></p>	<p><b>3. PREDICTABLE, safe</b></p> <p><b>DEVELOPMENT &amp; GROWTH</b> Goal-directed Future oriented Learning is slow Slow development of skills &amp; projects Building models, simulating for prediction</p> <p>Engagement &amp; social relatedness from everyday life (e.g. childhood or early adulthood)</p> 

**Figure 1.** Environment x Biobehavioral Control Model

## PROJECT DETAILS

### Experimental Design and Methods

#### Intervention Training for Former Players

Between 20 to 48 eligible and consented participants from the Atlanta area will be identified (with a goal of 40 completing the study). They will undergo a pre-training test session and will then be randomized to either the Immediate GRIT (ImT) training intervention or the Delayed Training (DeT) control. At this time there will be one intervention immediate (ImT) group and one delayed (DeT) control group of 5-12 participants per group. The immediate (ImT) group will be trained for 4 weeks with 2 biweekly sessions. At the end of GRIT training they will be post-tested. The delayed (DeT) group wait during these 4 weeks and do not receive training. At the end of the 4-week waiting period, they will also be post-tested. At this point, they will be offered GRIT training for 4 weeks with 2 biweekly sessions. At the end of their training, they will be given a second post-testing. This process will then be repeated for two additional groups of 5-12 ImT and 5-12 DeT participants.

Goal-Directed Resilience Training (GRIT) is a hands-on experiential simulation and repeated practice that takes the person back to his/her earlier goal-directed experiences and then applies them to episodes of pain and suffering. The brain is inherently a simulation device where actual and simulated actions activate the same cortical areas (e.g. Decety & Grèzes, 2006). Goal-directed responding is inhibited by stimulus-guided responses to fear or pain. The restoration of goal-directed engagement and relatedness are natural capacities we have for pain control (Erpelding & Davis, 2013). This is the main focus of the training. Participants are asked to identify engagement and social relatedness (the goal-directed resources) from childhood or early adulthood, since these early years are formative, as well as examples from present time. They are asked to re-experience these in descriptions and sensations, then take these episodes into experiences of pain or trauma, thereby transforming these into resilience. This is accomplished through a manualized program consisting of four modules: engagement, social relatedness, transformation, and defining a good life. GRIT training is a small-group intervention consisting of 5-12 participants per group. We propose a pilot study of 20-48 participants or 4 groups with 2 intervention and 2 control conditions to be conducted in Atlanta. Up to eight (8) subjects beyond our goal of 40 will be added to make up for attrition. Individuals randomized to control condition will participate in the GRIT the training after post-assessment. Training extends over 4 weeks, consists of 90-minute biweekly visits, for a total of 8 visits.

**Outcome Measures.** To test hypotheses 1 and 2, outcome measures for GRIT training include focused pain-relevant symptom measures, adaptive functions measures, neurocognitive measures, and PACE, as listed in Table 2. List of outcome measures are provided in Appendix 1.

Table 2. Proposed Outcome Measures for GRIT Training

<b>Focused Pain-Relevant Measures</b>	
Pain Outcome Questionnaire (POQ), (20 items)	
PROMIS Pain Interference Short Form. (8 items)	
PROMIS Sleep Impairment (8 items)	
PROMIS Sleep Disturbance (8 items)	
Pain Catastrophizing Scale, (13 items)	
Chronic Pain Acceptance Questionnaire, (8 items)	[time to completion = 23 minutes]
<b>Adaptive Functions Measures</b>	
Physical Health: SF-36 Health Measure: physical & mental health, (36 items)	
Well-Being: Ryff 's Positive Relations & Personal Growth, (14 items)	
Perceived Stress Scale (10 items)	

HEMA: Hedonic and Eudaimonic Motives for Activities, (9 items)  
PACE – Predictability as Core Evaluation [as outcome measure], (47 items)

Emotional Symptoms:

PHQ-9: Patient Health Questionnaire Depression Scale, (9 items)

GAD-7: Generalized Anxiety Disorder Scale, (7 items)

ACE: Adverse Childhood Experience, (10 items)

[time to completion = 50 minutes]

**Neurocognitive Functions**

D-KEFS: Delis-Kaplan Executive Function: Verbal Fluency, Color-Word Interference

RBANS: Repeatable Battery for the Assessment of Neuropsychological Status

NAB: Neuropsychological Assessment Battery: Word Generation [time to completion = 30 minutes]

**Preventing Chronic Pain Strategy**

PACE: Predictability as Core Evaluation, for chronic pain (used here as pre-post outcome measure)

**Physical Functions Measure** e.g. pre-post time measure of walking

Total time required to complete questionnaire scales and neurocognitive tests is 90 to 120 minutes.

