



# Lessons Learned from the Medical University of South Carolina Transdisciplinary Collaborative Center (TCC) in Precision Medicine and Minority Men's Health

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## Abstract

The Transdisciplinary Collaborative Center (TCC) in Precision Medicine for Minority Men's Health was established at the Medical University of South Carolina (MUSC) in 2015 to address disparities in the translation of precision medicine approaches among racial minority groups. This regional consortium focuses on three primary areas: (1) the development of a consortium of regional and national partners, (2) conducting transdisciplinary research examining synergistic effects of biological, social, physiological, and clinical determinants of chronic disease risks and outcomes, and (3) dissemination and implementation of precision medicine approaches, with an emphasis on reducing disparities in health care and outcomes among minority men. Given consistent calls to better translate precision medicine approaches and the focus of this consortium on addressing disparities among minority men, we provide an overview of our experience in developing the MUSC TCC, including barriers and facilitators to conducting translational research on minority men's health issues in the context of precision medicine. Lessons learned and areas for improvement include providing enough time to create consistent partnerships and community engagement to improve recruitment and retention, identifying unique ways to engage diverse partners from across the region and nation, and better approaches to dissemination and communication for large partnerships focusing on precision medicine.

## Keywords

population-based, health-care issues, cancer prevention, oncology/cancer, evaluation, genetics, development and aging

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## Introduction

Men from racial minority groups continue to experience poor health outcomes compared with nonminority men (National Center for Health Statistics, 2013). The life expectancy for African American men (67.7 years) is substantially lower compared with white men (74.6 years). Reducing racial disparities in morbidity and mortality among minority men remains a national imperative. One of the promising opportunities to improve health outcomes among racial minority groups is through a precision medicine approach. Precision medicine is defined

as “an emerging approach for disease treatment and prevention that takes into account individual variability in environment, lifestyle, and genes for each person” (National Institutes of Health, 2015, 2020). Since its initial conceptualization 17 years ago when the sequence of the human genome was completed, precision medicine has gained rapid attention, including being part of federally funded initiatives and a national research agenda (Ginsburg & Phillips, 2018).

In theory, precision medicine is designed to tailor individual's health care based on their biological, behavioral, and social factors that contribute to disease risks



and enhance health outcomes. However, the absence of empirical data on the interactive effects of these factors may limit the development of effective strategies for precision medicine and the dissemination and implementation of these approaches in both clinical and public health settings. Specifically, current development and implementation of approaches for precision medicine will be limited among minority men because empirical data are lacking about the ways in which risk factors and protective variables (e.g., resources for adaptation and coping) work independently and interact synergistically to produce health outcomes among men from racial and ethnic minority groups.

To address challenges in the implementation of precision medicine among minority men, the Transdisciplinary Collaborative Center (TCC) in Precision Medicine for Minority Men's Health was established at Medical University of South Carolina (MUSC) with funding by the National Institute for Minority Health and Health Disparities and the National Cancer Institute (NIMHD Project Number U54MD010706). Since 2015, the TCC has primarily focused on three areas: (1) using a broad-based consortium network comprised of regional and national partners representing academic medical centers, community-based health organizations, public health agencies, and community stakeholders to help shape the precision medicine-based research priorities and strategies by embracing the principles of community-based participatory research (CBPR), (2) conducting transdisciplinary research that examines the synergistic effects of biological, social, psychological, and clinical determinants of chronic disease risks and outcomes, and (3) disseminating and implementing best practices for applying precision medicine approaches to address disparities in health care and outcomes among minority men in diverse clinical and community settings. These goals are aligned through the broad focus on helping to advance the translation of precision medicine approaches among racial minority groups.

Given the unique transdisciplinary nature and focus of this consortium on addressing some of the national priorities related to advancing precision medicine, the goal of this article is to share experiences in developing the TCC. We will describe barriers and facilitators to conducting transdisciplinary translational research on minority men's health issues in the context of precision medicine.

## Overview of MUSC TCC in Precision Medicine and Minority Men's Health

The MUSC serves as the lead academic institution for these efforts, with academic institutions and community-based organizations collaborating across multiple states, including South Carolina, Texas, Virginia, Pennsylvania, and Maryland. The TCC is guided by a set of four specific aims and subaims (see Table 1).

