COBRE Center for Stress, Trauma, and Resilience (STAR COBRE): A Regional and National Hub for Transformative Research to Elucidate and Mitigate the Lasting Imprint of Early Stress and Trauma

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ABSTRACT

Early adversity is a major contributor to psychiatric conditions and poor physical health that burden individuals and groups across Rhode Island, the United States, and globally. We established a Center of Biomedical Research Excellence (COBRE) for Stress, Trauma, and Resilience (STAR) at The Miriam Hospital to identify mechanisms linking early adversity and health, to curtail detrimental consequences of stress and trauma, and promote resilience. The STAR COBRE is a vibrant regional and national hub for transformative research to elucidate and mitigate the lasting imprint of stress and trauma across the lifespan. We have a focus on reducing health inequities among historically marginalized families including those living in poverty and from underrepresented racial and ethnic communities. A cornerstone of the STAR COBRE is fostering an inclusive community to support the advancement of a diverse group of early career researchers to emerge as leading independent investigators conducting cutting-edge STAR research.

KEYWORDS: Stress, Trauma, Resilience, Adverse Childhood Experiences

INTRODUCTION

Early life stress and trauma are common and their impact profound and persistent. Perinatal exposure to adversity, including mental health symptoms and substance use are some of the earliest forms of stress and trauma. Perinatal depression affects up to 32.5% of pregnant people;[1] rates of prenatal substance use can range from 13.5%[2] to 23%.[3] In childhood, at least 600,000 children in the United States (U.S.) are victims of abuse and/or neglect each year,[4,5] and some estimates suggest that two-thirds of U.S. children will experience one or more significant adverse childhood experiences (ACEs) by the time they reach adulthood.[6] Rates are even higher in children living in poverty and among ethnoracially marginalized communities.[7,8] Children who experience ACEs are at higher risk for psychiatric disorders[5,9-11] and a wide range of physical health conditions (e.g., obesity, sleep disruption, cardiovascular disease).[12,13] Adults reporting six or more ACEs die almost 20 years earlier than those without major childhood adversity.[14] Reducing ACEs would be associated with a 24–44% reduction in depression, chronic obstructive pulmonary disease, and substance use in the U.S.[15] Based on the strength and consistency of these associations, there is a need to discover novel and actionable prevention and intervention targets to improve health and well-being.

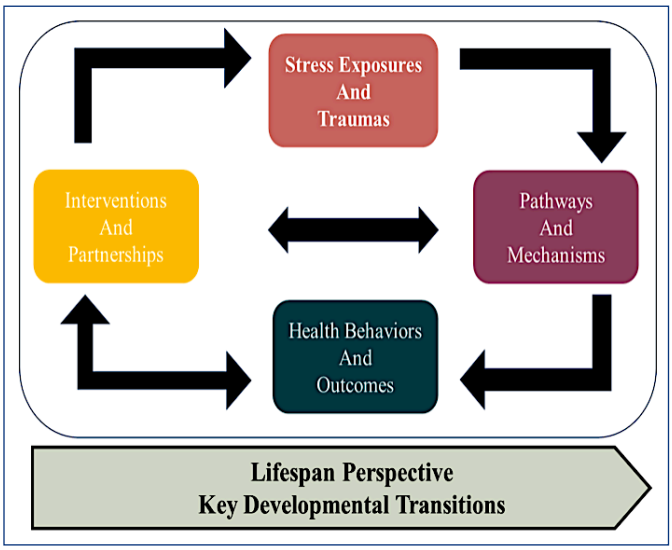
On a local level, nearly one in six children live in poverty in Rhode Island (RI), with evidence of concentrated disadvantage in the state's urban core.[16] Furthermore, RI has high rates of several stress adversity indictors.[17] Specifically, only 35.5% of families have access to neighborhood amenities[18] (e.g., a park, recreation center, library), 29% of households experience food insecurity,[19] 21.2% of mothers report mental distress,[20] and 10.1% of youth engage in illicit drug use.[21] Moreover, 11.6 % of children experience two or more ACEs such as parental divorce or separation, neighborhood violence, parent incarceration.[22] Building a center of excellence will allow us to better understand and mitigate the impact of stress and trauma, and elucidate pathways to resilience across Rhode Island.