**Subjects**

Between 20-48 former NFL players will be recruited for participation. The inclusion/exclusion criteria are listed in Table 3 below.

Table 3. Inclusion/Exclusion Criteria

Inclusion criteria	Exclusion criteria
Former football player between 18 – 65 of age who have passed pre-selection and are referred by FPHS, potentially diverse racial & ethnic identities	1. Active suicidality or suicidal intent requiring greater than outpatient level of care (Columbia Suicide Severity Rating Scale – C-SSRS)* 2. High risk drinking of alcohol (based on scoring guidelines of AUDIT-C)* 3. Active psychosis (Psychosis Screener)* 4. Inability to participate in a small group setting (self-reported inability to regulate constructive social interaction in small group setting)* 5. Inability to meet projected attendance requirements.**

\* Eligibility screening tools are provided in Appendices 2 and 3; Mental health action required for further evaluation and possible treatment are outlined in Appendix 8.

\*\* Attendance requirements are as follows. Participants are allowed to miss 2 out of 8 sessions. They are also given the option to make up one or both sessions. They are allowed to make up a maximum of 2 sessions. If they miss a 3<sup>rd</sup> session, they are not allowed to make it up but can stay in the study. If they miss a 4<sup>th</sup> session, they will be terminated from the study.

**Statistical Considerations**

Design. This is a balanced randomized block design. Twenty (20) to forty-eight (48) eligible and consenting participants from the Atlanta area will be identified from the cohort of research participants at the Football Players Health Study (FPHS) at Harvard University in Boston, MA. They will be selected based on answers previously given to specific FPHS survey questions listed below. They will undergo a pre-training test session and consequently be randomized with 1:1 allocation to either the Immediate GRIT training (ImT) intervention group or the Delayed (DeT) training control group. There will be two Immediate (ImT) intervention groups of 5-12 participants per training group and two Delayed training (DeT) control groups with 5-12 participants in each control group.

Outcome measures (c.f. Table 2). Sample Size and Power. This is a pilot study. Using focused pain-relevant or adaptive measures as outcomes with effect size (minimally detectable differences in weighted scores between the ImT experimental and DeT control group, scaled by pooled standard deviation) of 1, 2, 3, and 4, a regression model with treatment, age and block as effects and an overall 0.05 significance level, 20 participants per group yields an 0.80 statistical power.

For all analyses intent-to-treat principles will be adopted for those who drop out. Pre-treatment scores will be used to generate sampling frames consistent with a multiple imputation approach (Rubin, 1999) to determine post-treatment values.

Statistical Analyses. Summaries will rely on means, standard deviations for continuous variables and frequency and percentages for categorical ones. Univariate analyses for weighted scores and continuous variables groups comparisons will rely on t-tests (if normality assumptions are upheld) and/or non-parametric testing. Categorical variables will be compared using Chi-square/Fisher exact/McNamer testing. Multivariate analyses for the responses of scales/subscales weighted scores, factoring in covariates effects on interventions vs. control, age, block, pre-treatment scores, will use the Generalized Linear Mixed Modeling (GLMM) approach that will allow blocks as random effects and grant each subject their own intercept. All analyses will be conducted using SAS version 9.4

## IMPLEMENTATION STEPS

Study procedures for the GRIT intervention will be submitted to the Institutional Review Boards at MSM.

### 1. Recruitment & Screening

Recruitment and an initial round of eligibility screening of study participants for GRIT will be conducted at Harvard Medical School, the coordinating center of the Harvard Football Players Health Study (HFPHS). They have built a cohort of research participants through administering a First Health and Wellness Questionnaire (Q1) that included questions relevant to former players' experience of pain. The HFPHS will recruit for this study from this cohort of participants, whose verified eligibility and contact information is stored in the FPHS data repository (HMS protocol # 14-2691), and who have not opted-out of receiving study communications from the FPHS. This recruitment will be conducted by telephone and/or email.

Additional participants will be recruited into the HFPHS cohort through the Morehouse study team marketing the GRIT study in the Atlanta area. Morehouse may sponsor announcements in the local media and with football players' organizations in the greater Atlanta area that present information about this study alongside the greater HFPHS, and invite former players to participate in the HFPHS Q1 effort in order to be considered for this study.

Interested former players in the Atlanta area who are not yet enrolled in the HFPHS will be referred to contact the HFPHS using a GRIT study-specific email address, so that they take the Q1 survey and become part of the entire cohort of participants. They will be asked by FPHS to complete the Q1 questionnaire and thus become part of the HFPHS cohort.