### Theoretical Framework Used by the MUSC TCC

Early on, the research team established a theoretical framework to ensure alignment across TCC initiatives. The framework was guided by an emerging hypothesis about the contribution of psychosocial and social stressors to racial disparities in health outcomes; recent conceptual models indicate that these stressors impact biological processes that play a role in the initiation and progression of the disease (Gehlert et al., 2008; Thompson et al., 2017). Allostatic load (AL) is an indicator of biological dysregulation in response to psychological and social stress. AL is used as a marker of how much psychological and social stressors impact biological functioning and may be an effective framework for developing precision medicine approaches to address racial disparities among minority men (Seeman et al., 2010; Szanton et al., 2005). AL may be one way to

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**Table 1.** Specific Aims.

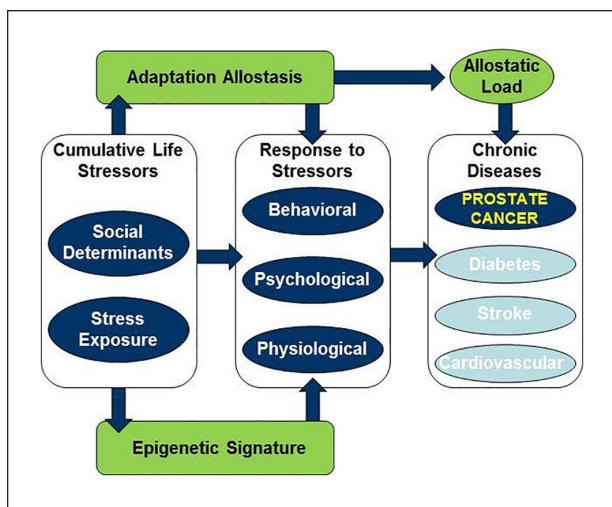
Specific aim	Subaims
Establish a broad-based consortium that will provide the infrastructure to support the active engagement of the diverse academic, clinical, community, and public health stakeholders in deploying precision medicine research and implementation to address health disparities among minority men.	<ul style="list-style-type: none"> <li>• Identify national priorities for precision medicine and health disparities research by working collaboratively across the consortium located in diverse regions across the southern regions of the United States.</li> <li>• Implement a small grants program to support precision medicine research priorities identified by the diverse stakeholders within the consortium.</li> </ul>
Conduct translational research to understand the dynamic interaction between biological, social, psychological, behavioral, and clinical factors and health care and disease outcomes to determine the most effective ways to integrate these data into precision medicine approaches.	<ul style="list-style-type: none"> <li>• Identify and catalyze transdisciplinary teams to conduct precision medicine research explicitly focus on the health care and disease outcomes among minority men.</li> <li>• Identify and collect core measures on biological, social, psychological, behavioral, and clinical factors across translational projects to identify those attributes that are most relevant for precision medicine.</li> <li>• Implement evidence-based strategies to recruit and retain minority men in translational precision medicine research.</li> <li>• Translate findings into evidence-based approaches for precision medicine to improve clinical practice and health outcomes and reduce disparities among minority men.</li> </ul>
Support the dissemination of evidence related to precision medicine and health disparities across the regions in our Consortia and engage stakeholders in the development of best practices to facilitate implementation and adoption of these approaches into clinical care and public health practice	<ul style="list-style-type: none"> <li>• Develop materials and methods to determine the needs, readiness, and capacity of stakeholders across multiple regions to implement and adopt precision medicine approaches.</li> <li>• Identify ethical legal and social issues (ELSI) related to linking and integrating data on biological, social, psychological, behavioral, and clinical factors and develop recommendations to address these issues.</li> <li>• Deliver evidence academies for precision medicine and health disparities to actively engage diverse stakeholders in the development of best practices for implementing precision medicine interventions into practice.</li> <li>• Translate findings from the TCC and other initiatives in precision medicine into policy recommendations for clinical care and public health practice that promote health equity. One recommendation would be integrating data that links social determinants of health with biological data into clinical decision making or clinical practice.</li> </ul>
Establish a data integration core that synergizes the expertise within the TCC in bioinformatics and medical informatics to validate findings on the interaction between biological, social, psychological, behavioral, and clinical factors and health care and outcomes from prospective studies conducted as part of the TCC and will be made available as a national resource for others to employ.	<ul style="list-style-type: none"> <li>• Create databases/registries that bring together the diverse types of data generated in bench experiments with clinical measurements derived from the electronic health record (EHR) and EHR data on the evolution of diseases over time.</li> <li>• Develop natural language processing-based tools to extract discrete details on social stressors from clinicians' notes and merge these data with clinical data.</li> </ul>