There is limited understanding of the mechanisms of risk and resilience related to early adversity. Existing studies linking early adversity to poor health often cannot address specific mechanisms because there is insufficient focus on (1) **the complexity of childhood experiences**; most studies include a single measure of adversity without including a multi-method approach that includes contextual and extra-familial adversities, (2) **assessment of proximal current adverse experiences**, and (3) **key behavioral and biological mechanisms** tied to health and disease. The Center for Biomedical Research Excellence (COBRE) for Stress, Trauma and Resilience (STAR) was designed to accelerate the career development of the next generation of researchers who are equipped to investigate stress, trauma, and resilience in vulnerable populations across development, and to utilize innovative approaches and designs to disentangle the multiple, inter-related mechanisms of risk and resilience needed to develop effective interventions.

STAR COBRE AIMS

The STAR COBRE based at The Miriam Hospital was launched in 2021 through specialized funding from the National Institute of General Medical Sciences (NIGMS; Grant #P20GM139767). The NIGMS COBRE program supports

Figure 1. STAR COBRE Conceptual Framework



the establishment and development of innovative, state-of-the-art behavioral and biomedical research centers at institutions in IDeA-eligible states through awards for three sequential five-year phases.[23] The STAR COBRE is currently in the third year of Phase 1. We are guided by a conceptual framework that is aimed at catalyzing innovative research to improve the health and well-being of individuals exposed to stress, trauma and adversity. As shown in **Figure 1**, catalyzing STAR research requires integration of innovative approaches to clinical and translational research focused on: (1) rigorous measures of stress exposures and traumas, (2) mechanisms of risk and resilience that will lead to novel and actionable intervention targets, and (3) health behaviors and outcomes. Our research takes a lifespan perspective focusing on key developmental transitions such as pregnancy, childhood, adolescence, and young/middle/late adulthood. The STAR COBRE is also guided by three overarching aims. Aim 1 is to establish a thematic, transformative, multidisciplinary center that will serve as a hub for faculty development, transformative research and innovation. Our second aim is to accelerate the development of a diverse group of highly promising early career researchers to emerge as leading, independently-funded investigators. This includes major research projects, research scientist recruits, and a pilot project program. Our third aim is to establish scientific cores necessary to support faculty projects and to support, sustain, and refine the STAR COBRE (1) Administrative Core (strategic planning, faculty mentoring, pilot projects, evaluation, budgeting), (2) Technology, Assessment, Data, & Analysis (TADA) Core (cutting edge technology-based *in vivo* and laboratory-based assessments, measures/methods, data management, statistics), and (3) Community Collaborative (CC) Core (enhancing impact at the state and local level by developing relationships with community collaborators). Woven through these aims is our goal of creating a vibrant STAR community with values of inclusion, collaboration, and support for researchers as whole people ("*Nurturing resilience through innovation and community*"). The STAR COBRE is the only research center in RI focused on stress, trauma, and resilience. Our long-term goal is to serve as a regional and national hub for research innovation and community, and to develop a critical mass of diverse investigators conducting transformative research to elucidate and mitigate the lasting imprint of childhood stress and trauma on health across the lifespan.