These steps will be used for selection and eligibility screening of participants for GRIT:

1. Identify all former football players living in the Atlanta area from the HFPHS cohort, who are 65 years of age or younger (currently about 79 former players) who are interested in continued research participation.
2. Contact those former players by phone and/or email to invite them to participate in the study.
  - a. If players communicate via email and are interested, HFPHS will schedule a screening call with them.
  - b. If a player is reached by telephone and they are interested, they will be asked if they would like to go through the screening process at that time, or schedule another call in the future.

3. Potential participants will be screened on the telephone according to the HFPHS screening guide attached. Screening data will be recorded in the secure internal study portal hosted at HMS.
4. Once a potential participant has been deemed eligible to participate by HFPHS, and has expressed interest, HFPHS staff will ask for their consent to share their contact information with the researchers at MSM, so they may be contacted to arrange for final screening, enrollment, and pre-testing. They will be notified that there may be a delay of many weeks until their information is transferred and they are contacted by MSM, as MSM cannot begin scheduling consent, final screening, and pre-testing sessions for individual participants until they are able to begin doing so with a full group of 10-24 (5-12 for each group).
  - a. It will be discussed with them that they will undergo two final eligibility screens for suicidality and psychosis with MSM researchers, and that it's possible they may not qualify for the study at that point. If they do not qualify for the study, they will be compensated for their time with half the amount of the pre-testing session (\$25).
5. Once the MSM research team has access to a potential participant's contact information through the secure study portal, they will contact them by telephone to schedule their final screening, enrollment, and pre-testing session. The participants will be contacted as soon as their information is received by MSM researchers.

## **2. Consenting & Pre-Testing**

Subjects will first be consented by the MSM researcher, sign a HIPAA waiver, and then undergo the final two eligibility screening assessments for suicidality and psychosis. If they qualify for the study they will then participate in the pre-testing session.

The consenting staff member will go over the consent form that describes the study, the risk and benefits, confidentiality and data security, participant rights, and each participant will have his questions answered. If the potential participant agrees with the consent information, he and the consenting person sign and date the consent form.

If a participant scores high on psychosis or suicidality during the final screening, the following steps will be initiated: They will be referred to professional mental health services as a source of support. The Georgia Crisis and Access Line (1-800-715-4225) will be offered to participant for assistance. The telephone resource is available 24 hours a day/ 7 days a week and offers licensed counselors to assist. Mental Health Action Plan in Appendix 8 outlines the steps that will be taken to keep the participant safe and obtain further emergency mental health evaluation and treatment.

If deemed fully eligible to participate in the study, the participant will then begin the pre-testing session with the tests listed in Table 2. The pre-testing session will also include asking the questions included in Appendix 5. No research procedure will take place prior to the informed consent and eligibility screening. Participants will be informed that they may skip answering any questions that make them uncomfortable, but that they may not skip all questions in any one individual test and if they do, they will be withdrawn from the study.

Participants will be given sufficient time to review the consent and opportunity to ask questions. We will not be enrolling patients that cannot participate in the informed consent. Legally authorized representatives are not involved in this study. There are no medical procedures involved in this study.

The pre-testing session will last 90-120 minutes after the consent process, and will include all of the assessments noted above in the Table 2 "Outcome Measures" list.

## **3. Enrollment & Tracking**

Once participant contact info has been shared with MSM researchers in the secure study portal, MSM will use the portal to track:

- a) Participant contact
- b) Final screen failures
- c) Consent / Enrollment Status
- d) Participant dropouts
- e) Withdrawal of participants from study
- f) Termination of participants from the study

This will allow HMS to track interactions of former players with MSM researchers to maintain awareness of potential participant burden, to consider the discontinued participants for other HFPHS studies, and to consider this information in relation to other ongoing projects.

#### **4. Randomization**

After pre-testing of the first 10-24 participants, they will be randomly assigned to either the Immediate ImT group (n=5-12) for immediate training or to the Delayed DeT control condition (n=5-12). The method of randomization is a balanced randomized block design with 1:1 allocation to either receiving the GRIT immediate ImT training intervention or the Delayed DeT control condition. A stratified permuted block design randomization scheme will be pursued with a variable but masked block size. A one–two stratification factors will be considered for selection from position played, age, and baseline severity of pain. The randomization protocol will further dictate inspection of balance of these factors between the two groups every ten recruited participants.

#### **5. Intervention Training**

There will be two Immediate Training ImT groups of 5-12 participants per training group and two Delayed Training DeT control groups with 5-12 participants in each group. One Immediate ImT intervention group will be trained at one time for 4 weeks with 2 biweekly sessions, followed by post-testing. During this time the Delayed DeT group waits, since only one group can be trained at one time. The Delayed DeT group will receive training after waiting 4 weeks and a first post testing session. At the end of its training, the DeT group will receive a second post-testing session.