integrate the effects of biological, social, psychological, and behavioral factors within and between organ sites for diseases that disproportionately affect minority men using data derived from clinical measures. However, prior studies have not examined the effects of AL with sufficient depth or breadth, especially among minority men or within the context of chronic conditions for which disparities exist. Thus, the MUSC TCC used AL as a model for integrating the effects of biological, social, psychological, behavioral factors using clinical data in order to develop approaches for precision medicine that address racial disparities in health outcomes among minority men. The TCC specifically focused on prostate

cancer as an example of how AL can be used to integrate multilevel data that are relevant to minority men's health and health disparities; this framework was selected because it could be extended to address other chronic conditions such as stroke, diabetes, and cardiovascular disease that disproportionately affects minority men in terms of morbidity and mortality (Figure 1).

### *Organizational Structure of the TCC*

The TCC involves a variety of stakeholders, which are divided into various advisory committees and cores. These committees are designed to engage a diverse



**Figure 1.** Conceptual model guiding transdisciplinary collaborative center efforts.

cross-section of multiregional partners representing academic biomedical scientists, community leaders, advocacy groups for vulnerable populations, and government leaders, in order to develop novel precision medicine approaches aimed at reducing health disparities in minority men. Two directors oversee all TCC activities. Together with the Administrative Core, the Consortium Core members guide the direction and prioritization of activities. These members include individuals from academic institutions, as well as community-based organizations that have a focus on health promotion and disease prevention, community outreach and education, and dissemination of health information, and provider education. Together with the Consortium Core, the Administrative Core ensures progress in terms of achieving TCC's goals, developing and prioritizing new initiatives that respond to emerging priorities, and managing, coordinating, and supervising the range of activities to ensure that they are completed in a timely manner. The Administrative Core has additional responsibilities that include overseeing fiscal management, monitoring, and evaluating all aspects of the TCC for formative input and summative outcomes, managing communications, ensuring interactions between project and core leaders, and developing and maintaining new partnerships.

The three research studies are led by transdisciplinary project leaders and focus on understanding: (1) sociobiological responses to stress in prostate cancer survivors, (2) defining and integrating AL index with immune and tumor microenvironment, and (3) integrating genomics and sociobiological data to inform the development of prostate cancer treatment. Details about the progress of each core are included in the evaluation of core components section.

One of the steps that the MUSC TCC took in order to achieve the aims of the Center was to develop a standardized survey for measuring self-reported social determinants. The social determinants survey (SDS) is a 30-minute survey that is administered to men who are enrolled in the three primary translational research studies and prospective survey of ethical, legal, and social issues among African American and white primary care patients at the MUSC. The SDS measures social and psychological stressors (e.g., perceived stress, social isolation) and resources (e.g., collective efficacy, resilience), disease-specific stressors (e.g., primary appraisals about prostate cancer diagnosis and treatment), financial hardship, quality of life, and cancer control behaviors using validated instruments and measures. In addition, men are asked to describe overall positive and negative life experiences and perceptions of social support as part of the SDS. In addition to obtaining self-reported data on social determinants, clinical data on prostate cancer variables (e.g., prostate-specific antigen, stage, and grade of disease) and AL are abstracted from electronic health records. Lastly, residential information is used to characterize social deprivation levels among participants (Center, 2020).

The Implementation Core focuses on sharing findings from the TCC with the community stakeholders and facilitation of the implementation of best practices and policies to ensure equitable access among all groups. The implementation core also works to identify ethical, legal, and social issues related to precision medicine; as part of this, instruments and items have been developed to measure concerns about linking genomic, environmental, and lifestyle data. Lastly, the implementation core helps ensure that findings from TCC projects and cores are disseminated to the scientific community and health-care providers through peer-reviewed articles, along with sharing findings with lay stakeholders and the general public using community outreach and education strategies.

