BIOGRAPHICAL SKETCH

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NAME: Brokamp, Cole

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

POSITION TITLE: Assistant 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
University of Cincinnati	B.S	06/2010	Biomedical Engineering
University of Cincinnati	Ph.D.	04/2016	Biostatistics and Bioinformatics
Cincinnati Children's Hospital Medical Center	Postdoctoral Research Fellow	10/2017	Biostatistics and Epidemiology

A. Personal Statement

I am an environmental and population health scientist trained at the intersection of biostatistics, epidemiology, and geoinformatics in order to advance precision public health. My work has focused on using GIS, machine learning, and causal inference methods with "big spatial data" to estimate the effect of spatiotemporal environmental exposures on neurobehavioral and psychiatric pediatric health outcomes. Specifically, my interest lies in the interaction of these urban exposures with individual- and community-level socioeconomic characteristics in order to to identify subpopulations of children who are more susceptible to environmental health problems and inform targeted interventions. I am also the founding director of the Geospatial Research Accelerator for Precision Population Health (GRAPPH) at Cincinnati Children's Hospital Medical Center, a shared facility that works to develop and democratize geospatial data and methodologies across the institution.

I look forward to contributing to Dr. Marusak's innovative and timely proposed R21 award that will be the first to test whether ambient air pollution increases risk of anxiety via impaired development of fear extinction neural circuitry during adolescence. My expertise and experience in developing spatiotemporal $PM_{2.5}$ exposure assessment models will help me contribute to accomplishing both specific aims. Specifically, I will advise and assist in estimation of $PM_{2.5}$ levels, both cumulative lifetime exposures and more recent exposures based on participants' residential addresses. Additionally, I will leverage my expertise in environmental epidemiology and biostatistical methods, specifically for longitudinal $PM_{2.5}$ and psychiatric health outcomes to assist with the selection of appropriate statistical tests, covariates, and analyses.

1. **Cole Brokamp**, Roman Jandarov, Monir Hossain, Patrick Ryan. Predicting Daily Urban Fine Particulate Matter Concentrations Using Random Forest. Environmental Science & Technology. 52 (7). 4173-4179. 2018.

2. **Cole Brokamp**, Jeffrey R. Strawn, Andrew F. Beck, Pat Ryan. Pediatric Psychiatric Emergency Department Utilization and Fine Particulate Matter: A Case-Crossover Study. *Environmental Health Perspectives*. 2019.

B. Positions and Honors

Positions and Employment

2012–2016	Research Associate, Department of Environmental Health, University of Cincinnati
2016–2017	Research Fellow, Cincinnati Children's Hospital Medical Center Division of Biostatistics & Epidemiology
2017–	Assistant Professor of Pediatrics, the University of Cincinnati Department of Pediatrics and Cincinnati Children's Hospital Medical Center Division of Biostatistics & Epidemiology

Honors

2010	B.S. awarded with Distinguished Honors, University of Cincinnati
2016	CCHMC Division of Biostatistics & Epidemiology Travel Award
2016	CCHMC Arnold W. Strauss Fellowship Award
2017	CCHMC Epidemiology & Biostatistics Top Publication and Top Research Achievement
2020	CCHMC Epidemiology & Biostatistics Top Publication

C. Contribution to Science

1. My early career has been spent developing spatiotemporal exposure assessment models for enivronmental pollutants and community characteristics based on machine learning techniques. This work includes the first machine learning or ensemble model used to assess exposure to elemental components of particulate matter. Recent introduction of remote sensing satellite data has allowed for extension of the land use random forest model to produce daily estimates of air pollution back to 2000 at a resolution of 1 x 1 km.

   a. **Cole Brokamp**, Eric B. Brandt, Patrick H. Ryan. Assessing Exposure to Outdoor Air Pollution for Epidemiological Studies: Model-based and Personal Sampling Strategies. Journal of Allergy and Clinical Immunology. 2019.

