AWARD NUMBER: W81XWH-22-1-0276

TITLE: Data Science to Improve Treatment Planning for Advanced Prostate Cancer Patients Treated with Radiotherapy

PRINCIPAL INVESTIGATOR: Heather Jim, PhD

CONTRACTING ORGANIZATION: H. Lee Moffitt Cancer Center and Research Institute, Inc.
Tampa, FL

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Data Science to Improve Treatment Planning for Advanced Prostate Cancer Patients Treated with Radiotherapy

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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none

14. ABSTRACT

Radiotherapy can cause short- and long-term bladder and bowel toxicities, with corresponding quality of life (QoL) detriments, in up to 60% of prostate cancer patients. This study focuses on improving radiation treatment planning with innovative combination of novel datasets and new advances in data science. We will use deep learning techniques developed by our research group to predict clinician-rated toxicity and patient-reported outcomes (PROs) using dosiomics (i.e., a recently-developed methodology to create very high-resolution three-dimensional maps of radiation dosage) and radiomics (i.e. imaging of novel tumor features such as shape and texture, that may affect radiation outcomes). We will develop and validate our prediction algorithms using detailed, existing retrospective datasets from 1,948 prostate cancer patients treated with radiation at Moffitt and 794 treated at the VA, respectively. To date, we have built and refined our retrospective data query and we are currently creating the Moffitt radiotherapy QoL database.

15. SUBJECT TERMS
Prostate cancer, quality of life, radiotherapy, data science, deep learning

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USAMRDC
Unclassified	Unclassified	Unclassified	Unclassified	15	19b. TELEPHONE NUMBER *(include area code)*

TABLE OF CONTENTS

1. INTRODUCTION:

Radiotherapy can cause short- and long-term bladder and bowel toxicities, with corresponding quality of life (QoL) detriments, in up to 60% of men with prostate cancer. As men can live for many years with prostate cancer, it is increasingly important to mitigate toxicity and preserve high levels QoL. The current study will address this problem using an innovative combination of novel datasets and new advances in data science. Our study will incorporate large-scale patient-reported outcomes (PROs), or QoL and toxicity from the patient perspective. We have one of the largest real-world PRO datasets to our knowledge, with 16,896 QoL and patient-reported toxicity surveys from 1,948 prostate cancer patients treated with radiation. We will integrate different '-omics' into machine learning models. This will include the use dosiomics, a recently-developed methodology to create very high-resolution three-dimensional maps of radiation dosage. Dosiomics can be used to identify radiation dosage to small areas with much greater precision than before. We will also use radiomics, or imaging of novel tumor features such as shape and texture, that may affect radiation outcomes. We will apply deep learning techniques developed by our research group to predict clinician-rated toxicity and PROs from the above data with much greater accuracy than previous approaches. We will externally validate our prediction algorithms using a detailed, existing retrospective dataset from 794 prostate cancer patients treated with radiation at the VA. Across both datasets, there 2,742 patients (526 patients Black, about 274 Hispanic). Study aims are as follows: 1) to develop deep learning models incorporating dosiomics and radiomics for actuarial multi-endpoint prediction of clinician-rated toxicities among prostate cancer patients treated with radiation, 2) to develop deep learning models incorporating dosiomics and radiomics for actual multi-endpoint prediction of PROs among prostate cancer patients treated with radiation, and 3) to validate deep learning models for actuarial multi-endpoint prediction of clinician-rated toxicities and PROs among prostate cancer patients treated with radiation in the VA. Upon completion of this study, we will have fulfilled our short-term objective to identify risk of short-and long-term toxicity and detriments in quality of life based on precise spatial evaluation of radiation dosage. This knowledge can immediately impact radiation treatment planning procedures. The longer-term objective of this line of research is to improve national guidelines to reduce toxicity and detriments of quality of life in men with prostate cancer.