The Data Integration Core focuses on creating new knowledge about AL by integrating data from projects within the MUSC TCC with supplemental information about individuals and populations. Specifically, the Data Integration Core creates databases and registries to bring together diverse types of data generated in bench experiments with clinical measurements derived from electronic health records. Investigators in the data integration core have worked with project leaders to develop natural language process tools to identify social determinants of health in the electronic health record (Zhu et al., 2019) and to identify barriers and facilitators to using informatics strategies to recruiting diverse populations to participate in translational research (Obeid et al., 2018).

The Consortium Core uses a CBPR approach to integrate and organize precision medicine research with



health disparities across HHS regions in the United States by forming a multiregional infrastructure to provide guidance to help promote health equity among minority men, identify priorities for research in precision medicine, implement minority pilot project research related to minority men's health in precision medicine, and translate findings into clinical and community-based practices to address racial disparities across minority men. The Consortium Core plays an important role in conceptualizing these activities, identifying challenges to implementing, and developing problems to address issues with completing research, implementation, and data integration activities across projects and cores.

## TCC Evaluation Efforts

### *Evaluation of Partnerships*

The TCC incorporates a variety of evaluation-related efforts to ensure appropriate progress across all domains of the consortium. In 2018, the TCC underwent an internal survey of investigators who work on center projects and cores. Questions included perspective about the mission and purpose of the goals, relationships within the TCC, perceptions about the leadership of the TCC, general roles and responsibilities, communication quality, and decision-making (Table 2). Each question was asked on a scale of 1 (strongly disagree) to 7 (strongly agree), and a total of eight study team members completed the survey. In addition, questions were asked about barriers related to the overall project and specific project cores. These were ranked on a scale of 1 (not at all) to 4 (to a great extent).

Overall, there were high levels of agreement with statements related to the mission and purpose of the MUSC TCC. The highest-rated statement was that “the projects being carried out through the grant represent best practice research guidelines from multiple professions” ( $M = 5.25$ ,  $SD = 2.54$ ). One comment exemplified this when asked about the positive aspects of the program, “leadership and transparency of program aims and procedures and commitment to excellence in scientific foundation and community engagement.” The lowest rated evaluation statement was, “the team's mission and goals are supported by sufficient resources (skills, funding, time, space)” ( $M = 4.88$ ,  $SD = 2.15$ ). Most also agreed that general relationships were of good quality ( $M = 5.43$ ,  $SD = 2.46$ ). Team leadership was rated at 4.78 ( $SD = 2.31$ ). Comments related to leadership were positive. For example, “the team at MUSC are easy to work with, answer questions that come up and support the community members on the project.” Additionally, “The PI has provided outstanding leadership in creating a culture of professional collaboration. She is always open to hearing

the ideas of team members.” Another area, general roles, and responsibilities had a range of responses, with the majority being a positive agreement with the statements. The highest-rated statement was, “team members acknowledge when members of my profession and have more skills and experts.” The lowest rated item was “team members negotiate the role they want to take in developing and implementing our projects” ( $M = 4.38$ ,  $SD = 2.44$ ). Assessment of decision-making and conflict included “processes are in place to quickly identify and respond to a problem” ( $M = 5$ ,  $SD = 2.12$ ) and “our team has an established process for conflict management” ( $M = 4.5$ ,  $SD = 2.06$ ).

When asked to rate level of concern about each barrier, the highest ranked barrier was “competing responsibilities (e.g., not enough time)” ( $M = 2.13$ ,  $SD = 0.93$ ). The lowest rated barrier was identifying appropriate community partners ( $M = 1.38$ ,  $SD = 0.48$ ). Specific research barriers included recruiting ( $M = 2$ ,  $SD = 1.10$ ) and retraining study participants ( $M = 2$ ,  $SD = 0.71$ ), along with obtaining lab samples from study participants ( $M = 2$ ,  $SD = 0.71$ ). The least concerning barrier was quality of lab samples obtained for analyses ( $M = 1.25$ ,  $SD = 0.43$ ).

### *Evaluation Based on Core Components*

Each component of the TCC has been tracking the specific activities and outcomes that support the overall mission of the TCC. Cores are asked to share their updates annually using a standardized form that asks about accomplishments, challenges, presentations and publications, intramural and extramural funding, training opportunities, collaboration with other centers, community engagement, and policy or practice changes (Table 3).

