

BIOGRAPHICAL SKETCH

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NAME: Mark G. Vangel, Ph.D.

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

POSITION TITLE: Assistant Professor of Radiology (Harvard Medical School), Biostatistician (Massachusetts General Hospital), Biostatistician (Massachusetts Institute of Technology)

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
Massachusetts Institute of Technology, Cambridge, MA	S.B.	06/1980	Mathematics
Massachusetts Institute of Technology, Cambridge, MA	S.M.	09/1981	Mathematics
Harvard University, Cambridge, MA	A.M.	06/1988	Statistics
Harvard University, Cambridge, MA	Ph.D.	06/1992	Statistics

A. Personal Statement

I am a statistician with approximately 35 years of collaborative experience in diverse fields. I have specialized in applications of statistics to neuroimaging since 2002, and I have provided statistical support to the NCIGT team since 2009. In addition to providing statistical support at MGH and BWH, I also conduct a program of research that involves combining information (e.g., multiple-subject inference in neuroimaging, meta-analysis), applied Bayesian inference, and causal inference in functional neuroimaging. In the proposed project, I will be working closely with investigators in each of the TRDs to ensure that appropriate biostatistical methods are leveraged in the design and analysis of all studies. Below are selected co-authored NCIGT publications.

- Unadkat P, Fumagalli L, Rigolo L, **Vangel MG**, Young GS, Huang R, Mukundan S Jr, Golby A, Tie Y. Functional MRI Task Comparison for Language Mapping in Neurosurgical Patients. *J Neuroimaging*. 2019 Jan 16. doi: 10.1111/jon.12597. PubMed PMID: 30648771.
- Alessandrino F, Taghipour M, Hassanzadeh E, Ziaei A, **Vangel M**, Fedorov A, Tempny CM, Fennessy FM. Predictive role of PI-RADSV2 and ADC parameters in differentiating Gleason pattern 3 + 4 and 4 + 3 prostate cancer. *Abdom Radiol*. 2018 Jul 31;1–7. PMID: 30066169
- Fedorov A, **Vangel MG**, Tempny CM, Fennessy FM. Multiparametric Magnetic Resonance Imaging of the Prostate: Repeatability of Volume and Apparent Diffusion Coefficient Quantification. *Invest Radiol*. 2017;52(9):538–46. PMID: 28463931
- Glazer DI, Tatli S, Shyn PB, **Vangel MG**, Tuncali K, Silverman SG. Percutaneous Image-Guided Cryoablation of Hepatic Tumors: Single-Center Experience with Intermediate to Long-Term Outcomes. *AJR Am J Roentgenol*. 2017 Dec;209(6):1381-1389. doi: 10.2214/AJR.16.17582. Epub 2017 Sep 27. PubMed PMID: 28952807; PubMed Central PMCID: PMC5698169.

B. Positions and Honors**Positions and Employment**

1980–1984 Mathematician, Management Information Systems Office, U.S. Army Materials Technology Laboratory, Watertown, MA 02172

- 1984–1993 Mathematical Statistician, Mechanics of Materials Branch, U.S. Army Materials Technology Laboratory, Watertown, MA 02172
- 1993–1995 National Research Council Postdoctoral Associate, Statistical Engineering Division, National Institute of Standards and Technology, Gaithersburg, MD 20899
- 1995–2000 Mathematical Statistician, Statistical Engineering Division, National Institute of Standards and Technology, Gaithersburg, MD 20899
- 1999–2000 Visiting Associate Professor, Institute of Statistics and Decision Sciences, Duke University, Durham, NC 27708
- 2000–2002 Research Scientist, Department of Biostatistical Science, Dana–Farber Cancer Institute, Boston, MA
- 2002– Statistician, General Clinical Research Center, Massachusetts General Hospital, Charlestown, MA
- 2002– Statistician, General Clinical Research Center, Massachusetts Institute of Technology, Cambridge, MA
- 2002–2004 Instructor, Department of Radiology, Harvard Medical School, Boston, MA
- 2004– Assistant Professor, Department of Radiology, Harvard Medical School, Boston, MA

