BIOGRAPHICAL SKETCH

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NAME: Sean Lorenzo Simpson

eRA COMMONS USER NAME (credential, e.g., agency login): simpson0298

POSITION TITLE: Associate Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Harvard University, Cambridge, MA	BA	2002	Applied Mathematics
University of North Carolina, Chapel Hill, NC	PhD	2008	Biostatistics

A. Personal Statement:

I am a faculty biostatistician in the Department of Biostatistical Sciences, with joint appointments in Biomedical Engineering and Neuroscience, and an Affiliate appointment with the Maya Angelou Center for Health Equity (MACHE) here at Wake Forest School of Medicine (WFSM). My main research focus has been on the development of novel fusions of multivariate statistical tools with network science methods for the analysis of whole-brain network data. Studying the brain as a whole and statistically accounting for the inherent complexity in the way various regions of the brain interact will engender a more biologically meaningful approach to understanding normal and abnormal brain function. My research focus is central to this grant as we will be fusing information theoretic and multivariate statistical methods to analyze brain networks. More specifically, my role will be to oversee the methodological development aspect of the project, and lead the methods development for aim 2 focused on furthering the development of and testing a mixed model framework as a methodology for modeling and drawing statistical inference from whole-brain networks.

> a. **Simpson SL**, Bowman FD, Laurienti PJ (2013). Analyzing Complex Functional Brain Networks: Fusing Statistics and Network Science to Understand the Brain. Statistics Surveys 7, 1-36. PMCID: PMC4189131
> b. **Simpson SL**, Laurienti PJ (2015). Disentangling Brain Graphs: A Note on the Conflation of Network and Connectivity Analyses. *Brain Connectivity*, In Press.
> c. **Simpson SL**, Burdette JH, Laurienti PJ (2015). The Brain Science Interface. *Significance (Magazine of the Royal Statistical Society)* 12(4), 34-39.
> d. Bowman FD, **Simpson SL**, Drake DF (2015). Joint fMRI and DTI Models for Brain Connectivity. In Handbook of Modern Statistical Methods: Neuroimaging Data Analysis. To Appear.

B. Positions and Honors.

Positions
1997	Mentorship, NASA, Hampton, VA
1998 - 2001	Internship, Virginia Power, Richmond, VA
2001 - 2002	Research Assistant, Malaria Research, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA

2003	Research Assistant, UNC-Chapel Hill Medical School, University of North Carolina, Chapel Hill, NC
2003	Research Assistant, Health Promotion and Disease Prevention Center, University of North Carolina, Chapel Hill, NC
2004 - 2006	Research Assistant, Power Analysis for Multivariate Models, UNC Department of Biostatistics, University of North Carolina, Chapel Hill, NC
2004 - 2007	Research Assistant, Medical Image Display and Analysis Research Group, UNC Department of Biostatistics, University of North Carolina, Chapel Hill, NC
2007 – 2008	Statistical Consultant/Teaching Assistant, Initiative for Maximizing Student Diversity (IMSD), UNC Department of Biostatistics , University of North Carolina Chapel Hill, NC
2008 – present	Assistant Professor, Division of Public Health Sciences, Department of Biostatistical Sciences, Wake Forest School of Medicine, Winston-Salem, NC
2008 – present	Affiliate, Maya Angelou Center for Health Equity, Wake Forest School of Medicine, Winston-Salem, NC
2009 – present	Graduate Faculty, Wake Forest University, Winston-Salem, NC
2009 – present	Secondary Appointment, Translational Science Institute, Wake Forest School of Medicine, Winston-Salem, NC
2009 – present	Member, Laboratory for Complex Brain Networks, Wake Forest School of Medicine, Winston-Salem, NC
2010 – present	Member, Center for Bioethics, Health, and Society, Wake Forest School of Medicine
2013 – present	Affiliate Faculty, School of Biomedical Engineering and Sciences, Wake Forest School of Medicine
2013 – present	Adjunct Assistant Professor, Department of Biostatistics, University of North Carolina Chapel Hill, NC
2015 – present	Faculty, Neuroscience Program, Wake Forest School of Medicine