Each of the cores has been successful in completing activities and outcomes as specified in the original proposal. The administrative core, which also features an evaluation component, has hosted meetings related to prostate cancer, established and implemented social media pages, and provided mentorship and training resulting in funded research projects. The implementation core, which focuses on disseminating findings to the community and identifying ethical, legal, and social issues related to precision medicine, has successfully implemented a precision medicine survey with primary care patients and completed an environmental scan to identify community priorities for dissemination activities. Actions have also been completed to administer this survey to primary care patients at the MUSC. Together with the consortium core, the implementation core has also established a curriculum for a continuing medical education (CME) course related to precision medicine.

**Table 2.** Evaluation of TCC Partnerships.

Evaluation component	Mean (SD)
<b>Mission purpose and goals</b>	
The team mission embodies an inter-professional collaborative approach	5.13 (2.32)
The team's goals are clear, useful, and appropriate to my work	5.13 (2.42)
The team's mission and goals are supported by sufficient resources (skills, funding, time, space)	4.88 (2.15)
The projects being carried out through the grant represent best practice research guidelines from multiple professions	5.25(2.54)
There is a real desire among team members to work collaboratively	5 (2.5)
<b>General relationships</b>	<b>5.43 (2.46)</b>
<b>Team leadership</b>	<b>4.78 (2.31)</b>
<b>General role responsibilities, autonomy</b>	
Team members feel they have adequate input into planning the U54 initiative	4.38 (2.39)
Team members acknowledge when members of my profession have more skills and expertise	5.5 (2.35)
Team members negotiate the role they want to take in developing and implementing our projects	4.38 (2.44)
Team members are held accountable for their work	4.63 (1.99)
It is clear who is responsible for the various activities of the U54 initiative	4.5 (2.35)
Team members would feel comfortable advocating for changes to their U54 project activities if needed	5 (2.39)
Each team member shares accountability for team decisions and outcomes	4.43 (1.92)
Team members are responsible for communicating and providing expertise in an assertive manner	4.5 (2.24)
Team members feel limited in the degree of autonomy in patient/client care that they can assume	1.71 (0.70)
<b>Communication and information exchange</b>	
Team members concerns are addressed effectively through regular team meetings and discussion	4.5 (2.29)
The team has developed effective communication strategies to share project updates	4.5 (2.29)
Relevant information is reported to appropriate team members in a timely manner	4.63 (2.34)
I trust the accuracy of information reported among team members	5.38 (2.29)
Team meetings provide an open, comfortable, safe place to discuss concerns	5.25 (2.49)
<b>Decision-making and conflict management</b>	
Processes are in place to quickly identify and respond to a problem	5 (2.12)
When team members disagree, all points of view are considered before deciding on a solution	4.75 (2.33)
Our team has an established process for conflict management	4.5 (2.06)
<b>Overall barriers*</b>	
Getting project team hired and oriented	1.75(1.09)
Identifying scientific collaborators with appropriate expertise	1.63 (0.69)
Identifying appropriate community partners	1.38 (0.48)
Finding times when key partners are available to meet	1.88 (0.78)
Regulatory approvals to conduct research	1.5 (0.71)
Loss of staffing	1.63 (0.86)
Adequacy of project budgets	1.63 (1.11)
Differences in opinions about the purpose or direction of the U54 initiative	1.75 (0.66)
Competing responsibilities (i.e., not enough time)	2.13 (0.93)
<b>Barrier-specific research*</b>	
Recruiting study participants	2 (1.10)
Retaining study participants	2 (0.71)
Obtaining lab samples from study participants	2 (0.71)
Quality of lab samples obtained for analyses	1.25 (0.43)
Complexity of performing lab tests	1.75 (0.43)
Obtaining surveys from study participants	1.75 (0.43)
Unanticipated adverse events within research projects	1.6 (0.80)

\*Rated on a scale of 1 = not at all, 4 = to a great extent; all other items asked on a scale of 1 (strongly disagree) to 7 (strongly agree).