Training sessions will be held at the Morehouse School of Medicine in the Research Wing. There will be two 90-minute training sessions per week, taking place between 4-6pm on two days out of Mondays through Thursdays. The exact days and times of the training will be set in advance for each group, and will not be accommodating of individual schedules.

Should a participant miss a scheduled training session or be unable to complete a session in full, the attendance requirements are as follows:

Participants are allowed to miss 2 out of 8 sessions. They are also given the option to make up one or both sessions. They are allowed to make up a maximum of 2 sessions. If they miss a 3<sup>rd</sup> session, they are not allowed to make it up but can stay in the study. If they miss a 4<sup>th</sup> session, they will be terminated from the study. The content of the makeup sessions will follow the content of the modules: (1) introduction to concepts (2) illustrative examples (3) applications to own life with exercises. Makeup sessions will be one-on-one with the interventionist, and will last no more than 30 minutes. Participants will be compensated for makeup sessions as they are for group training sessions they attend.

If a participant attends but cannot complete a training session, it will be considered a missed session if they leave before the half-way time point (45 minutes). In this case the above policy regarding missed sessions will apply. If they leave the training session after 45 minutes, they may complete the rest of the session as a homework assignment, since homework

assignments are practiced at the end of each session. Participants will only be compensated for incomplete sessions if they attend for at least half (45 minutes).

GRIT intervention training is a hands-on group experiential simulation and repeated practice that takes participants back to their earlier goal-directed experiences and then applies these to episodes of pain and suffering. Participants are asked to identify engagement and social relatedness (the goal-directed resources) from childhood or early adulthood, to re-experience these in descriptions and sensations, then take these episodes into experiences of pain or trauma, thereby transforming negative episodes into instances of personal resilience. At the end, participants are asked to design and implement a good life for themselves. In this manner, the past is used to construct a future, and goal-directed responding is replacing stimulus-guided responses to fear or pain. A manualized program consists of four modules that cover engagement, social relatedness, transformation, and making a good life, shown in Table 4. The manual is provided in Appendix 4.

Table 4. A Modular Program for Goal-Directed Resilience Training (GRIT)

Introduction	<b>Introduction and Psychoeducation</b> Main elements: engagement, relatedness, transformation, building a good life
Module I	<b>Approach/Engagement</b> Consists of interest, curiosity, appreciation, noticing beauty. Find examples from childhood/early adulthood of interest, curiosity, etc. Describe examples, what the senses are doing, make a visual representation. Review written and visual examples, do activities, do homework assignments
Module II	<b>Social Relatedness</b> Consists of empathy, compassion, helping, friendship, love. Find examples from childhood/early adulthood of empathy, helping, etc. Describe examples, what your senses are doing, make a visual representation. Review written and visual examples, do activities, do homework assignments
Module III	<b>Transformation</b> Return to pain or traumatic event with an example of engagement or relatedness. Identify pain or stressful event you wish to return to. Be in that scene or pain as (e.g. holding the first frog in your hand when you were five while retelling a battle scene in Vietnam, etc.) Reading examples of transformation, do activities, do homework assignments.
Module IV	<b>Building a Good Life</b> Imagine and describe a life well lived. Describe a good life for yourself, with engagement, with social relatedness. Create opportunities for growth when pain has limits and stunts growth. Reading examples and activities for creating a good life are provided.

For each Module the training follows the same format. The content is covered in 3 parts: (1) Main concept to be covered in the module, (2) Examples of the concept in readings (3) Exercises that apply the concepts to personal experiences. Completion of the exercises are started in the training class and assigned to be completed as homework and to be turned in the following week.

## **6. Homework**

The Study Workbook (within Appendix 6) contains all assignments, practice exercises, and instructions. Each module is to be completed in two sessions of one week. Homework is assigned at the beginning of each week and to be turned in at the beginning of the next week. For each module, the homework asks participants to find examples from their lives of the main concept covered in that module, note their sensory reactions, and apply the examples to change how they experience pain and stress.

The Habit Maker Checklist tracks the application of training concepts and activities in participants' everyday life. Participants are to complete one checklist for each week.

Completion of The Study Workbook and the weekly Habit Maker Checklist questionnaire are required of all participants, and participants may be withdrawn from the study if they are not completing their homework assignments.

## **7. Control Condition**

As previously described, the control condition is the Delayed DeT group that waits for 4 weeks while the Immediate ImT group experiences the GRIT training. At the end of the four weeks of training of ImT and waiting of DeT, both groups are post-tested. At that point the Delayed DeT group receives the GRIT training and then a second post-testing.