2. KEYWORDS:

Quality of life, treatment toxicity, prostate cancer, radiation, data science, deep learning

3. ACCOMPLISHMENTS:

- **What were the major goals of the project?**

Specific Aim 1: To develop deep learning models incorporating dosiomics and radiomics for actuarial multi-endpoint prediction of clinician-rated toxicities among prostate cancer patients treated with radiation.	**Timeline**	**Moffitt**	**Thomas Jefferson University**
Major Task 1: Study start-up	Months		
Subtask 1: Complete subcontract with Thomas Jefferson University (Jim, El Naqa, Dicker)	1-2	100%	100%
Subtask 2: Obtain Moffitt Scientific Review Committee approvals for Aims 1-2, IRB determination of non-human subjects research, and USAMRDC ORP HRPO approval (Jim, El Naqa)	1-2	100%	100%
Subtask 3: Request and obtain retrospective data from the Moffitt Collaborative Data Services Core for Aims 1-2 (Jim, El Naqa)	3	50%	
Milestone(s) Achieved: Subaward with Thomas Jefferson executed, regulatory approvals obtained, Moffitt retrospective clinical dataset obtained		50%	
Major Task 2: Data cleaning, scoring, and analyses for Aim 1			
Subtask 1: Cleaning and scoring of clinical, demographic, and PRO data as needed for Aims 1-2 (Jim)	4-5	50%	
Subtask 2: Dosiomic and radiomic feature extraction for Aims 1-2 (El Naqa)	6-7	0%	
Subtask 3: Data integration for Aims 1-2 (Jim, El Naqa)	8-9	0%	

Subtask 4: Design and optimize deep neural network for Aim 1 (El Naqa)	10-13	25%	
Subtask 5: Model interpretation, evaluation, and internal validation for Aim 1 (Jim, El Naqa, Dicker)	14-16	0%	0%
Milestone(s) Achieved: Internally-validated model for Aim 1		25%	25%
Specific Aim 2: To develop deep learning models incorporating dosiomics and radiomics for actual multi-endpoint prediction of PROs among prostate cancer patients treated with radiation	**Timeline**	**Moffitt**	**Thomas Jefferson University**
Major Task 3: Data analyses for Aim 2			
Subtask 1: Deep neural network optimization for Aim 2 (El Naqa)	17-19	0%	
Subtask 2: Model interpretation, evaluation, and internal validation for Aim 2 (Jim, El Naqa, Dicker)	20-22	0%	0%
Subtask 3: Write and submit abstract and manuscript describing process of dataset integration (Jim, El Naqa, Dicker)	23-25	0%	0%
Milestone(s) Achieved: Internally-validated model for Aim 2, abstract focused on dataset integration			
Specific Aim 3: To validate deep learning models for actuarial multi-endpoint prediction of clinician-rated toxicities and PROs among prostate cancer patients treated with radiation in the VA			
Major Task 4: Obtain, clean, score data for Aim 3			
Subtask 1: Obtain deidentified HINGE dataset (i.e., facilitated by Dr. Katsoulakis, Moffitt personnel obtain VA approvals, data sharing agreement, data transfer) (Jim, El Naqa)	13-23	50%	
Subtask 2: Cleaning and scoring of clinical, demographic, and PRO data, as needed for Aim 3 (Jim, El Naqa)	24	0%	
Milestone(s) Achieved: cleaned scored dataset ready for analyses related to Aim 3		0%	
Major Task 5: Data analyses for Aim 3			
Subtask 1: Dosiomic and radiomic feature extraction for Aim 3 (El Naqa)	25-27	0%	
Subtask 2: Data integration for Aim 3 (Jim, El Naqa)	28-29	0%	
Subtask 3: Deep neural network optimization for Aim 3 (El Naqa)	30-32	0%	
Subtask 4: Model interpretation, evaluation, and internal validation for Aim 3 (Jim, El Naqa, Dicker)	33-35	0%	0%
Subtask 5: Write and submit abstracts and manuscripts describing final results (Jim, El Naqa, Dicker)	34-36	0%	0%
Milestone(s) Achieved: Validated model for Aim 3, manuscripts and abstracts describing final results			