Other Experience and Professional Memberships

2010 - Present	Statistics Without Borders
2010 - Present	Organization for Human Brain Mapping
2009 - Present	International Biometric Society
2006 - Present	American Statistical Association
2007-2008	Minority Health Conference Broadcast Committee
1998-2002	National Society for Black Engineers
2001-2002	Senior Representative (Board Member), Harvard Society for Black Scientists and Engineers
1998-2001	Member Japan Society, Harvard University

Honors and Awards

2015	Selected as a Delta Omega Theta Chapter Member, Gillings School of Global Public Health, University of North Carolina
2010-Present	Selected as a Translational Research Academy Scholar (Wake Forest School of Medicine)
2004-2006	Recognized in The Chancellor's List (Honoring America's Outstanding Graduate Students
2003-2006, 2007-2008	Recipient of NICHD Grant for Population StudiesDepartment of Biostatistics (Chirayath Suchindran), University of North Carolina
2002-2003	Awarded Julie Gatewood Latane Fellowship in Interdisciplinary Living,
2002-2004	Awarded Fryer Fellowship/Merit Scholarship, Department of Biostatistics, University of North Carolina
2002-2007	Awarded Royster Fellowship/Merit Scholarship, Graduate School, University of North Carolina
1998	Awarded Scholarship from the National Action Council for Minorities in Engineering for Excellence in Mathematics and Engineering
1998-2002	Awarded Virginia Power/Dominion Power Scholarship for Excellence in Mathematics and Engineering

C. Contribution to Science

1. As evidenced by the launching of the Human Connectome Project by the NIH in 2009, the 1000 Functional Connectomes Project in 2009, and the President's BRAIN mapping initiative in 2013, brain connectivity analyses are key in our understanding of normal brain function, alterations due to disorders such as age-related cognitive decline and dementia, and risk factors for such disorders. Brain network analyses (a subfield of connectivity analyses) have exploded over the last decade, gaining traction due to their profound clinical implications, but analytical methods for brain network data are sparse. My primary focus the last six years has been on the development of novel fusions of multivariate statistical tools with network science methods to engender powerful analytical tools that will aid in our understanding of normal and abnormal brain function. My efforts in this area have led to a 5-year NIH funded K award titled "Statistical Methods for Whole-Brain Connectivity Networks", a first-authored invited review paper, 6 methodological papers (5 first-authored), an invited book chapter, an invited magazine article, 12 invited talks (7 at national conferences), 5 conference abstracts at national and international meetings, 7 non-conference presentations, and several submitted or in progress grant applications. Two of the first-authored methodological papers illustrated the utility of exponential random graph models (ERGMs) for analyzing brain networks with one being cited 32 times since its publication three years ago, and the other 34 times in four years. Use of the approaches developed in these manuscripts (and in the other, more recent, first-authored methodological papers) has given insight into potential mechanisms that may lead to cognitive decline in older age. The methods have also been noted for their potential utility in many other areas of research including the development of novel target outcomes for clinical trials related to brain health.
   a. **Simpson SL**, Hayasaka S, Laurienti PJ (2011). Exponential Random Graph Modeling for Complex Brain Networks. PLoS ONE 6(5), e20039. PMCID: PMC3102079.
   b. **Simpson SL**, Moussa MN, Laurienti PJ (2012). An Exponential Random Graph Modeling Approach to Creating Group-Based Representative Whole-Brain Connectivity Networks. NeuroImage 60, 1117-1126. PMCID: PMC3303958.
   c. **Simpson SL**, Laurienti PJ (2015). A Two-Part Mixed-Effects Modeling Framework For Analyzing Whole-Brain Network Data. NeuroImage 113, 310-319. PMCID: PMC4433821
   d. **Simpson SL**, Lyday RG, Hayasaka S, March AP, Laurienti PJ (2013). A Permutation Testing Framework to Compare Groups of Brain Networks. *Frontiers in Computational Neuroscience* 7, 171. PMCID: PMC3839047