The data integration core works across projects to integrate data about AL and develop novel tools to identify multilevel determinants of minority health that are

relevant to precision medicine. Specific outcomes have included the standardization of variables and data dictionaries, chart review to examine sociodemographic

**Table 3. TCC Accomplishments Based on Core Components.**

Center component	Rationale for component	Activities	Outcomes
Administrative Core (evaluation)	Ensures the success of TCC goals and strategies by managing, coordinating, and supervising the range of proposed activities to ensure that they are completed in a timely manner	<ul style="list-style-type: none"> <li>Hosted State of Science in Prostate Cancer Meeting</li> <li>Established and implemented social media communication strategies</li> <li>Evaluation activities for all cores</li> <li>Mentorship and training</li> </ul>	<ul style="list-style-type: none"> <li>State of Science on Prostate Cancer Meeting held on November 16, 2018</li> <li>The TCC has established a Facebook social media page and website</li> <li>Funded three pilot research projects</li> </ul>
Implementation Core	Sharing findings with the community and facilitation of best practices to ensure equitable access among all groups	<ul style="list-style-type: none"> <li>Implementation of precision medicine study in primary care to identify ethical, legal, and social issues associated with precision medicine and examine stress responses in primary care sample</li> <li>Environmental scan of organizational capacity and readiness for precision medicine</li> <li>CME for precision medicine</li> </ul>	<ul style="list-style-type: none"> <li>n = 129 male primary care patients enrolled in precision medicine study to date</li> <li>n = 36 primary care patients completed laboratory stress test thus far</li> <li>Establishing curriculum for CME in precision medicine</li> </ul>
Data Integration Core	Creating new knowledge about AL by integrating data from projects within the TCC	<ul style="list-style-type: none"> <li>Standardization of variables and development of data dictionaries</li> <li>Developed NLP systems</li> <li>Examination of recruitment outcomes using EHR</li> </ul>	<ul style="list-style-type: none"> <li>K12 obtained to identify and predict opioid use disorder using health information technology</li> <li>The NLP pipeline development work was completed for three domains of social determinants—stress, depression/anxiety, and alcohol use.</li> <li>Completed analysis of participation in an EHR-based recruitment registry at the MUSC health system.</li> </ul>
Consortium Core	Use of CBPR approaches to integrate and organize precision medicine research with health disparities across regions in the United States	<ul style="list-style-type: none"> <li>Developed and implemented a regional community-based dissemination strategy for precision medicine</li> </ul>	<ul style="list-style-type: none"> <li>Developed Regional Implementation Teams to facilitate implementation of minority men health workshops across the four consortium regions</li> <li>Implemented community workshops to address minority men's health issues</li> </ul>
Research Project 1: sociobiological responses to stress in prostate cancer survivors	Investigate the role of stress reactivity mechanism in the development of immune responses to prostate cancer examining patients who are participating in a prostate vaccine trial.	<ul style="list-style-type: none"> <li>Recruitment of subjects to the prostate cancer vaccine trial</li> <li>Genotyping of immunoglobulin polymorphisms</li> <li>Genotyping of polymorphisms for glucocorticoid receptor gene</li> </ul>	<ul style="list-style-type: none"> <li>Completed enrollment for prostate cancer vaccine trial (n = 33)</li> <li>Administered Social Determinants Survey to clinical trial participants</li> <li>Completed enrollment for laboratory-based Trier Social Stress Test (n = 12) among men enrolled in the vaccine trial</li> </ul>
Research Project 2: defining an integrated AL index with immune and tumor microenvironment factors	To examine molecular mechanisms involved in the initiation and progression of prostate cancer by evaluating the tumor microenvironment interactions between the immune system, the tumor glycome, social determinants, and allostatic load.	<ul style="list-style-type: none"> <li>Determination of Forssman antibody levels</li> <li>Link tissue samples and social determinants data to support translational research in biomarkers</li> </ul>	<ul style="list-style-type: none"> <li>Tissues and biofluids analyzed for N-glycan tissue imaging</li> <li>Three additional grant proposals submitted (U01, R21, and R01)</li> <li>Developed system to identify prostate cancer patients using tumor registry and biorepository</li> </ul>
Research Project 3: integrating genomics and sociobiological data to inform the development of prostate cancer treatment	Examine the effects of Vitamin D supplementation on molecular changes in prostate tissue to inform the development of treatment recommendations for men who have early stage disease.	<ul style="list-style-type: none"> <li>Recruitment of subjects from prostate biopsy clinic in Veteran's Administration Medical Center</li> <li>RNA sequencing analysis</li> <li>Bioinformatics</li> <li>Prospective assessment of biomarkers to determine AL</li> </ul>	<ul style="list-style-type: none"> <li>Established retrospective cohort of prostate cancer patients</li> <li>Administering Social Determinants Survey to a retrospective cohort of patients (n = 128)</li> <li>Linking plasma and tissue samples from biorepository with social determinants data to examine associations between inflammatory tissue and disease progression, in addition to glycan changes associated with a tumor, tumor stroma, and nontumor regions of tissue.</li> <li>Completed analysis of prostate transcriptome using RNA analysis</li> <li>Initiated Vitamin D supplementation study</li> <li>Administration of Social Determinants Survey</li> <li>124 patients have been enrolled in Phase 1 and 121 in Phase 2</li> </ul>