Other Experience and Professional Memberships

- 1984– American Statistical Association (Fellow)
- 1988– Institute of Mathematical Statistics
- 1998– Biometric Society, Eastern North American Region

Honors

- 2008–2011 Editorial Board, Menopause
- 2004–2006 Associate Editor, Journal of the American Statistical Association
- 1998–2003 Associate Editor, Technometrics
- 1998– W.J. Youden Award in Interlaboratory Testing
- 1999– Fellow, American Statistical Association

C. Contributions to Science

1. My earliest statistical research was in the theory and application of statistical intervals, with an emphasis on tolerance and prediction intervals in random-effects and mixed models. I was motivated initially by applications in materials science, but I have begun to investigate applications of tolerance intervals to radiology and neuroimaging.
 - a. **Vangel MG**. New methods for one-sided tolerance limits for a one-way balanced random effects ANOVA model. *Technometrics* 1992; 34(2):176-185.
 - b. **Vangel MG**. Confidence intervals for a normal coefficient of variation. *American Statistician* 1996; 50:21-26.
 - c. Fedorov A, Wells WM, Kikinis R, Tempany CM, **Vangel MG**. Application of tolerance limits to the characterization of image registration performance. *IEEE Trans Med Imaging* 2014; 33(7):1541-1550. PMID: PMC4096345.

2. Another research interest is combining information, with applications in interlaboratory comparisons, meta-analysis, and multiple-subject neuroimaging. The first two publications below were together awarded the W.J. Youden Prize of the American Statistical Association in 1998.
 - a. Rukhin AL, **Vangel MG**. Estimation of a common mean and weighted means statistics. *J Am Stat Assoc* 1998; 93(441):303-308.
 - b. **Vangel MG**, Rukhin AL. Maximum likelihood analysis for heteroscedastic one-way random effects ANOVA in interlaboratory studies. *Biometrics* 1999; 51(1):129-136.
 - c. **Vangel MG**. Combining functional MRI data on multiple subjects. *Classification, Cluster Analysis, and Data Mining*, eds. D. Banks, L. House, P. Arabie, F.R. McMorris, and W. Gaul, Springer-Verlag, Berlin, 2004.
 - d. Zou KH, Greve DN, Wang M, Pieper SD, Warfield SK, White NS, Manadhar S, Brown GG, **Vangel MG**, Kikinis R, Wells WM III for the FIRST BIRN Research Group. Reproducibility of functional MR

imaging: preliminary results of a prospective multi-institutional study performed by Biomedical Informatics Research Network. Radiology 2005; 237(3):781-789. PMID: PMC1351264.

3. My research in causal inference and networks in neuroimaging began with work in Granger causality. I am presently extending this work to graphical modeling in neuroimaging.
 - a. Zhang L, Zhong G, Wu Y, **Vangel MG**, Jiang B, Kong J. Using Granger-Geweke causality model to evaluate the effective connectivity of primary motor cortex (M1), supplementary motor area (SMA) and cerebellum. J Biomed Sci Eng 2010; 3:848-860. PMID: PMC2991070
 - b. Ciesielski KT, Rauch SL, Ahlfors SP, **Vangel M**, Wilhelm S, Rosen BR, Hämäläinen MS. Role of medial cortical networks for anticipatory processing in obsessive-compulsive disorder. Hum Brain Mapp 2012; 33(9):2125-2134. PMID: PMC3235253.
 - c. Loggia ML, Kim J, Gollub RL, **Vangel MG**, Kirsch I, Kong J, Wasan AD, Napadow V. Default mode network connectivity encodes clinical pain: an arterial spin labeling study. Pain 2013; 154(1):24-33. PMID: PMC3534957.
 - d. Kitzbichler MG, Khan S, Ganesan S, **Vangel MG**, Herbert MR, Hämäläinen MS, Kenet T. Altered development and multifaceted band-specific abnormalities of resting state networks in autism. Biol Psychiatry 2015; 77(9):794-804. PMID: PMC4270956.