   b. **Cole Brokamp**, Roman Jandarov, Monir Hossain, Patrick Ryan. Predicting Daily Urban Fine Particulate Matter Concentrations Using Random Forest. Environmental Science & Technology. 52 (7). 4173-4179. 2018.

   c. **Cole Brokamp**, Roman Jandarov, MB Rao, Grace LeMasters, Patrick Ryan. Exposure assessment models for elemental components of particulate matter in an urban environment: A comparison of regression and random forest approaches. *Atmospheric Environment*. 151. 1-11. 2017.

   d. **Cole Brokamp**, MB Rao, Patrick Ryan, Roman Jandarov. A comparison of resampling and recursive partitioning methods in random forest for estimating the asymptotic variance using the infinitesimal jackknife. *Stat*. 6(1). 360-372. 2017.

   e. **Cole Brokamp**, Grace LeMasters, Patrick Ryan. Residential mobility impacts exposure assessment and community socioeconomic characteristics in longitudinal epidemiology studies. Journal of Exposure Science and Environmental Epidemiology. 26(4). 428-34. 2016.

   f. **Cole Brokamp**, MB Rao, Tina Zhihua Fan, Patrick H Ryan. Does the elemental composition of indoor and outdoor PM2.5 accurately represent the elemental composition of personal PM2.5?. Atmospheric Environment. 101. 226-234. 2015.

2. Building on advanced exposure assessment models has allowed me to lead epidemiological studies on the impacts of the built environment (e.g., fine particulate matter, greenspace, combined sewer overflows, community deprivation) on several different pediatric health outcomes (e.g., psychiatric, neurobehavioral, gastrointestinal, and all-cause hospital utilization).

   a. **Cole Brokamp**, Jeffrey R. Strawn, Andrew F. Beck, Pat Ryan. Pediatric Psychiatric Emergency Department Utilization and Fine Particulate Matter: A Case-Crossover Study. *Environmental Health Perspectives*. 2019.

   b. Juliana Madzia, Patrick Ryan, Kimberly Yolton, Zana Percy, Nick Newman, Grace LeMasters, **Cole Brokamp**. Residential Greenspace Is Associated with Childhood Behavioral Outcomes. *Journal of Pediatrics*. 30. 37-43. 2019.

c. **Cole Brokamp**, Andrew F. Beck, Neera K. Goyal, Patrick Ryan, James M. Greenberg, Eric S. Hall. Material Community Deprivation and Hospital Utilization During the First Year of Life: An Urban Population-Based Cohort Study. *Annals of Epidemiology*. 30. 37-43. 2019.

d. **Cole Brokamp**, Andrew F. Beck, Louis Muglia, Patrick Ryan. Combined Sewer Overflow Events and Childhood Emergency Department Visits: A Case-Crossover Study. *Science of the Total Environment*. 607-608. 1180-1187. 2017.

3. I have developed a novel approach and accompanying software package called DeGAUSS which overcomes multiple privacy-related challenges in the use of address data in multi-site studies and also serves as a more general reproducible and scalable research tool for geocoding and geomarker assessment. This approach is currently being implemented in a wide variety of national environmental health studies. Extending this approach into a scalable and sustainable framework for automated integration of disparate and heterogeneous geomarkers via spatiotemporal location has reduced the need for manual data curation and specialized expertise required to utilize them within biomedical research studies.

a. **Cole Brokamp**, Chris Wolfe, Todd Lingren, John Harley, Patrick Ryan. Decentralized and Reproducible Geocoding and Characterization of Community and Environmental Exposures for Multi-Site Studies. *Journal of American Medical Informatics Association.* 25(3). 309-314. 2018.

b. **Cole Brokamp**. DeGAUSS: Decentralized Geomarker Assessment for Multi-Site Studies. *Journal of Open Source Software*. 2018.