- **What was accomplished under these goals?**
  We have spent the first year in an iterative process of: 1) specifying retrospective data requests from the Moffitt Collaborative Data Service Core and VA HINGE ; 2) reviewing data received as a full, multidisciplinary research group for accuracy, comprehensiveness, and completeness; 3) modifying our data requests accordingly; and 4) designing the deep neural network architectures. We now have a comprehensive set of the correct elements and a data request on the full Moffitt sample is being processed.

- **What opportunities for training and professional development has the project provided?**
  Dr. Denis Dusdas was hired as a post-doctoral fellow on the project and have acquired necessary skills to develop and apply machine learning techniques to treatment planning datasets.

- **How were the results disseminated to communities of interest?**
  Nothing to report

- **What do you plan to do during the next reporting period to accomplish the goals?**
  We anticipate receiving the full dataset from Moffitt in the next month. We will then clean the data in parallel with manually pulling pdf information from the medical record. Once this process has occurred, we will complete the scope of work described for Aim 2. Although the process of specifying data elements took longer than anticipated, this investment of time will pay off during Aim 2, which will be conducted more efficiently with a dataset that is already known to be comprehensive and accurate.

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**
     Nothing to report

   - **Actual or anticipated problems or delays and actions or plans to resolve them**
     Nothing to report

   - **Changes that had a significant impact on expenditures**
     Nothing to report

   - **Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents**
     Nothing to report

   - **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**
     Nothing to report

     - **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:

- **What individuals have worked on the project?**

Name:	*Heather Jim, PhD*
Project Role:	*Principal Investigator*
Researcher Identifier (e.g. ORCID ID):	*ORCHID ID: 0000-0001-7353-3711*
Nearest person month worked:	*2*
Contribution to Project:	*Dr. Heather Jim has worked as the Principal Investigator of the study, overseeing all aspects of implementation and analysis.*
Funding Support:	*N/A*

Name:	*Peter A Johnstone, MD, FACR, FASTRO, FARS*
Project Role:	*Co-Investigator*
Researcher Identifier (e.g. ORCID ID):	*ORCHID ID: 0000-0003-4221-9388*
Nearest person month worked:	*0.4*
Contribution to Project:	*Dr. Johnstone has worked with the Principal Investigator on the research protocol and the implementation of recruitment and treatment.*
Funding Support:	*N/A*

Name:	*Crystal Bryant*
Project Role:	*Research Coordinator*
Researcher Identifier (e.g. ORCID ID):	*N/A*

Nearest person month worked:	*2*
Contribution to Project:	*Ms. Bryant has worked as the senior research coordinator of the study. She handled the day to day operations of the implementation of the project.*
Funding Support:	*N/A*

Name:	*Taylor Welniak*
Project Role:	*Research Coordinator*
Researcher Identifier (e.g. ORCID ID):	*N/A*
Nearest person month worked:	*9*
Contribution to Project:	*Ms. Welniak has worked as the research coordinator of the study. She handled the day to day operations of the implementation of the project.*
Funding Support:	*N/A*