D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support

- | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------|
| UL1 R002541 | (Nadler) | 05/01/2018-04/30/2023 |
| NIH/NCRR
Harvard Clinical and Translational Science Center
Provide enriched resources to educate and develop the next generation of researchers trained in the complexities of translating research discoveries into clinical trials and ultimately into practice. Design new and improved clinical research informatics tools for analyzing research data and managing clinical trials. Support outreach to underserved populations, local community and advocacy organizations, and health care providers. Assemble interdisciplinary teams and forge new partnerships with private and public health care organizations.
Role: Statistician | | |
| P41EB015898 | (Tempany) | 08/15/2015-06/30/2020 |
| NIH/NIBIB
Image Guided Therapy Center
The primary goal of our proposed P41 program is to use imaging to improve target definition, localization and targeting of diseased tissue and using image guidance to optimize treatments, improving outcomes and decreasing invasiveness. In the next cycle, we propose to address open challenges in image-guided therapy (IGT) related to ill defined target definition, inaccurate localization and targeting.
Role: Statistician | | |
| R01AT008563 | (Kong) | 09/01/2015-05/31/2020 |
| NIH/NCAM
The Neurobiology of Placebo and Nocebo Effects: a Brain Imaging Study
To provide statistical support for the clinical studies.
Role: Statistician | | |
| 4R33AT009310 | (Kong) | 09/15/2018-08/31/2021 |
| NIH/NCAM
Mechanistic Studies on video guided acupuncture imagery treatment of pain
Goals: To use fMRI to investigate the underlying mechanisms of video-guided acupuncture imagery treatment, verum acupuncture, and sham acupuncture in both healthy subjects and chronic pain patients. The findings will | | |

enhance our understanding of the brain mechanisms of mind-body interaction, imagery treatment, acupuncture, and pain management.

Role: Statistician

P50DC015446 (Hillman) 04/01/2017-03/31/2022
NIH

Clinical Research Center for the Improved Prevention, Diagnosis, and Treatment of Hyperfunction
The major goal of this project is to provide statistical support for clinical studies.

Role: Statistician

K24 MH110807 (Kubicki) 05/01/2017-04/30/2022
NIH

Mentoring and Neuroimaging Research on White Matter pathology in Schizophrenia

The grant will support mentoring and training of both the PI and the talented junior clinical scientists in translational research aimed at understanding biological mechanisms of brain pathology affecting white matter connectivity in schizophrenia.

Role: Statistician

5R01MH112737 (Camprodon) 04/01/2017-03/31/2022
NIH

A transdiagnostic assessment of Electroconvulsive Therapy modulation of reward circuitry: targets, biomarkers and predictors of response

The goal is to take advantage of the high efficacy and fast response of ECT to (1) identify much-needed treatment targets, and develop high impact Clinical tools, namely (2) biomarkers and (3) predictors of response. Our approach is circuit-centered and transdiagnostic, focusing on reward networks and their associated Clinical dimensions across diagnoses that are common indications for ECT.

Role: Statistician

R01MH112385 (Psaros) 04/01/2017-03/31/2022
NIH

Falling off the HIV treatment cascade cliff: understanding postpartum attrition to HIV care. The goals of this project are to conduct a prospective study of HIV-infected women enrolled in a PMTCT program in order to estimate the rate of attrition from HIV care and identify factors associated with attrition from and retention in HIV care during the postpartum period. We will also conduct interviews to explore changes in barriers and facilitators over time.

Role: Statistician

R34AT009170 (Psaros) 09/01/2016-04/30/2020
NIH

Developing a Resilience Intervention for Older, HIV-Infected Women

The goal of this project is to adapt a mind-body resiliency intervention to the needs of HIV-infected women over 50, conduct preliminary testing of the group intervention via an open pilot study, and conduct a randomized pilot to test the feasibility and acceptability of all study procedures.

Role: Statistician

R01EB025964 (Jagadeesan) 09/15/2018-05/31/2022
NIH/NIBIB

Lung Navigation System for Localizing and Resecting Nodules

The major goal of this study is the development of convolutional neural networks-based machine learning algorithms for lung nodule classification and a LungNav system with tumor deformation algorithms and augmented reality methods to localize and guide complete surgical resection of lung nodules.