AL = allostatic load; CME = continuing medical education; EHR = electronic health record; NLP = Natural Language Processing; RNA = ribonucleic acid; TCC = Transdisciplinary Collaborative Center.

factors associated with participation in EHR recruitment registry, and completion of six peer-reviewed articles. The consortium core uses CBPR approaches to integrate precision medicine research with health disparities across regions in the United States. The consortium developed and implemented a regional community-based dissemination strategy and Regional Implementation Teams to facilitate minority men's health workshops within each region.

The TCC also includes three research projects that have made significant progress. Project 1 focuses on understanding sociobiological responses to stress in prostate cancer survivors who are at increased risk for prostate cancer recurrence. Specifically, the project is tasked with investigating the role of stress reactivity mechanisms in the development of immune responses to prostate cancer among patients who are enrolled in a prostate cancer vaccine clinical trial. Project 1 completed subject accrual to the PROSTVAC trial and developed the assays that are needed to measure the primary clinical outcomes for the trial. Project 2 is examining the association of tissue and serum immune and inflammatory signature with disease progression in African American and white men and evaluating the association between social determinants and prostate cancer biomarkers and immune functioning in these patients. Project 2 is also identifying N-glycan panels indicative of stroma, tumor, and immune infiltrate regions associated with African American and white patients. Project 2 has developed novel strategies for identifying N-glycan panels that are indicative of stroma, tumor, and immune infiltrate regions associated with prostate cancer in African American and white patients. This work specifically focused on characterizing the extracellular matrix because collagen is the main constituent of reactive stroma with a realignment of collagen fibers and altered transcription of fibrillar collagens occurring systematically throughout PCa progression. In this analysis, study investigators quantitatively measured collagen type and distribution across pathology graded radical prostatectomies using novel methods of imaging mass spectrometry paired with chromatographic proteomic sequencing strategies. As part of examining the effects of Vitamin D supplementation among African and white Veterans undergoing prostate biopsy, Project 3 examined the nature and distribution of financial toxicity and financial strain among Veterans. This work is important because it demonstrates that even in an equal access health-care system, minority men are more likely than white men to experience financial strain. Lastly, evaluation indicators for the overall MUSC TCC include publications, presentations, grant applications, and workforce development. These indicators are tracked, monitored, and reported to program officials to ensure that sufficient progress is

being made with respect to our overall productivity and impact.

## Practical Lessons Learned

The goal of this article was to provide an overview and descriptive evaluation of the MUSC TCC. This unique transdisciplinary consortium focuses on improving research and access to precision medicine among men from racial minority groups. While the MUSC TCC has seen a great deal of success since its development in 2015, there are a variety of key lessons learned to help improve future efforts in this area. Lessons align with the three primary aims of the study and include the need for more time to build community-based partnerships, ongoing efforts are needed to improve recruitment and retention across diverse patient populations, and better approaches are needed to disseminate and communicate information internally and externally with large consortiums and networks that are distributed across multiple regions and communities.

One of the key components of the TCC was the broad consortium of networks and community-based partnerships. Our evaluation suggests that partners understood the mission and purpose of the TCC and this led to efficiencies in terms of developing strategic priorities, developing and implementing new initiatives, and facilitating effective communications. While the overall partnerships in the TCC were strong, the most common challenge cited was the need for additional resources or time based on a multitude of competing priorities and responsibilities that exist outside of the grant. Given the nature of the consortium (national and diverse) and the multitude of other competing demands cited by each partner, this was a particularly difficult challenge to overcome. Community partners involved in Regional Implementation Teams (RIT) could be more engaged in TCC core activities. While processes have been implemented to meet with the RIT consistently, participation has varied because of competing priorities among members. Community-academic partnerships are critical to advancing research and, based on our experience, appear to be especially important to establish when considering precision medicine research initiatives. In addition to the efforts undertaken during this initiative, other researchers working to address health disparities using CBPR approaches have found success in creating specific guiding principles that are agreed upon by both the academic institution and community partners (Chau et al., 2007). These, along with specific sustaining action steps, an explicit link to how these strategies are relevant to multiple partners, and the administrative infrastructure among both academic and community organizations to support these actions, could support continued community engagement.