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

PD/PI: Heather Jim - CHANGES IN ACTIVE SUPPORT	
Title: Data Science to Improve Treatment Planning for Advanced Prostate Cancer Patients Treated with Radiotherapy **Goals:** Radiation can cause short- and long-term toxicities, including problems with urinary and bowel functioning which can negatively impact quality of life, in up to 60% of patients. Improving patient quality of life is a FY21 PCRP Overarching Challenge. Our team believes we can improve the lives of prostate cancer patients who receive radiation through this innovative proposal that incorporates the latest advances in artificial intelligence. The current study will address this problem using an innovative combination of novel datasets and cutting-edge data science. **Specific Aims:** To develop deep learning models incorporating dosiomics and radiomics for actuarial multi-endpoint prediction of clinician-rated toxicities among prostate cancer patients treated with radiation; To develop deep learning models incorporating dosiomics and radiomics for actual multi-endpoint prediction of PROs among prostate cancer patients treated with radiation and; To validate deep learning models for actuarial multi-endpoint prediction of clinician-rated toxicities and PROs among prostate cancer patients treated with radiation in the VA. **Project Number:** W81XWH-22-1-0276 **PD/PI:** Heather Jim, Initiating PI/Issam El Naqa, Partnering PI **Time Commitment:** 1.92 calendar months **Supporting Agency:** US Army/CDMRP-PCRP **Agency Contact Info:** Joshua McKean, Grants Officer, Joshua.d.mckean3.civ@mail.mil, ph: 301-619-4046 **Agency Address:** 820 CHANDLER ST FORT DETRICK MD 21702-5014 **Performance Period:** 06/01/2022-05/31/2025 **Total Award Amount:**	New Active Award *(This Award)*

Title: Neurocognitive and Patient-Reported Outcomes after Chimeric Antigen Receptor T-Cell Therapy: A Controlled Comparison **Goals:** The goal of the study is to better understand changes in PROs and cognition in adult CAR T-cell therapy recipients in the first year after treatment compared a matched comparison group of people without cancer. **Specific Aims:** To better understand changes in PROs and cognition in adult CAR T-cell therapy recipients in the first year after treatment compared a matched comparison group of people without cancer. **Project Number:** R01CA244328 **PD/PI:** Jim, Heather **Time Commitment:** 1.2 calendar months **Supporting Agency:** NIH/NCI **Agency Contact Info:** Roxanne Jensen, 240-276-7588, roxanne.jensen@nih.gov **Performance Period:** 06/01/2022 – 05/31/2027 **Total Award Amount:**	New Active Award
Title: Disparities in Uptake of new FDA-Approved Therapies for Metastatic Renal Cell Carcinoma **Goals:** The goal of this study is to evaluate racial and social determinants of health (SDOH) differences in uptake of new FDA approved treatment regimens since 2005. We will evaluate whether uptake in FDA-approved therapies accounts for disparities in disease outcomes (e.g., overall survival, progression-free survival). We will also evaluate whether putative racial and socioeconomic disparities have attenuated across time as awareness of health equity in cancer care has increased. **Specific Aims:** To evaluate racial and social determinants of health (SDOH) differences in uptake of new FDA approved treatment regimens since 2005; to evaluate whether uptake in FDA-approved therapies accounts for disparities in disease outcomes (e.g., overall survival, progression-free survival); and to evaluate whether putative racial and socioeconomic disparities have attenuated across time as awareness of health equity in cancer care has increased. **Project Number:** 69-22251-01-01 **PD/PI:** Jim, Heather **Time Commitment:** 0.12 calendar months **Supporting Agency:** Flatiron Health and Foundation Medicine **Agency Contact Info:** Mariana Hernandez,143 Second Street, San Francisco, CA 94105 **Performance Period:** 11/19/2022 – 11/28/2023 **Total Award Amount:**	New Active Award
Title: Development and Validation of a Patient-Reported Measure Assessing Chimeric Antigen Receptor (CAR) T-Cell Therapy-Related Side Effects **Goals:** To develop and validate a measure assessing acute and chronic patient-reported side effects associated with CAR T-cell therapy, in collaboration with the developers of the Functional Assessment for Chronic Illness Therapy (FACIT) measures, commonly used in cancer patients. **Specific Aims:** To develop and validate a measure assessing acute and chronic patient-reported side effects associated with CAR T-cell therapy, in collaboration with the developers of the Functional Assessment for Chronic Illness Therapy (FACIT) measures, commonly used in cancer patients. **Project Number:** R03CA259489 **PD/PI:** Anna Barata **Time Commitment:** no measurable effort **Supporting Agency:** NIH/NCI **Agency Contact Info:** Roxanne Jensen, roxanne.jensen@nih.gov **Performance Period:** 04/01/2022 – 03/31/2024 **Total Award Amount:**	New Active Award