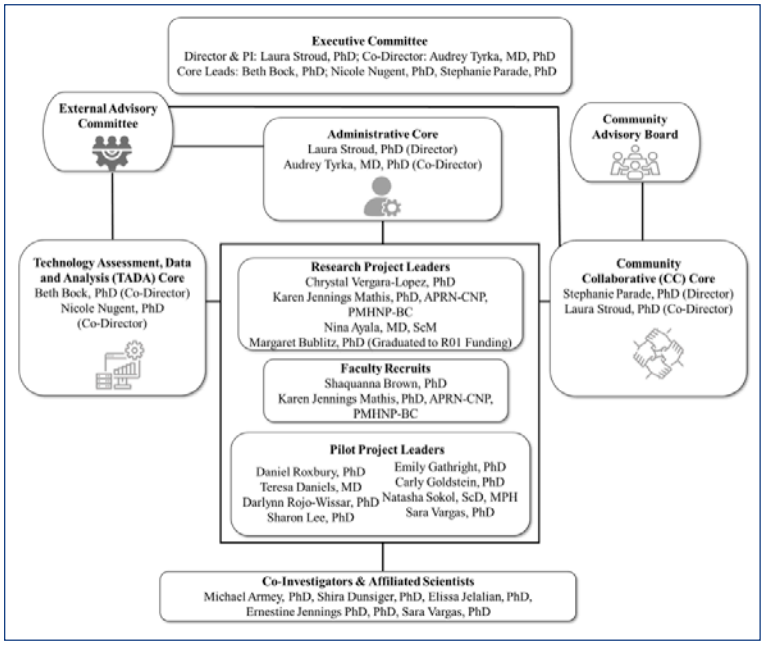
LEADERSHIP AND STRUCTURE

Integrated Leadership

The STAR COBRE is directed by Dr. Laura Stroud, PhD, Principal Investigator (PI), and Dr. Audrey Tyrka, MD, PhD, Co-Director. Together, Drs. Stroud and Tyrka have over 40 years of internationally recognized experience in conducting STAR research across the life course. Dr. Stroud offers expertise in the intergenerational transmission of stress and trauma from pregnancy to infancy, and the adolescent/pubertal transition, as well as biobehavioral markers/mechanisms of risk and resilience. Dr. Tyrka provides expertise in studies of childhood stress, trauma, and resilience in children and adults, and cellular and molecular markers/mechanisms. The Executive Committee includes additional international experts in STAR-related research, innovative methodologies, and mentorship. Dr. Beth Bock, PhD (Co-Director, TADA Core) offers over 20 years of experience in the development and implementation of technology-delivered assessments and interventions including novel mHealth interventions for health behavior change. Dr. Nicole Nugent, PhD (Co-Director, TADA Core), provides years of experience in studies of traumatic stress, and is an elected member of the Board of Directors for the International Society of Traumatic Stress Studies (ISTSS). Dr. Nugent provides expertise in innovative novel technological methods for experience sampling and laboratory tasks, and genomics and advanced statistical modeling including intensive data sampling and "big data". Finally, Dr. Stephanie Parade, PhD (Co-Director, CC Core) is an internationally recognized expert in child development in the context of risk, with an emphasis on the consequences of maltreatment and ACEs across the lifespan. Dr. Parade's work is directly embedded in the community and conducted in collaboration with state and community agencies in RI.

Members of the STAR COBRE executive committee developed a close collaboration through building the STAR Initiative within the Department of Psychiatry and Human Behavior at Brown starting in 2019. They then applied for and received funding for a T32 postdoctoral research fellowship program (Grant # NICHD T32 HD101392) focused on childhood stress, trauma, and resilience in 2020, followed by the COBRE center grant submission funded 2021. The STAR T32 research fellowship serves as a pathway for new

Figure 2. STAR COBRE Organizational Structure



faculty for the COBRE and there are many opportunities for interactions between STAR COBRE investigators and the STAR T32 fellows.

Organizational Structure

As shown in **Figure 2**, the STAR COBRE includes five integrated components centered around support for Research Project Leads (RPLs), STAR Research Scientist Recruits, and Pilot Project Leads (PPLs) by an Administrative Core, two scientific cores: the TADA Core and the CC Core, an External Advisory Committee (EAC), and a Community Advisory Board. Together the cores and advisory groups aid the STAR COBRE in developing and implementing innovative approaches to STAR research. The EAC includes three internationally recognized experts in STAR research who have provided guidance, expertise and support for the STAR COBRE leadership, RPLs, and PPLs. Building on Executive Committee members' collaborations with state government and community agencies, we created a unique Community Advisory Board (CAB) that meets twice annually to provide guidance regarding local government and community priorities, and feedback regarding projects.