4. I have also contributed to several studies on the disparities of health outcomes within children and the contribution of the place-based and social determinants of health to these disparities in order to identify root causes and meaningful solutions.

a. Erica Andrist, **Cole Brokamp**, Stuart Taylor, Carley Riley, Andrew Beck. Neighborhood Poverty and Pediatric Intensive Care Use. *Pediatrics*. 2019.

b. Andrew F. Beck, Carley L. Riley, Stuart Taylor, **Cole Brokamp**, Robert S. Kahn. Toward a Culture of Health in Hospitals: Pervasive population disparities in inpatient bed-day rates across conditions and subspecialties. *Health Affairs*. 37(4). 551-559. 2018.

c. Lauren C. Riney, **Cole Brokamp**, Andrew F. Beck, Wendy Pomerantz, Hamilton Schwartz, Todd A. Florin. Emergency Medical Services Utilization is Associated with Community Deprivation in Children. *Prehospital Emergency Care*. 2018.

5. Lastly, I have contributed to a research team that has recently used functional data analysis combined with joint modeling (FD-JM) to identify and predict rapid decline in lung function among patients with cystic fibrosis (CF) lung disease. My work in translating this predictive model into an interactive application has allowed for patients and clinicians to take advantage of it at the bedside. Focus groups and partnerships with clinicians have allowed us to iteratively develop the application based on end-user feedback. Work with the CF Foundation Patient Registry (CFFPR) to implement these models and visualizations into clinical settings has improved prognostic care.

a. Christopher Wolfe, Teresa Pestian, Emrah Gecili, Weiji Su, Ruth H. Keogh, John P. Pestian, Michael Seid, Peter J. Diggle, Assem Ziady, John P. Clancy, Daniel H. Grossoehme, Rhonda D. Szczesniak, **Cole Brokamp**. Cystic Fibrosis Point of Personalized Detection (CFPOPD): An Interactive Web Application. JMIR Med Inform. 8(12):e23530. 2020.

b. Rhonda D. Szczesniak, Weiji Su, **Cole Brokamp**, Ruth H. Keogh, John P. Pestian, Michael Seid, Peter J. Diggle, John P. Clancy. Dynamic predictive probabilities to monitor rapid cystic fibrosis disease progression. Statistics in Medicine. 2019.

c. Rhonda D. Szczesniak, **Cole Brokamp**, Weiji Su, Gary L. McPhail, John Pestian, and John P. Clancy. Improving Detection of Rapid Cystic Fibrosis Disease Progression—Early Translation of a Predictive Algorithm into a Point-of-Care Tool. *IEEE Journal of Translational Engineering in Health and Medicine.* 7(1). 1-8. 2019.

d. Rhonda Szczesniak, **Cole Brokamp**, Weiji Su, Gary L. McPhail, John Pestian, John P. Clancy. Early Detection of Rapid Cystic Fibrosis Disease Progression Tailored to Point of Care: A Proof-of-Principle Study. *Healthcare Innovations and Point of Care Technologies*. (HI-POCT), 2017 IEEE. 204-207. 2017.

e. Rhonda D. Szczesniak, Dan Li, Weiji Su, **Cole Brokamp**, John Pestian, Michael Seid, John P. Clancy. Phenotypes of Rapid Cystic Fibrosis Lung Disease Progression during Adolescence and Young Adulthood. *American Journal of Respiratory And Critical Care Medicine*. 196(4). 471-478. 2017.

f. US Patent: Assem Ziady, Rhonda Szczesniak, John Clancy, **Cole Brokamp**, inventors; Cincinnati Children's Hospital Medical Center, assignee. Compositions and methods for treatment of lung function. United States patent US 10,761,099. 2020 Sep 1.

g. Software Application: Cystic Fibrosis Point of Personalized Detection (CFPOPD) for Forecasting Rapid Decline: http://predictfev1.com Co-Developers: Clancy, Szczesniak.