Title: The COACH Study: A Framework for individualized COaching in young Adult Cancer survivors to encourage Healthy behaviors **Goals:** The goals of this study are to (1) quantitatively assess diet and PA behaviors, awareness and adherence of American Cancer Society guidelines, risk factors for non-adherence, preferences, and quality of life in young adult cancer survivors and to (2) qualitatively examine factors related to diet and physical activity (e.g., sociocultural, environmental, individual), barriers and facilitators, and intervention format preferences in young adult cancer survivors. **Specific Aims:** The goals of this study are to (1) quantitatively assess diet and PA behaviors, awareness and adherence of American Cancer Society guidelines, risk factors for non-adherence, preferences, and quality of life in young adult cancer survivors and to (2) qualitatively examine factors related to diet and physical activity (e.g., sociocultural, environmental, individual), barriers and facilitators, and intervention format preferences in young adult cancer survivors. **Project Number:** R03CA270475 **PD/PI:** Crowder, Sylvia **Time Commitment:** no measurable effort **Supporting Agency:** NIH/NCI **Agency Contact Info:** Tanya Agurs-Collins collinsta@mail.nih.gov **Performance Period:** 05/04/2022 – 04/30/2024 **Total Award Amount:**	New Active Award
Title: Integrating Health Informatics in a Scalable Stepped Care Self-Management Program for Survivors After Hematopoietic Cell Transplantation **Goals:** Among HCT survivors with poor health care adherence to cardiometabolic or new cancer surveillance and/or elevated cancer-related distress, determine the impact of a patient-centered, self- management stepped care program compared to an active control group provided access to HCT survivorship best practices. In addition, determine characteristics of intervention participants who require telehealth stepped care at 1-month and determine resources that would be needed to sustain the intervention as a national HCT survivorship program if implemented through the CIBMTR//NMDP. **Specific Aims:** 1) Among HCT survivors with poor health care adherence to cardiometabolic or new cancer surveillance and/or elevated cancer-related distress, determine the impact of a patient-centered, self-management stepped care program compared to an active control group provided access to HCT survivorship best practices; 2) Determine characteristics of intervention participants who require telehealth stepped care at 1-month; and 3) Determine resources that would be needed to sustain the intervention as a national HCT survivorship program if implemented through the CIBMTR//NMDP (i.e., costs, level of expertise, and use of intervention components relative to costs. **Project Number:** R01CA215134 **PD/PI:** Jim, Heather (Site PI) **Time Commitment:** no measurable effort **Supporting Agency:** NIH/NCI **Agency Contact Info:** Nonniekaye Shelburne, nonniekaye.shelburne@nih.gov **Performance Period:** 05/2018 – 04/2022 **Total Award Amount:**	Ended Award
Title: Pilot study to explore time restricted eating (TRE) to improve immunotherapy outcomes in advanced head and neck cancer patients **Goals:** A pilot clinical study in head and neck cancer patients receiving ICB therapy who will be randomized to a regular eating regimen or TRE. **Specific Aims:** A pilot clinical study in head and neck cancer patients receiving ICB therapy who will be randomized to a regular eating regimen or TRE. **Project Number:** 02-27001-22-07 **PD/PI:** Muzaffar **Time Commitment:** 0.12 calendar months **Supporting Agency:** Moffitt Cancer Center & Advent Health **Agency Contact Info:** Maureen Ahearn, Maureen.ahearn@moffitt.org **Performance Period:** 05/2021 – 04/2022 **Total Award Amount:**	Ended Award