## **8. Post-Testing**

Following completion of 4-week training, the immediate ImT participants and Delayed DeT controls will be scheduled for post-intervention assessments, listed in Table 2. These will be nearly identical to the pre-intervention assessments, will last 90-120 minutes, and will occur within 2 weeks of the final treatment session. In case of extreme emergencies, if a participant cannot schedule their post-testing session within 2 weeks of completing the training, post-testing can be extended by another 2 weeks for no more than a total of 4 weeks from training completion. Delayed DeT Controls will receive training after their first but before a second post-testing session.

## **9. Length of Study Enrollment**

A participant may be enrolled in this study from 6-18 weeks

## **10. Compensation & Reimbursement**

Per participant, compensation will consist of \$75 for their enrollment & pre-testing visit (\$25 if they are not eligible for the study after final screening), \$75 per training session for a total of \$600/8 sessions, and \$75 for their post-testing session. The control group will receive a second \$75 payment for second post-testing session. The total payment for each of the groups will equate to \$750 for the ImT group (experimental) and \$825 for the DeT group (control). Payment will be made at the end of each testing session and at the end of the completion of all training sessions. Missed sessions will be offered as makeup sessions of no more than two makeup sessions. Participants will be paid for makeup sessions. Participants will be paid for all training sessions they attend, regardless of whether they complete the study requirements of 8 sessions & post-testing. Method of payment will be by ClinCard, which works like a debit card. They will receive the ClinCard after their enrollment session at MSM, and it will be reloaded at each payment time. They will be able to use the funds in approximately 1 business day. This is to repay participants for time spent in the study and any inconvenience.

### Participant Parking

The Morehouse School of Medicine has a parking deck available to visitors and study participants for a total cost of \$5 per visit between the hours of 7:00am-5:00pm Monday-Friday. If they are driving, participants will pay out of pocket for the cost of parking when they attend each of the study sessions. The highest amount of cost for parking that a participant would incur would amount to \$55. The compensation being provided for their participation in the study is intended to offset any incurred costs to the participant.

### Compensation Summary

Final screen & pre-testing- 90-120 minutes: \$75

For participants who attend but who are found not to be eligible for the study: \$25