Complete List of Published Work in ORCiD:

https://orcid.org/0000-0002-0289-3151

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

Ongoing Research Support

NIH/NLM 1R01LM013222-01A1
A Framework for Automated and Reproducible Geomarker Curation and Computation at Scale
Brokamp, PI (08/01/2020 – 07/31/2024)
This award will create a framework for developing a standardized, free and open source library of reproducible and computable geomarkers that will enhance the efficiency and collaboration of biomedical researchers utilizing place-based data at scale.
Role: PI

ECHO Opportunities and Infrastructure Fund Award
Decentralized and Reproducible Geomarker Assessment for Multi-Site Studies
Brokamp, PI (09/01/2019 - 08/31/2021)
This award will work towards building geospatial exposure assessment computing tools for utilizing high resolution spatiotemporal gridded datasets within ECHO.
Role: PI

NIH/NHLBI R01HL141286-01A1
Mapping Environmental Contributions to Rapid Lung Disease Progression in Cystic Fibrosis
Sczcesniak, PI (01/01/2019 - 12/31/2023)
The overall objective of this research is to leverage a rich CF registry, extant national and local environmental data sources, and prospectively collected study data to accurately forecast the onset of rapid decline progression.
Role: Co-I

NIH/NHGRI U01HG011172
Polygenic Risk Scores for Healthier African American Families
Harley, PI (04/01/2020 - 3/31/2025)
We will ascertain and enroll 800 African American mothers with newborn babies along with available fathers and siblings and develop polygenic risk scores and incorporate them into genomic risk estimates for Asthma, Atopic Dermatitis, Obesity, Hypertension, Hypercholesterolemia, Premature Birth, and Breast Cancer. We will cope with the ethics of returning results and for selected situations intervene for mitigate risk.
Role: Co-I

NIH/NIEHS 1R01ES031054-01A1
Epigenetics, Air Pollution, and Childhood Mental Health
Brunst, PI (07/01/2020 - 04/31/2025)
This project utilizes data from three longitudinal birth cohorts to examine the impact of air pollution on the epigenome

and the onset of childhood anxiety and depression symptoms. DNA methylation biomarkers are investigated to advance our understanding of potential molecular pathways involved in air pollution neurotoxicity and/or anxiety and depression pathophysiology.
Role: Co-I

Recently Completed Research Support

ODH Contract No. CSP907820
Model Identifying Geographic Areas in Ohio for Blood Lead Testing
Brokamp, PI (04/01/2020 - 09/30/2020)
This award will develop a predictive model to determine which children should be tested for potentially high blood lead during physician visits based on their residential location.
Role: PI

Internal Processes and Methods Award - Center for Clinical & Translational Science & Training
Using Machine Learning to Supplement Electronic Health Record databases with Individual Socioeconomic Status
Brokamp, PI (09/1/2017 - 06/30/2019)
Retrospective epidemiological studies are often created using electronic health record databases that lack individual level demographic data. We propose a novel machine learning based approach that uses open city and auditor databases to predict individual level income and family socioeconomic status.
Role: PI

Internal Arnold W. Strauss Fellowship Award - Cincinnati Children's Hospital
Assessing Exposure to Air Pollution Across Time and Space
Brokamp, PI (07/01/16 - 06/30/17)
The primary objective of this award is to combine satellite-based measurements, land use characteristics, and meteorologic data to create a hybrid spatiotemporal model for ground level exposure to particulate matter using exact addresses and dates.
Role: PI

Internal Processes and Methods Award - Center for Clinical & Translational Science & Training
Validating a Geocoding Approach for Multi Site Studies
Brokamp, PI (01/24/17 - 06/30/17)
The primary objective of this award is to compare the geocoding (assigning latitude and longitude coordinates to addresses) accuracy of our software DeGAUSS (DEcentralized Geomarker Assessment for mUlti Site Studies) to with other common geocoding software. Furthermore, each method will be evaluated based on it ability to correctly estimate environmental exposures and community-level characteristics.
Role: PI