

**AWARD NUMBER:** W81XWH-21-2-0047

**TITLE:** Machine Learning for Chronic Pain Management Optimization Within a Health Equity Framework

**PRINCIPAL INVESTIGATOR:** Krista Highland, PhD

**CONTRACTING ORGANIZATION:** Henry M. Jackson Foundation, Bethesda, MD

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# REPORT DOCUMENTATION PAGE

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<b>14. ABSTRACT</b> Through rigorous and continuous stakeholder engagement, this study will leverage algorithmic models constructed in a robust simulation environment using the entirety of available medical record and patient-reported outcome data to evaluate multilevel and modifiable aspects of pain management inequities. Combined with patient-centered qualitative data, the study will ensure actionable findings to improve pain management effectiveness and service member readiness.						
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## 1. INTRODUCTION:

Pain management inequities can be deleterious to both the well-being of service members and their families - and military readiness. Research to-date has identified several structural and systemic barriers to adequate pain management, but available research is limited in the breadth and scope required to develop and implement evidence-based policies, programs, and decision support tools to optimize pain management. The present study will leverage an advanced simulation modeling environment and patient-centered qualitative interviews to develop actionable results that can support pain management optimization across the Military Health System.

## 2. KEYWORDS:

Chronic pain, health equity, integrative pain management, health services research, healthcare optimization, machine learning, simulation modeling, qualitative interviews, patient partnership

## 3. ACCOMPLISHMENTS:

### What were the major goals of the project?

CY21 Goal – Regulatory approvals and agreements completed

**COMPLETE:** IRB amendment approved

**COMPLETE:** Complete IAIR and other regulatory documents for HRPO approval

CY22 Goals – Aim 1 Analyses and Aim 2 Analytic Set-Up

**IN PROGRESS:** Complete Aim 1 analyses and dissemination materials

**COMPLETE:** Consult with stakeholders and identify analytic inputs for Aim 2

CY23 Goals– Aim 2 Analyses and Aim 3 Analytic Set-Up

Complete Aim 2 analyses and dissemination materials

Consult with stakeholders and identify analytic inputs for Aim 3

CY24 Goals – Aim 4 Analyses and Study Close Out

Complete Aim 4 analyses and dissemination materials

Close out study

**What was accomplished under these goals?**

AIM 1 Subtasks

Major Task 1: Modified and amended regulatory protocol and data sharing agreements

Obtained and ingested updated data into MBM2 APL secure Server

Subtask 1: Delivered briefing of constructed distributions based on selected samples

Subtask 2: Identified and confirmed model inputs

Subtask 3: Completed Aim 1 analyses / descriptive statistics of population

Subtask 4: Disseminated and reviewed findings with stakeholders

Subtask 5: Completed 50% of the first manuscript

AIM 2 Subtasks

Subtask 1: Consulted with stakeholders (e.g., DoD Stepped Care Model for Pain Implementation Work Group, DHA Pain Management Clinical Support Service) to identify decision forks, nodes, and factors of interest – completed

Subtask 2: Identified and confirmed model inputs

**What opportunities for training and professional development has the project provided?**

*Nothing to Report*

**How were the results disseminated to communities of interest?**

Preliminary Aim 1 findings were disseminated to the Chair of the DHA Pain Management Clinical Support Service

**What do you plan to do during the next reporting period to accomplish the goals?**

Aim 1, Subtask 5: Develop and submit APL portions of manuscript (methodology)

Aim 2, Subtask 3: Construct model distributions and complete analyses using the site's computational resources

Aim 2, Subtask 4: Disseminate and review of findings with stakeholders

Aim 2, Subtask 5: Develop and submit manuscript

**4. IMPACT:**

**What was the impact on the development of the principal discipline(s) of the project?**

*Nothing to Report*

**What was the impact on other disciplines?**

*Nothing to Report*

**What was the impact on technology transfer?**

*Nothing to Report*

**What was the impact on society beyond science and technology?**

*Nothing to Report*

**5. CHANGES/PROBLEMS:**

**Changes in approach and reasons for change**

We have submitted a request for SOW modification to include qualitative interview data. This requested change is consistent with our study aims and we are awaiting approval from the awarding agency.

**Actual or anticipated problems or delays and actions or plans to resolve them**

The analysis portion of AIM 1 was delayed due to a temporary lapse in coverage in the data sharing agreement (DSA) between JHU/APL and DHA. This resulted in subset of the analysis being completed for Aim 1, rather than an analysis on all of the available data. The DSA has since been renewed and full preliminary analysis is now near completion. The JHU/APL team is also in the process of requesting an additional updated data set to be able to conduct an expanded population analysis but is anticipating potential delays in obtaining that data. If the data is delayed, progress on the analysis will continue for Aim 2, based on the existing data set.