Per training session- 90 minutes: \$75

Total for 8 sessions = \$600

Post-testing session- 90-120 minutes: \$75

2<sup>nd</sup> post-testing session (for delayed control group only): \$75

### Totals

Immediate experimental group: \$750

Delayed control group: \$825

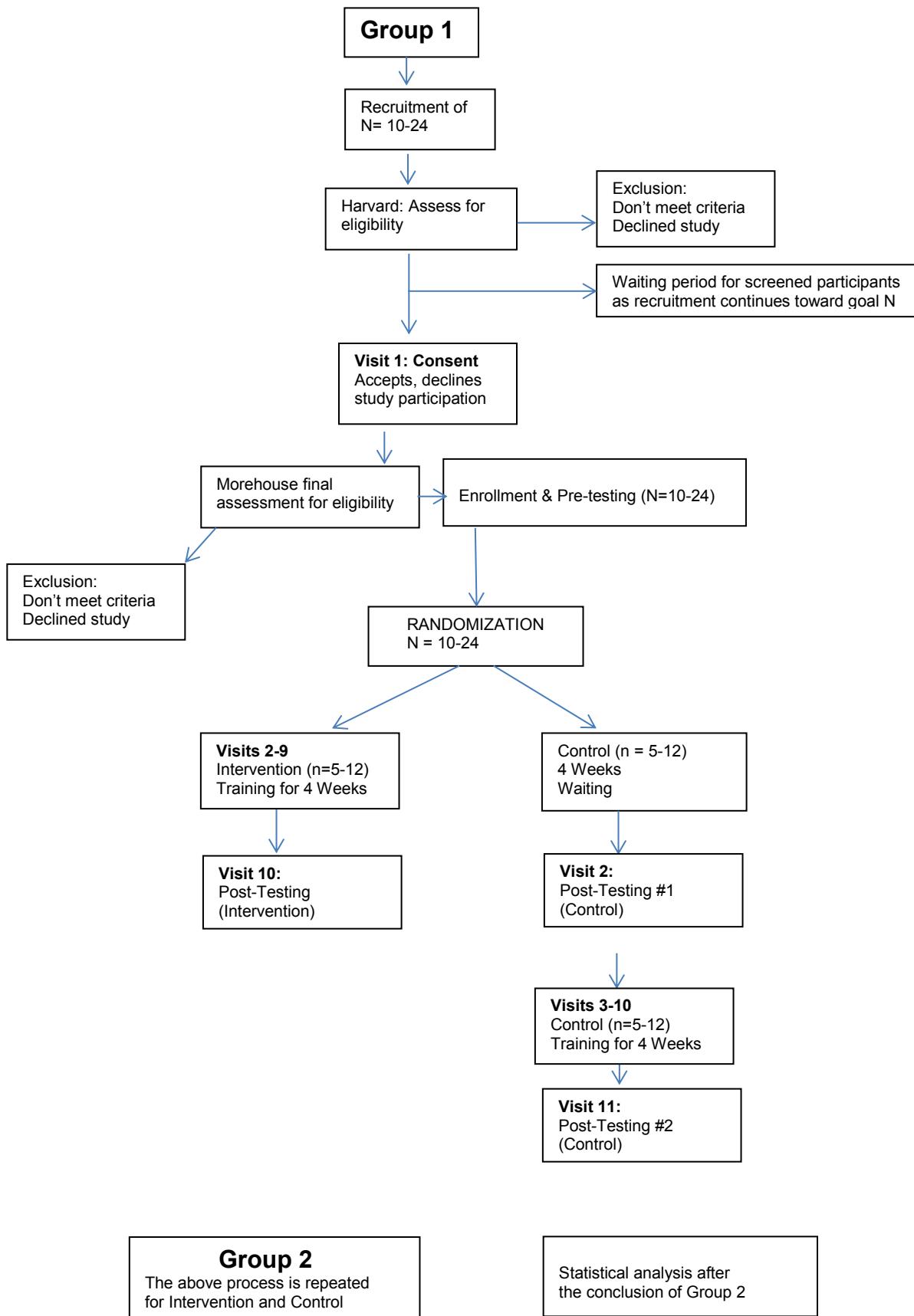
### Timeline

The timeline for Group 1 (ImT) and Group 2 (DeT) is summarized in Table 5 below. The time course of the steps involved in this study are shown in the timeline diagram.

Table 5. Timeline

<b>Timeline</b>			
<b>Mo</b>	<b>Intervention</b>	<b>Mo</b>	<b>Intervention</b>
1	Recruitment Group 1	8	<b>Training ImT 2 (N=5-12)</b>
2	Pre-Test 1 (N=10-24); Random Assignment	9	Post-Test 1 (N=10-24)
3	<b>Training ImT 1 (N=5-12)</b>	10	Training, DeT 2 (N=5-12)
4	Post-Test 1 (N=10-24)	11	Post-Test DeT 2 (N=5-12)
5	Training, DeT 1 (N=5-12)	12	Data Analysis
6	Post-Test DeT 1 (N=5-12); Recruitment Group 2	13	Write-up
7	Pre-Test 2 (N=10-24); Random Assignment		

## Timeline for Group 1 Intervention and Control



## **Quality Monitoring of the Study**

Blinding Monitor to assure that participants and person conducting the testing are blind as to intervention and control conditions.

Fidelity Monitor will assure that therapists will conform to the method as set out in the modularized program.

Workbook includes all homework assignments

Habit Maker Checklist will monitor application of program content to daily life.

Workbook Log tracks completed homework

Appendix 6 includes the above items: (1) Monitors – Blinding, Fidelity, (2) Homework – Workbook, Habit Maker Checklist, (3) Homework Log.

## **Withdrawal Criteria**

Investigators may withdraw a subject from the study at any time for the following reasons:

- The participant has not met the training attendance or testing session scheduling requirements of the study, as outlined above
- The participant has not met the homework requirements of the study, as outlined above
- A serious adverse event occurs
- The investigator considers, for safety reasons, it is in the best interest of the individual participant or other participants that the individual participant stop participation in the study

## **Data Security and Management**

Potential study participants' contact information including name, phone number, and email address will be recorded and accessed through a secure online application, referred hereafter as "the study app", from data contained in the existing FPHS repository protocol (described in HMS protocol #14-2691). The study app is a secure application that has been specifically created for this project to utilize as a secure, HIPAA compliant mechanism for retrieving and transferring participant information to and from the HMS data repository. Apart from recording potential participants' contact information, the study app will be used to record and access participants' responses to the HMS screening guide. The study app will additionally serve as a logistics tool to record and access information regarding a participants' study status at MSM (e.g. final screening, consent, enrollment, progress, and completion) and assigned study ID, and for the MSM team to keep the HMS team apprised of any adverse events or issues with participants. The study app is the only place where participant contact information will reside, and it will also house the study key connecting participant's identities with their study IDs.

The study app will only be accessible to designated study staff members, PI's and investigators via an online portal that requires a distinct username and password and login to a virtual private network (VPN) client. Potential participants who are deemed to be ineligible for the study will have their collected information removed from the study app within 14 days of being notified of their ineligibility.

