

**The goal of the Rheumatic and Musculoskeletal Disease (RMD) Epidemiology and Outcomes Training Program at the University of North Carolina is to provide state-of-the-art resources and a rich environment to train independent researchers who will improve our understanding of the magnitude, etiology, impact, and treatment of RMDs, and who will assume leadership roles in RMD epidemiology and outcomes research.**

Training Advisory Committee (TAC). The TAC will evaluate trainees and programs biannually and will formally meet with trainees biannually. The TAC members include Drs. Callahan and Nelson (co-Program Directors [PDs]), along with Dr. Kelli Allen (Rheumatology, Allergy and Immunology [RAI] Division and VA affiliation), Dr. Yvonne Golightly (PT, Epidemiology), Dr. Beth Jonas (RAI Chief and master educator), Dr. Todd Schwartz (School of Public Health [SPH]-Biostatistics and School of Nursing), and Dr. Jennifer Lund (SPH-Epidemiology). The main Preceptors for this proposal include co-PDs, TAC members (above) and an additional eight experienced investigators (Batsis, Kosorok, Leeman, Loeser, Marron, Pietrosimone, Soto, Thoma) with independent research who are committed to training pre- and postdoctoral fellows.

**Table A. Core Competency Areas of Expertise for the Primary Preceptors**

	Amanda Nelson	Leigh Callahan	Todd Schwartz	Kelli Allen	Yvonne Golightly	Beth Jonas	Jennifer Lund	John Batsis	Michael Kosorok	Jennifer Leeman	Richard Loeser	J.S. Marron	Brian Pietrosimone	Sandra Soto	Louise Thoma
Epidemiology Methods	X	X	X	X	X	X	X	X	X	X			X	X	
Clinical Trials Methods	X	X	X	X	X	X	X	X	X	X		X	X		
Statistical Methods	X	X	X	X			X	X			X				
Data and Computational Methods	X	X	X				X	X		X	X	X			
Rigor and Reproducibility	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Study Recruitment Methods	X	X		X	X		X		X	X		X	X		
RMD Clinical Aspects	X	X	X	X	X	X	X			X		X	X	X	
RMD Treatment Guidelines	X	X		X	X	X					X				X
RMD Outcome Measures	X	X	X	X	X		X			X					
Health Services Research		X		X	X		X		X				X		
Behavioral Intervention Research		X	X	X	X		X		X	X		X	X		
Genetics / 'Omics	X							X		X	X				
Biochemical Biomarkers	X									X		X			
Biomechanics					X					X		X			X
Imaging and Analysis	X							X		X	X	X			
Education and Training	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stakeholder Engagement	X	X		X	X	X	X		X				X	X	

Proposed training. Our program is designed to provide a diverse set of trainees with methodologic, clinical content area and professional competencies that will allow them to advance to the next level in their career trajectory and make major impacts in RMD epidemiology and outcomes research. Core Competencies will be included in all training plans, along

with resources available to help trainees to achieve these competencies. All trainees will receive instruction on data science principles relevant to career stage and interest. Principles of data sharing, data security, and data privacy are paramount to clinical and human subjects research and will be addressed as such in the training plan for all trainees. Similarly, scientific communication is a core competency for all individuals working toward a career in the biomedical workforce. All trainees will receive training in oral and written presentations, including manuscript and grant writing, commensurate with their level. Rigor and reproducibility principles will be reinforced throughout training.

Peer Cohort. The T32 trainees will interact with each other as part of a peer cohort. This will enhance the inter-professional aspect of the program, as RMD research does not reside in any one specialty, but rather across numerous areas. The full cohort will present to each other in conjunction with the Stakeholder Advisory Board at least twice per year (research-in-progress), with additional meetings to discuss proposals, abstracts, papers, etc. Individual Development Plans: at the time of program initiation, mentor teams will work with trainees to develop and update their IDP.

UNC Core Center for Clinical Research (CCCR). The CCCR will be an important resource to trainees, particularly through the Methodology Core that provides a comprehensive and integrated set of RMD-focused services to optimize the quality, efficiency and innovation of the CCCR research community, and the Phenotyping and Precision Medicine Resource Core that helps to optimize the design and implementation of clinical studies.