The Cores, EAC, and CAB work together to provide integrated support and mentoring for STAR early career researchers. Research conducted as part of the STAR COBRE includes large projects conducted by early-career RPLs, research scientist recruits, and a pilot project program which funds smaller scale projects. RPLs receive mentorship from leading NIH-funded scientists to accelerate their transition to independent funding. Research Scientist recruits participate in all of the programming designed for RPLs. The pilot program recruits early career investigators and those new to STAR research to obtain preliminary data for independent and mentored grant applications. Pilot awardees have the opportunity to later become RPLs when opportunities arise.

To date, our STAR COBRE has supported 22 investigators. As shown in **Table 1**, there have been 4 RPLs, one RPL who "graduated" to an R01 and now serves as a research

Table 1. Projects in the STAR COBRE

Projects	Title	Principal Investigator
Research Project	Mindfulness, Optimism and Resilience for Perinatal Health and Equity (MORPHE) Trial	Nina Ayala, MD, ScM
Research Project	Maternal history of childhood sexual abuse and adverse perinatal outcomes: Harnessing novel ecological methods to understand mechanisms	Margaret Bublitz, PhD
Research Project	Perceived Discrimination, Intersection of Identities, and Health Risk Behaviors in Black Adolescents	Karen Jennings Mathis, PhD, APRN-CNP, PMHNP-BC
Research Project	Childhood Maltreatment, Repetitive Negative Thinking, and Mental Health in Adolescence: A 12-Year Longitudinal Study	Chrystal Vergara-Lopez, PhD
Pilot Project	Associations of accelerated cellular age and infant mental health	Teresa Daniels, MD
Pilot Project	Building Resilience to Increase Cardiac Rehabilitation Initiation: A Multiphase Optimization Strategy Pilot Factorial Preparation Phase Study	Carly Goldstein, PhD
Pilot Project	An Implementation Science-Informed Systematic Review and Meta-analysis of Stress Management in Cardiac Rehabilitation	Emily Gathright, PhD, FAACVPR
Pilot Project	Early Life Stress and Blood Pressure Trajectories in Black and White Perinatal Women	Sharon Lee, PhD
Pilot Project	Parent-child relationship quality in adolescence and sleep and health in adulthood: associations among individuals who were in foster care	Darlynn Rojo-Wissar, PhD, MPH
Pilot Project	Wearable smart textiles for non-invasive detection of the stress biomarker cortisol	Daniel Roxbury, PhD
Pilot Project	Parenting & Obstetric Experiences: A Qualitative Study	Natasha Sokol, ScD, MPH
Pilot Project	Assessment of sexual trauma, health, & functioning histories in routine clinical care	Sara Vargas, PhD

mentor, two research scientist recruits, and 8 PPLs, with multiple additional pilot projects under development. STAR COBRE investigators have published 50 publications and delivered numerous presentations. There have been several collaborative publications including one led by Co-Director Dr. Parade, titled "Community-Engaged Research: Bringing the Science of Developmental Psychopathology into the Real World"[24] published in *Development & Psychopathology*, as well as another led by Pilot Project Lead Dr. Lee, titled "How can we build structural resilience? Integration of Social-Ecological and Minority Stress Models" published in *American Psychologist*. Numerous grant applications have already been submitted (n=54) and funded (n=34). Additionally, the STAR COBRE hosts an Annual Research Symposium that showcases the contributions of our cores, research projects and pilot initiatives. The STAR COBRE has also proudly co-sponsored several events including The Annual Global Consortium for Prevention of Depression, The Sojourner House *SOJO MoJoe Breakfast*, where Dr. Tyrka received the "2024 Community Champion Award" and The Center for Advanced Practice at Adoption RI, where Dr. Parade received the "Children First and Always Award." We have further enhanced accessibility by establishing our own website (https://starcobre.org/) and presence on social media platforms (X @STAR_BrownDPHB).