2. Concurrent with my development of new methodologies for brain network analysis, I have also conducted complementary work on synthesizing and applying current tools to brain network data in order to illuminate relationships between brain physiology and health and behavioral outcomes. This work has led to 7 manuscripts (6 published, 1 in review). My role in these studies has been to statistically analyze the data and interpret the findings within their statistical and biological context.
   a. Telesford Q, Morgan AR, Hayasaka S, **Simpson SL**, Barret W, Kraft RA, Mozolic JL, Laurienti PJ (2010). Reproducibility of graph metrics in fMRI Networks. *Frontiers in Neuroinformatics* 4, 117. PMCID: PMC3002432
   b. Moussa MN, **Simpson SL**, Mayhugh RE, Grata ME, Burdette JH, Porrino LJ, Laurienti PJ (2015). Long-Term Moderate Alcohol Consumption Does Not Exacerbate Age-Related Cognitive Decline in Healthy, Community-Dwelling Older Adults. *Frontiers In Aging Neuroscience*, 6, 341. PMCID: PMC4283638
   c. Stanley ML, **Simpson SL**, Dagenbach D, Lyday RG, Burdette JH, Laurienti PJ (2015). Changes in Brain Network Efficiency and Working Memory Performance in Aging. *PLoS One* 10(4), e0123950. PMCID: PMC4395305
   d. Paolini BM, Laurienti PJ, **Simpson SL**, Burdette JH, Lyday RG, Rejeski WJ (2015). Global Integration of the Hot-State Brain Network of Appetite Predicts Short Term Weight Loss in Older Adults. *Frontiers In Aging Neuroscience* 7, 70. PMCID: PMC4423432

3. The transitioning of the National Center on Minority Health and Health Disparities to full institute status in 2010 indicates the increasing recognition of the importance of improving minority health and eliminating health disparities. My intellectual and social interest in issues of health equity was piqued in graduate school through my research at the Health Promotion and Disease Prevention center at UNC, my involvement in the Minority Student Caucus and organizing committee of the Minority Health Conference, and my tenure as a trainee on the NIH funded Initiative for Maximizing Diversity (IMSD) grant. My

dedication to understanding and eliminating health disparities has continued as a faculty member, manifesting itself through my work with the Maya Angelou Center for Health Equity (MACHE) as an Affiliate, and my disparities focused collaborations with researchers throughout the institution. Most notably, I have been collaborating as a Jackson Heart Study (JHS) investigator with the Image Lab at WFSM (now at Vanderbilt) on a cardiac MRI component focused on understanding and reducing cardiovascular related health disparities in African-Americans. The primary goal of this component is to use MRI imaging of the heart and thoracic aorta to develop novel data related to morphologic structure, flow characteristics, and atherosclerotic burden that can be used for standard epidemiologic analyses. I have also been working with the JHS Diabetes and Obesity Working Group and other JHS collaborators on investigating the causes of the disproportionate burden of chronic diseases in African-Americans and learning how best to prevent these diseases. My efforts in health disparities related research, mentoring, and training have led to an invited talk as the keynote speaker for the diversity mentor lunch series for the NIH sponsored IMSD program, 12 papers (4 published, 8 in preparation or in the peer-review process), 10 conference abstracts, a request to take over the ENAR Diversity Workshop as lead organizer, and several submitted or in progress grant applications.

   a. Bruce MA, Beech BM, Crook ED, Sims M, Griffith DM, **Simpson SL**, Ard J, Norris KC (2013). Sex, Weight Status, and Chronic Kidney Disease Among African Americans: The Jackson Heart Study. *The Journal of Integrative Medicine* 61, 701-707.

   b. Webb BC, **Simpson SL**, Hairston KG (2011). From Politics to Parity: Using a Health Disparities Index to Guide Legislative Efforts for Health Equity. *American Journal of Public Health* 101, 554-560. PMCID: PMC3036688

   c. Slager RE, **Simpson SL,** LeVan TD, Poole JA, Sandler DP, Hoppin JA (2010). Rhinitis Associated With Pesticide Exposure Among Private Pesticide Applicators in the Agricultural Health Study. *Journal of Toxicology and Environmental Health, Part A* 73: 20, 1382-1393. PMCID: PMC2964833

   d. Thomas KB, **Simpson SL**, Tarver WL, Gwede CK (2010). Is social support from family associated with PSA testing in a sample of men? An exploratory analysis using the Health Information National Trends Survey (HINTS) 2005. *American Journal of Men's Health* 4, 50-59.