Additional Training Opportunities. Depending on trainees' interests and backgrounds, in alignment with our personalized approach, the Training Advisory Committee, along with each T32 trainee's mentors, will work to identify resources most relevant to each trainee's work (all will not be relevant to all trainees, and some may require resources not listed here). TARC and UNC (see Facilities and Resources) provide a wealth of opportunities for trainees to gain additional skills that will allow them to achieve their career goals. Examples of topics for further training that we believe will be of high interest to our trainees include but are not limited to:

- Artificial intelligence/machine learning methods
- Bioinformatics
- Real-world data (e.g., Medicare, Medicaid, claims data)
- Qualitative research
- Quality improvement
- Implementation science
- Biomechanics
- Health equity
- Mentor training

### Research Experiences

A core aspect of our T32 training program will be “hands on” research experience. Our mentors have rich ongoing research programs that will allow trainees to gain skills in conducting robust, innovative RMD science and provide opportunities to lead and contribute to academic products. Identification of a research project will begin during each potential trainee’s application phase, and a detailed plan will be developed by the trainee and mentor team at the beginning of the T32 period. The research plan will include:

- Specific research questions and hypotheses
- Data sources and analysis plans
- Research team (which may include individuals beyond the mentor team)
- Timeline and milestones
- Professional development including grant writing, pilot grants, writing groups as appropriate
- Products (including conference abstract submissions and manuscripts)

It is expected that the trainee will assume primary responsibility for leading a main research project during the T32 period, as this type of leadership is an important competency.

**Table B. Core Competencies and Examples of Available Resources**

Core Competencies by Category	Training Opportunities & Resources
<i>Responsible Conduct of Research</i>	<i>Provide essential background and skills for future careers</i>
Human Subjects Protections	TraCS Orientation for New Clinical Research Personnel UNC Network for Research Professionals Webinars CITI Training including regular renewal Coursework (e.g., GRAD 705, 721)
Data management & security	UNC Network for Research Professionals Webinars, IT resources
<i>Research Methods</i>	<i>Personalized based on background and goals</i>
Clinical Trial Design	TARC Rheumatology 101 series Coursework (e.g., EPID 733 Clinical Trials in Epidemiology, EPID 790 Intervention Epidemiology)
Epidemiologic Study Design	TARC Rheumatology 101 series Coursework (e.g., EPID 710 Fundamentals of Epidemiology)
Statistics, Data, and Computational Science	TraCS Biostatistics Seminar Series CCCR ABC Sessions & individual mentoring Coursework (e.g., BIOS 600 Statistical Inference, EPID 766 on healthcare databases for research) Odum Institute Short Courses (Structural Equation Modeling, Bayesian statistics, survey research, programming courses) University Library programming courses (R, Python) ITS Research Computing
Stakeholder Engagement in Research	Participation with TARC SAB TraCS Stakeholder Engagement: Consultations & Online Training
Rigor and Reproducibility	TraCS Professional Development Series CCCR Speaker series session NIH Online Modules Hands-on Research Experience
IRB and Regulatory Processes	UNC Network for Research Professionals Webinars TraCS Online Training Modules
<i>Clinical Aspects of RMDs</i>	<i>Clinical interactions are key for developing even non-clinical researchers</i>
	TARC Rheumatology 101 series Clinical Shadowing (Rheum, PT, Geriatrics, etc.) Rheumatology Grand Rounds and other conferences ACR online courses
<i>Professional Development</i>	<i>Crucial for success of independent RMD researchers</i>
Grant writing	Internal (TraCS) and External Grant Writing Seminars and Workshops TraCS Professional Development Series CCCR ABC Sessions Coursework (e.g., AHSC 909, EPID 725/726)
Manuscript preparation & responding to reviews	CCCR ABC Sessions TraCS Professional Development Series Coursework (e.g., AHSC 914)
Manuscript reviewing	Co-reviewing with mentors (1+ manuscript/year)
Scientific communication	TARC Research Day CCCR ABC Sessions TraCS Professional Development Series Journal Clubs on topic areas of interest
Mentoring	CCCR ABC Sessions TraCS Professional Development Series Targeting Equity in Access to Mentoring (UNC Center for Faculty Excellence)
Integration of work and personal time, self-care	Mentorship team interactions TraCS Professional Development Series
Development of collaborative and leadership skills	CCCR ABC Sessions Graduate School Leadership Development Scholars
<i>Diversity, Equity &amp; Inclusion</i>	<i>Essential skills for all professionals</i>
	TARC DEI Core Meetings & Activities TraCS Inclusive Science Program Trainings SOM DEI trainings and DEI Certificate program Coursework (e.g., NURS 960, EPID seminars)