Second, all research programs involved in the consortium cited recruitment and retention as a concern. This may have stemmed, in part, from the need for better communication and consistent community-based engagement previously discussed. The TCC does not limit community engagement to recruitment and retention efforts, but greater involvement of all partners in the development and implementation of strategies may have improved the efficiency and effectiveness of recruitment and retention strategies. A previous study showed that personal factors such as high stress level and obesity were associated with lack of retention of African Americans who were recruited into a study that utilized the CBPR (Babatunde et al., 2017). The Family Relations model, developed by McCurdy and Daro describe how a combination of individual, provider, program, and community factors impact all aspects of research, with a specific focus on how these factors influence precision medicine and precision public health efforts (Supplee et al., 2018). According to this model, incorporating rapid-cycle methods could help improve engagement and retention. Rapid-cycle methods employ consistent quality improvement techniques to monitor recruitment and retention and make course corrections in real time, as needed (Spoth et al., 2013).

Finally, dissemination and implementation is a critical aspect of the TCC. While we were successful in the dissemination of key information, given the fast-paced nature of discovery, communicating information about precision medicine can be especially challenging. Initially, our approach focused on using an evidence academy model as the primary method for disseminating information because it emphasizes integrating research, practice, and policy (Rohweder et al., 2016). Alternative models for dissemination and implementation may have been better suited to promote the communication of evidence-based practices for precision medicine to potential users or specific target audiences. In contrast to other types of preventive efforts (e.g., prostate cancer screening), evidence about precision medicine is emerging and clinical strategies based on this approach are being developed. In recognition of this and limited exposure to information about precision medicine reported by community partners and study participants, we modified our dissemination strategies to focus more on improving knowledge and awareness about precision medicine among community residents. Specifically, we now use a community-based information workshop format to disseminate information about precision medicine and multilevel determinants that are relevant to these approaches (e.g., stress responses) to community residents. This approach is better aligned with our efforts to promote action and understanding among community residents to better prepare them to make more informed decisions about precision medicine in anticipation of the more

widespread availability and adoption of these strategies in clinical and public health strategies. Additionally, we now place greater emphasis on disseminating information about best practices for obtaining and documenting social determinants of health among health-care providers, rather than disseminating a specific evidence-based practice to members of the health-care community. This decision was made in light of the emerging evidence about precision medicine and findings generated by our data integration core, which demonstrate limited documentation of social determinants of health (e.g., social isolation and financial strain) in electronic health records (Zhu et al., 2019). National organizations now endorse the documentation of social determinants of health in clinical and public health settings. Understanding the contribution of social factors to disease risk and outcomes is also one component of precision medicine initiatives. Efforts in the TCC now have a greater focus on enhancing the capacity of health-care providers to obtain and document these variables using evidence-based methods. Social determinants of health is one module in the CME course that is being developed by the implementation and consortium cores; additional funding has been obtained by TCC investigators to implement the natural language processing tools developed by the data integration core into primary care practice.

## Conclusions

Leaders in the field of precision medicine have often cited concern about ways that precision medicine may unintentionally increase disparities in health outcomes. The TCC set out to address this concern by focusing on improving precision medicine understanding, research, and dissemination among racial minority groups. Many opportunities exist to continue enhancing strategies for engaging racial minority groups, with key tenants continuing to be building transdisciplinary partnerships, providing sufficient resources and time to develop and maintain relationships with academic and community partners, and considering the ways we communicate and disseminate information both during and after the project. Conducting precision medicine research using community-academic partnerships has unique challenges; however, we can continue building on best practices and lessons learned from research efforts working in community-engaged research, public health, and precision medicine.

## Author's contributions

This commentary describes the process of developing a unique regional consortium focused on minority men's health. We identified opportunities to improve implementation, including insuring enough time for community engagement and identifying unique ways to engage partners.

Lessons learned from the implementation of the TCC can help improve efforts to establish large research consortiums.

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### Consent for publication

All authors have agreed to submission and consent to publish.

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