Role: Statistician

R33AT009341 (Kong) 04/01/2019-03/31/2021
NIH/NCCIH
Enhancing acupuncture treatment effect through non-invasive neuromodulation
The major goal of this project is to study 1) the longitudinal (one-month) effects of different treatments as indicated by changes in resting state functional connectivity (rsFC), cerebral blood flow (CBF), clinical outcomes of low back pain, and quantitative sensory test (QST) and 2) the association between these changes. Both acupuncture and tDCS are promising therapeutic methods for chronic pain. Elucidating the brain mechanisms of acupuncture, tDCS, and the synergistic effects of the two will facilitate the development of new pain management methods and promote improvements in pain care.
Role: Statistician

R01AG063975 (Kong) 09/15/2019-06/30/2020
NIH/NIAMS
Modulation effects of Baduanjin mind-body exercise on subjective cognitive decline
The major goal of the project is to study the effect of mind-body intervention on subjects with subjective cognitive decline.
Role: Statistician

R01NS112694 (Valera) 11/01/2019-10/30/2023
NIH
Impact of intimate partner violence-related mild traumatic brain injuries on neural, cognitive, and psychological health of women
The major goal of this project is to understand the sequelae of intimate partner violence-related traumatic brain injury.
Role: Statistician

R01CA245145 (Winickoff) 01/01/2020-12/31/2024
NIH/NCI
Electronic Pediatric Office Systems to Support Treatment for Parental Tobacco Use
The goal of the proposed study is to ensure that every parent who smokes tobacco and visits the child's doctor receives tobacco dependence treatment—something that happens less than 2% of the time in spite of free tobacco cessation quitlines in all 50 states and widespread insurance coverage of nicotine replacement therapy (NRT).
Role: Statistician

Completed Research Support

P01AT006663 (Rosen) 09/01/2011-06/30/2017
NIH
Neuroimaging Acupuncture on Brain Activity in Chronic Low Back Pain
This application seeks support for a new Center of Excellence for Research on CAM (CERC) to apply neuroimaging methodologies to explore the central mechanisms of acupuncture action in chronic low back pain (cLBP), a clinically significant disorder for which effective modes of treatment are currently lacking.

K24MH099421 (Manoach) 12/01/2012-11/30/2017
NIH/NIMH
Mentoring and Research on Cognitive Deficits in Schizophrenia
This K24 will support mentoring and training of both the PI and talented junior clinical scientists in translational research aimed at understanding and treating the disabling cognitive deficits in schizophrenia that are related to sleep.

R01CA190901

(Ratai)

09/07/2015-07/31/2019 NIH/NCI

Identifying Early Failure to Anti-angiogenic Therapy in Recurrent GBM

The goal of this study is to identify Early treatment failures in response to Anti-angiogenic agents in glioblastoma patients using an advanced Imaging Tool known as magnetic resonance spectroscopy that will allow probing the metabolic profile of the tumor.

P01CA084203

(Hasan)

03/11/2015-12/31/2019

NIH/NCI

Molecular Response and Imaging-based Combination Strategies for Optimal PDT

This project builds on recent advances in the understanding of cancer biology, in mechanisms of current and emerging therapies as well as the enormous progress made in imaging technologies, to propose new photodynamic therapy (PDT)-based combination treatments for pancreato-biliary and non-melanoma skin cancers.

* Dr. Vangel is on Core B entitled "Biological Models, Biostatistics, Molecular Pathology and Microscopy"

R03 MH110745

(Lyll)

08/15/2016-08/14/2019

NIH/NIMH

Imaging White Matter Maturation and Genetic High Risk for Schizophrenia

This application aims to understand the neurodevelopmental timeline of structural aberrations in white matter tracts that may be related to specific neurocognitive deficits in individuals at genetic high risk for schizophrenia. The PI and investigators of this proposal will apply cutting-edge image analysis methodologies to already collected diffusion weighted images and relate it to neurocognitive data from three unique cohorts of genetic high-risk for schizophrenia individuals and matched healthy controls with ages which span the course of early development: Infancy, Childhood, Early Adulthood.