Title: Identifying and Reducing Disparities in Symptom Burden Among African American Prostate Cancer Survivors **Goals:** To identify disparities in pain, sleep disturbance, and depression among African American prostate cancer survivors and risk factors for these disparities. **Specific Aims:** To identify disparities in pain, sleep disturbance, and depression among African American prostate cancer survivors and risk factors for these disparities. **Project Number:** W81XWH2010126 **PD/PI:** Gonzalez, Brian **Time Commitment:** 0.12 calendar months **Supporting Agency:** DOD **Agency Contact Info:** Unavailable **Performance Period:** 04/01/2020 – 03/31/2023 **Total Award Amount:**	Ended Award
Title: Survivorship in Lymphoma Patients Treated with Axicabtagene Ciloleucel: Neurocognitive and Patient-Reported Outcomes **Goals:** The main goals are to evaluate longitudinal changes in neurocognition following axi-cel therapy, and describe longitudinal changes in patient-reported outcomes for patients receiving axi-cel cell therapy. **Specific Aims:** 1) Evaluate longitudinal changes in neurocognition following axi-cel therapy, and 2) describe longitudinal changes in patient-reported outcomes for patients receiving axi-cel cell therapy. **Project Number:** 18013103 **PD/PI:** Jim, Heather **Time Commitment:** 0.12 calendar months **Supporting Agency:** Kite Pharma **Agency Contact Info:** Unavailable **Performance Period:** 09/13/2019 - 09/13/2022 **Total Award Amount:**	Ended Award
Title: Post-Hurricane Cancer Care: Patient Needs after Hurricane Maria **Goals:** The current study will describe unmet medical and psychological needs as well as barriers and facilitators to care in cancer patients in Puerto Rico. In addition, the study will assess the impact of extreme physical and mental stress on hypothalamic-pituitary-adrenal (HPA) axis functioning which is known to affect cancer biology. **Specific Aims:** To analyze unmet medical and psychological needs as well as barriers and facilitators to care in cancer patients in Puerto Rico and to assess the impact of extreme physical and mental stress on hypothalamic-pituitary-adrenal (HPA) axis functioning which is known to affect cancer biology. **Project Number:** R21MD013674, R21MD013674-02S1, R21MD013674-02S2 **PD/PI:** Jim, Heather **Time Commitment:** 0.12 calendar months **Supporting Agency:** NIH/NIMHD **Agency Contact Info:** Jennifer Alvidrez, alvidrezjl@mail.nih.gov **Performance Period:** 09/12/2018 – 05/31/2022 **Total Award Amount:**	Ended Award
Co-I: Peter Johnstone - CHANGES IN ACTIVE SUPPORT	
Title: Data Science to Improve Treatment Planning for Advanced Prostate Cancer Patients Treated with Radiotherapy **Goals:** Radiation can cause short- and long-term toxicities, including problems with urinary and bowel functioning which can negatively impact quality of life, in up to 60% of patients. Improving patient quality of life is a FY21 PCRP Overarching Challenge. Our team believes we can improve the lives of prostate cancer patients who receive radiation through this innovative proposal that incorporates the latest advances in artificial intelligence. The current study will address this problem using an innovative combination of novel datasets and cutting-edge data science. **Specific Aims:** To develop deep learning models incorporating dosiomics and radiomics for actuarial multi-endpoint prediction of clinician-rated toxicities among prostate cancer patients treated with radiation; To develop deep learning models incorporating dosiomics and radiomics for actual multi-endpoint prediction of PROs among prostate cancer patients treated with radiation and; To validate deep learning models for actuarial multi-endpoint prediction of clinician-rated toxicities and PROs among prostate cancer patients treated with radiation in the VA. **Project Number:** W81XWH-22-1-0276	New Active Award *(This Award)*