Confidentiality of participants' records will be maintained in secure offices at the research site. Personally identifiable data (except full names and contact information as outlined above) will be stored in locked cabinets in locked rooms and/or in a password protected file on secure computer drives and study specific folder. Data will be stored in accordance with regulations required by PI and Co-I respective institutions. HIPAA laws and regulations will be implemented.

Captured data for the **Goal-Directed Resilience Training (GRIT)** study will be housed on the platform of the Research Electronic Data Capture (REDCap) on one of Morehouse School of Medicine's (MSM) research studies servers. MSM servers are positioned behind multilayered firewalls to prevent unauthorized internal or external access. Electronic data capture protocols and forms will be devised and interfaced using REDCap. Data capture, management, and use procedures and protocols at MSM are governed by the rules and policies of the Health Insurance Portability and Accountability Act (HIPAA) to protect the privacy, confidentiality and well-being of study participants. Captured data will be de-identified through assignment of study IDs to participants that are not conducive of revealing their identity. All analyses, reporting and query of the data will be conducted using participants' study IDs. Master list of linked names and identifiers to study IDs will only be accessible to designated study personnel and the study PI through the study app outlined above. Once the captured data is deposited, verified and checked for completeness, integrity and accuracy, only designated study team will have various levels-privileges to access the data for query, reporting and analyses purposes, through verifiable user's name and passwords.

Responses to enrollment questions and outcome measures that are directly administered and recorded on answer sheets will be coded and transferred onto a spreadsheet. Answer sheets and spreadsheets will not contain any identifiable information, with only the subject ID used.

When the study is closed, duplicate copies of data collected and stored by MSM will be securely transferred to HMS.

## **Risks/Assessment**

Risks and discomfort to the participant may arise from:

(1) Questions in the screening tests. The final screening assessments will consist of questions concerning possible risk for considering and pursuing suicide. The questions range from whether a participant has thought of suicide to whether they have an actual plan and intend to carry it out. They will also assess presence of disturbed thinking typical of psychosis. The questions range from another source planting thoughts in the participant's mind to the participant believing they have special powers. The Mental Health Action Plan in Appendix 8 describes our approach for assessing and keeping patients safe with regard to suicidality and psychosis.

(2) Questions from the scales during pre- and post- testing. Participants may experience the questions to be sensitive and/or unsettling. The participant may choose not to answer any questions if they do not want to. Skipping an entire test is not an option, and participants will be informed that if they choose to do this they will be withdrawn from the study. Further details are described in Appendix 8.

(3) Topics raised during the small group intervention. The interventionist will explore a subject within the training group – how the participants have experienced a subject, solved it, and how to incorporate it into the training concept and learn from it. If a participant experiences discomfort and/or

concerns that extend beyond the group's concerns and are not suitable for this approach, or a participant expresses a desire to end their participation in a given training session, the session will be ended for that individual participant and postponed until the participant feels ready to return for the next session. Incomplete sessions will be dealt with per the attendance requirements outline in the "5. Intervention Training" section above. If the participant and the trainer feel that more time is needed, therapy outside of the study training sessions may be recommended and dropping out of the study may be considered. Participants will be given referral information for outside evaluation and assistance as needed.

The Mental Health Action Plan in Appendix 8 describes our approach for assessing and keeping participants safe.

### **Dissemination of GRIT Training and the ExBC Model**

To make GRIT training broadly available, we plan to post an outline of the four modules and a summary of the introduction on the Internet. Interested participants can order the GRIT manual as a self-study program.

### **STUDY PERSONNEL**

#### **Roles and Responsibilities**

PI (Herman Taylor, MD, MPH) will oversee the conduct of the intervention study (GRIT) in Atlanta. He will oversee all Atlanta-based study staff, and the recruitment of potential participants residing in greater Atlanta who have not yet taken the first questionnaire to become a part of the Harvard Study. He will assist in referring potential participants, assist in the final stage of participant screening, assist in medical issues when they arise with participants, review main documents of the study such as the protocol, and contribute to write-up and publication of studies and exploration of funding.

Co-PI – (Ross Zafonte, DO) will supervise participating study staff members in Boston, communicate with the IRB in Boston, review main documents of the study such as the protocol, and participate in analysis and write-up of the study.

Biostatistician for Study design and Analysis (Mohammad Mubasher, PhD) will draw the randomization scheme, generate the assignments and implement the randomization process. He will also prospectively evaluate the adequacy of the randomization scheme for possible corrections. Additionally, will be responsible for the integrity and accuracy of the collected data and conduct univariate and multivariate analyses. Finally, he will generate statistical reports and co-author the findings of the study.