4. My graduate work, which focused on understanding and modeling inter-correlated data, has led to cutting edge methodological developments and important clinical applications that may inform future investigations related to brain network analysis and health disparities research. More specifically, my dissertation research and related publications aimed to develop new covariance models for longitudinal and spatial data. Proper covariance modeling is critical for drawing accurate statistical inference (i.e., minimizing false positives) and maximizing power (i.e., minimizing false negatives).

   a. **Simpson SL**, Edwards LJ, Muller KE, Sen PK, Styner MA (2010). A Linear Exponent AR(1) Family of Correlation Structures. *Statistics in Medicine* 29, 1825-1838. PMCID: PMC4020183.

   b. **Simpson SL**, Edwards LJ (2013). A Circular LEAR Correlation Structure for Cyclical Longitudinal Data. *Statistical Methods in Medical Research* 22, 296-306.

   c. **Simpson SL**, Edwards LJ, Muller KE, and Styner MA (2014). Kronecker Product Linear Exponent AR(1) Correlation Structures for Multivariate Repeated Measures Data. *PLoS One* 9(2), e88864. PMCID: PMC3931642.

   d. **Simpson SL**, Edwards LJ, Muller KE, and Styner MA (2014). Separability Tests for High-Dimensional, Low Sample Size Multivariate Repeated Measures Data. *Journal of Applied Statistics* 41, 2450-2461. PMCID: PMC4203479

5. In addition to my specific focus on covariance modeling, I have also contributed to the field of repeated measures/inter-correlated data analysis more generally with methodological developments and collaborative work. The developed multivariate methods have applications in a wide variety of biomedical fields, and have already been applied in hypertension, neurodevelopmental, neuropsychiatric research. My work in this area includes 7 methodological publications (5 first-authored), one of which is referenced by the GLMPOWER documentation in SAS, 1 software-related publication, 1 applications publication, 1 invited talk, 10 conference abstracts, and 14 non-conference presentations. I was also asked to serve as a Chair for a session on high-dimensional data at the International Biometric Conference.

   a. Edwards LJ, **Simpson SL** (2014). An Analysis of 24-Hour Ambulatory Blood Pressure Monitoring Data using Orthonormal Polynomials in the Linear Mixed Model. *Blood Pressure Monitoring* 19, 153-163. PMCID: PMC4058995.

b. Johnson JL, Muller KE, Slaughter JC, Gurka MJ, Gribbin MJ, **Simpson SL** (2009). POWERLIB: SAS/IML Software for Computing Power in Multivariate Linear Models. *Journal of Statistical Software* 30, 1-27. PMCID: PMC4228969
c. Muller KE, Edwards LJ, **Simpson SL**, Taylor DJ (2007). Statistical Tests with Accurate Size and Power for Balanced Linear Mixed Models. *Statistics in Medicine* 26, 3639-3660.
d. Vaughan L, Leng I, Dagenbach D, Resnick SM, Rapp SR, Jennings JM, Brunner RL, **Simpson SL**, Beavers D, Coker LH, Gaussoin SA, Sink K, Espeland MA (2013). Intra-Individual Variability in Domain-Specific Cognition and Risk of MCI and Dementia. *Current Gerontology and Geriatrics Research*, Article ID 495793. PMCID: PMC3881440

The list of my published work can be found under My Bibliography in My NCBI. Please follow the link below.
http://www.ncbi.nlm.nih.gov/myncbi/browse/collection/45823651/?sort=date&direction=descending

D. Research Support

<u>Ongoing Research Support</u>

K25EB012236-01A1   Simpson (PI)   09/01/2012 – 08/31/2017
Statistical Methods for Whole-Brain Connectivity Networks
My goal for the K25 award is to establish myself as an independent neuroimaging researcher with expertise in brain network analysis and an integral member of multidisciplinary research teams devoted to addressing diseases of the brain.
Role: Principal Investigator