**Changes that had a significant impact on expenditures**

The subcontract award was not granted to the JHU/APL team until December 2021 which resulted in a delay in the site's project kickoff. Additionally, post kickoff there were some early delays to onboarding staff from the JHU/APL team, leading to a slower than expected spend for the first 6 months of the grant timeline. The site's team has adjusted staffing and levels of effort in order to catch up to the reporting period goals.

**Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents**

**Significant changes in use or care of human subjects**

*Nothing to Report*

**Significant changes in use or care of vertebrate animals**

*Nothing to Report*

**Significant changes in use of biohazards and/or select agents**

*Nothing to Report*

**6. PRODUCTS:**

- **Publications, conference papers, and presentations**

**Journal publications.**

*Nothing to Report*

**Books or other non-periodical, one-time publications.**

*Nothing to Report*

**Other publications, conference papers and presentations.**

*Nothing to Report*

- **Website(s) or other Internet site(s)**

*Nothing to Report*

- **Technologies or techniques**

*Nothing to Report*

- **Inventions, patent applications, and/or licenses**

*Nothing to Report*

- **Other Products**

*Nothing to Report*

## 7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

Name: Krista Highland  
Project Role: Co-PI  
Research Identifier:  
Nearest person month worked:  
Contribution to Project: no change

Name: Lisa Harris, DO  
Project Role: Co-PI  
Research Identifier: NA  
Nearest person month worked: .24  
Contribution to Project: no change

Name: Virginia Kalish, MD  
Project Role: Co-PI  
Research Identifier: NA  
Nearest person month worked: .24

Contribution to Project: retired, no longer a contributor to the project

Name: Jill Panos, PsyD  
Project Role: Co-PI  
Research Identifier: NA  
Nearest person month worked: .24  
Contribution to Project: no change

Name: CDR Christopher Phillips, MD  
Project Role: Co-PI  
Research Identifier: NA  
Nearest person month worked: .24  
Contribution to Project: no change

Name: MAJ Ryan Costantino, PharmD  
Project Role: Co-PI  
Research Identifier: NA  
Nearest person month worked: .6  
Contribution to Project: no change

Name: LTC Lori Whitney, DNAP, MBA/MHA  
Project Role: Co-PI  
Research Identifier: NA  
Nearest person month worked: .36  
Contribution to Project: No longer working on this project, replacement Co-PI is Lt Col Varney

Name: Lt Col Jennifer Varney, DNP, MSN, APRN, FNP-BC  
Lori Whitney, DNAP, MBA/MHA  
Project Role: Co-PI  
Research Identifier: NA  
Nearest person month worked: .36  
Contribution to Project: New DHA PMCSS on this project.

Name: MAJ Gregory Palmrose, PharmD, PhD  
Project Role: Co-PI  
Research Identifier: NA  
Nearest person month worked: .36  
Contribution to Project: no change

Name: Megan O'Connell  
Project Role: Data Scientist  
Research Identifier: NA  
Nearest person month worked: 1.8  
Contribution to Project: no change

Name: Julee Rendon  
Project Role: JHU Site Project Manager

Research Identifier: NA  
Nearest person month worked: .5  
Contribution to Project: no change

Name: Isabelle Hasty  
Project Role: Data Analyst  
Research Identifier: NA  
Nearest person month worked: .5  
Contribution to Project: no change

Name: Jason Lee  
Project Role: Data Analyst  
Research Identifier: NA  
Nearest person month worked: .5  
Contribution to Project: no change

Name: Stephen Kay  
Project Role: Modeling and Simulation  
Research Identifier: NA  
Nearest person month worked: 1  
Contribution to Project: no change

Name: Akanksha Chattopadhyay  
Project Role: Data Analyst / Modeler  
Research Identifier: NA  
Nearest person month worked: 1  
Contribution to Project: no change

Name: Raghav Ramachandran  
Project Role: Data Analyst / Modeler  
Research Identifier: NA  
Nearest person month worked: .5  
Contribution to Project: no change

**Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?**

Dr. Highland's active (and future active) support will not have any impact on the effort required for the present award.

**What other organizations were involved as partners?**

*Nothing to Report*

**8. SPECIAL REPORTING REQUIREMENTS**

**COLLABORATIVE AWARDS:**

**QUAD CHARTS:**

**9. APPENDICES:**