Consultant (Martha Kent, PhD) will be responsible for the implementation of the content to be trained in this intervention, including training the co-therapist, training and supervising pre-post testing, reviewing and monitoring fidelity of intervention training by co-therapist, further development and adaptation of the training manual, participation in the testing process of PACE and its development as an at-risk screen. Participate in the interpretation and write-up of findings. Participate in the development of main documents of the study such as the protocol, contribute to write-up and publication of studies and exploration of funding. On staff as Research Scientist and Neuropsychologist at Phoenix VA Health Care System. Adjunct Faculty at Arizona State University.

Consultant (Glenda Wrenn, MD, MPH) will assist in cultural relevance aspects of the program in focus groups and broader applications of the intervention to relevant areas of players' lives. On staff in Psychiatry Department, Morehouse School of Medicine; appointment at VAMC, Atlanta. Oversight in the implementation of intervention elements: consenting, pre-post testing, intervention & control training. Contribute to the development of the content for control condition with emphasis on chronic pain in football players. Contribute to cultural adaptation of the manual.

Consultant (Leroy Reese, PhD) will assist in cultural relevance aspects of the program in focus groups and broader applications of the intervention to relevant areas of players' lives. On staff in the Community Health & Preventive Medicine department at Morehouse School of Medicine; and will provide oversight in the implementation of intervention elements: consenting, pre-post testing, intervention & control training. Contribute to the development of the content for control condition with emphasis on chronic pain in football players. Contribute to cultural adaptation of the manual.

**Interventionist (Gilberte Bastien, PhD, MPH)**

The interventionist will work with one group at a time and meet in small group sessions of no more than 10 twice a week. She will be trained by Dr. Kent in the application of the GRIT intervention and control conditions. She will be required to follow Dr. Kent's method exactly in their implementation. Each intervention visit and control visit lasts for 90 minutes. Any participant concerns that arise that cannot be addressed in the session will be brought to the attention of the Co-PI and Project Manager.

**Interventionist (Brian McGregor, PhD)**

This interventionist will substitute as needed for the primary interventionist (Bastien) in facilitating small group sessions. He will work with one group at a time and meet in small group sessions of no more than 10 twice a week. He will be trained by Dr. Kent in the application of the GRIT intervention and control conditions. He will be required to follow Dr. Kent's method exactly in their implementation. Each intervention visit and control visit lasts for 90 minutes. Any participant concerns that arise that cannot be addressed in the session will be brought to the attention of the Co-PI and Project Manager.

**Psychiatry Residents (Ru Hasan, MD / Chris Villongco, MD)**

The psychiatry residents are needed because the persons administering the testing has to be blind as to which participant belongs to the intervention or the control condition. The psychiatry residents will be responsible for administering all the neuropsychological screening tests, pre-tests, and post-tests throughout the study. Individual neuropsychological tests will be administered in individually scheduled sessions. If not familiar with a required test, he or she will be trained by the consultant to administer it. The residents will also score the neuropsychological tests and enter these scores into a data file.

Project Manager/ Atlanta site (Marques Harvey, MPH, MDiv) Assists with the recruitment, data collection, tracking, and follow-up of participants at the Atlanta, Georgia site. Helps to ensure timely and accurate completion of any local regulatory requirements, budgetary compliance, as well as completing any required progress reports. Coordinates ongoing meetings, conference calls with study personnel to ensure progress. Responsible for IRB reporting, and will conduct all consent sessions with participants.

Project Manager / HMS (Sarah Cohan, PMP) Oversees all recruitment and screening activities at the HFPHS.

### Other HMS Study Staff:

- Dean Marengi – Harvard Medical School – Data Coordinator
- James Drummeey – Harvard Medical School – Data Coordinator
- Daniel Runt – Harvard Medical School – Data Coordinator
- Dylan Keating – Harvard Medical School – Research Assistant
- Ilaria Amato – Harvard Medical School – Research Assistant
- Soo Kyung Sarah Kim – Harvard Medical School – Research Assistant
- Nicole Jones – Harvard Medical School – Research Project Coordinator

### **FUTURE PLANS**

This pilot study has the potential to identify a strategy to enable remote self-assessment for pain to inform treatment seeking decision-making among football players. The pilot intervention is a necessary first step in gathering preliminary data and assessing the need for cultural tailoring of a resilience intervention previously studied in veteran populations. Although the pilot study is a face-to-face intervention, future studies with adequate funding to support a large-scale comparison of in person and hybrid online and live-video intervention format. There is a significant need for accessible, effective interventions that minimize stigma, while establishing an ecosystem of resilience for football players impacted by pain. In Year 2, we will submit a proposal for R21 or equivalent to advance the development of a remote intervention to address pain.