Administrative Core

The Administrative Core (AC), co-directed by Drs. Stroud and Tyrka serves as the "engine" for the STAR COBRE, providing scientific leadership, administrative support, and career development activities to ensure the success of RPLs, Research Scientists, and PPLs. In addition, this core fosters the broad development of STAR expertise and resources and importantly, a supportive STAR community with values of inclusivity and holistic support for individual well-being. The AC oversees all functions of the COBRE, including budgets, financial and program reports, and compliance with all federal regulations of NIGMS. This core supervises the dissemination of COBRE activities, projects and cores, educational offerings, and accomplishments to academic and community partners. Drs. Stroud and Tyrka are responsible for recruiting and supporting STAR faculty, RPLs, and PPLs. Moreover, the AC has a state-of-the-art Mentoring and Educational Program which includes individual mentoring for RPLs as well as both didactic and hands-on seminars/workshops such as a R01 grant writing seminar. The AC also hosts an academic year-long Research Lecture Series featuring local, national, and international investigators across all levels of a professional trajectory. The Research Lecture Series immerses participants in transformative research and cutting-edge methodologies for understanding the impact of stress and trauma and pathways to resilience across the lifespan. The STAR COBRE has also fostered collaboration, including partnering with five Lifespan COBREs to organize the "*Resources to Impact your Research*" workshops, participating in and sponsoring the RI IDeA symposium. Lastly, we have introduced arts-based programing workshops including a "*Mastermind Failure Club,*" a live reading of an excerpt from *"Invoices for Emotional Labor"* and discussion led by Poet Christopher Johnson, and a Storytelling workshop.

The AC is responsible for coordinating and supporting the EAC who meet with the STAR COBRE leadership, RPLs, Research Scientists, and PPLs during annual symposia and retreats and with the leadership group bi-annually. The EAC offers external mentorship and also plays a critical role in approving and evaluating RPL and PPL projects. The AC, in conjunction with the EAC, supports the operational efficacy of the COBRE in advancing STAR research.

Technology, Assessment, Data and Analysis (TADA) Core

The TADA Core, co-directed by Drs. Beth Bock and Nicole Nugent, assists STAR investigators with innovative, integrated, and ecologically valid methodological approaches to the study of stress, trauma, and resilience. This is achieved by providing expertise related to research design, technology, and various other methodological approaches, while also providing data management resources and analytical support for STAR investigators. Additionally, to address the rapid progression of technological innovations, the TADA Core organizes, and hosts a series of seminars focused on innovative methods and technologies (e.g., an EMA series, wearables panel). The TADA Core houses sophisticated equipment (e.g., eye tracking machine/computer) and software (e.g., to conduct ecological momentary assessments). The TADA Core has also developed an assessment battery to be used across STAR projects, permitting a strategy for investigators to deploy validated and impactful common measures of stress and trauma across study populations and designs. TADA Core faculty and staff are available to provide REDCap assistance and support for qualitative methods, geographic information services, and a spectrum of ambulatory technologies.

Community Collaborative Core (CC) Core

The CC Core, co-directed by Drs. Parade and Stroud, is designed to enhance the impact of the STAR COBRE at state and local levels through relationships with community collaborators. The CC Core provides expertise, resources, and consultation to STAR Investigators regarding the development and sustainability of collaborations with state and local non-profit agencies. Additionally, the core supports STAR investigators in recruiting and retaining children and adults with stress and trauma histories from historically underserved populations and provides expertise on the ethical conduct of research. The CC Core also aims to enhance STAR investigators' competence in issues of diversity, equity, inclusion, and belongingness and in working with historically marginalized populations through trainings that focus on self-reflection and intersectionality. The CC Core also works closely with the STAR COBRE's Community Advisory Board.

CONCLUSIONS

In conclusion, the establishment and progression of the STAR COBRE is an important step towards addressing the challenges associated with childhood adversity. The center provides unique infrastructure in RI to advance research, cultivate resilience, and contribute valuable insights to the field. As the center continues to evolve, we are poised to emerge as a leading force in transformative research designed to understand and mitigate the impact of stress and trauma, and to foster healthier and more resilient communities.

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