PD/PI: Heather Jim, Initiating PI/Issam El Naqa, Partnering PI **Time Commitment:** 0.36 calendar months **Supporting Agency:** US Army/CDMRP-PCRP **Agency Contact Info:** Joshua McKean, Grants Officer, Joshua.d.mckean3.civ@mail.mil, ph: 301-619-4046 **Agency Address:** 820 CHANDLER ST FORT DETRICK MD 21702-5014 **Performance Period:** 06/01/2022-05/31/2025 **Total Award Amount:**	
Co-I: Adam Dicker - CHANGES IN ACTIVE SUPPORT	
Title: Data Science to Improve Treatment Planning for Advanced Prostate Cancer Patients Treated with Radiotherapy **Goals:** Radiation can cause short- and long-term toxicities, including problems with urinary and bowel functioning which can negatively impact quality of life, in up to 60% of patients. Improving patient quality of life is a FY21 PCRP Overarching Challenge. Our team believes we can improve the lives of prostate cancer patients who receive radiation through this innovative proposal that incorporates the latest advances in artificial intelligence. The current study will address this problem using an innovative combination of novel datasets and cutting-edge data science. **Specific Aims:** To develop deep learning models incorporating dosiomics and radiomics for actuarial multi-endpoint prediction of clinician-rated toxicities among prostate cancer patients treated with radiation; To develop deep learning models incorporating dosiomics and radiomics for actual multi-endpoint prediction of PROs among prostate cancer patients treated with radiation and; To validate deep learning models for actuarial multi-endpoint prediction of clinician-rated toxicities and PROs among prostate cancer patients treated with radiation in the VA. **Project Number:** W81XWH-22-1-0276 **PD/PI:** Heather Jim, Initiating PI/Issam El Naqa, Partnering PI **Time Commitment:** calendar months **Supporting Agency:** US Army/CDMRP-PCRP **Agency Contact Info:** Joshua McKean, Grants Officer, Joshua.d.mckean3.civ@mail.mil, ph: 301-619-4046 **Agency Address:** 820 CHANDLER ST FORT DETRICK MD 21702-5014 **Performance Period:** 06/01/2022-05/31/2025 **Total Award Amount:**	New Active Award *(This Award)*

- **What other organizations were involved as partners?**
  Nothing to report

8. SPECIAL REPORTING REQUIREMENTS:

- **COLLABORATIVE AWARDS:**
  An annual progress report has been prepared for both the initiating and collaborating awards (W81XWH-22-1-0276 and W81XWH-22-1-0277).

- **QUAD CHARTS:**
  Not applicable

9. APPENDICES:

- **Appendix A:** Inclusion Enrollment Report

OMB Number: 0925-0770
Expiration Date: 09/30/2024

PHS Inclusion Enrollment Report

1. * Inclusion Enrollment Report Title

Data Science to Improve Treatment Planning for
Advanced Prostate Cancer Patients Treated with Radiotherapy

2. * Using an Existing Dataset or Resource ☐ Yes ☒ No

3. * Enrollment Location Type ☒ Domestic ☐ Foreign

4. Enrollment Country(ies)

USA: UNITED STATES

5. Enrollment Location(s)

Moffitt Cancer Center

6. Comments

Planned

Racial Categories	Ethnic Categories				
	Not Hispanic or Latino		Hispanic or Latino		Total
	Female	Male	Female	Male	
American Indian/ Alaska Native	0	49	0	19	68
Asian	0	75	0	7	82
Native Hawaiian or Other Pacific Islander	0	7	0	1	8
Black or African American	0	451	0	75	526
White	0	1,823	0	149	1,972
More than One Race	0	63	0	23	86
Total	0	2,468	0	274	2,742

Cumulative (Actual)

Racial Categories	Ethnic Categories									
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			**Total**
	Female	**Male**	**Unknown/ Not Reported**	**Female**	**Male**	**Unknown/ Not Reported**	**Female**	**Male**	**Unknown/ Not Reported**	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	0	0	0	0	0	0	0	0	0	0
White	0	0	0	0	0	0	0	0	0	0
More than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0

Report 1 of 1