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

As a biostatistician and geoinformatician, I have specialized myself in the areas of machine learning and its application to large environmental and clinical datasets. Recent democratization of "big spatial data" and advances in geoinformatics have allowed unprecedented access to environmental and socioeconomic characteristics that vary highly with respect to both time and space. More precise environmental features require more complex modeling and I have dedicated my early career to furthering exposure science methodology in order to bring more precise exposure assessment tools to environmental and population health studies.

I have created a satellite-based land use random forest model that produces daily estimates of fine particulate matter from 2000 through 2015 at a resolution of 1 x 1 km across the Greater Cincinnati area. I will continue to utilize this model to assign $PM_{2.5}$ exposures to study participants as well as work to extend the models to more recent years. I have previously collaborated with Drs. Ryan, Cecil, and Yolton within the CCAAPS cohort, studying the health effects of traffic related air pollution and the neurobehavioral effects of environmental greenspace. Lastly, I also have experience with distributed lag models, specifically studying how the effects of fine particulate matter impact the risk of psychiatric exacerbations in children at different lagged times and cumulatively.

In this project, I will serve as co-investigator and will utilize my training and expertise in statistical modeling with respect to lagged environmental exposures and health outcomes to supervise and work alongside a staff Biostatistician/Epidemiologist who will be responsible for (1) updating and creating exposure assessment models, (2) conducting temporal exposure assessment within the CCAAPS cohort, and (3) analyzing the lagged effects of pollutant exposures on psychosocial outcomes.

In summary, my experience and expertise with the CCAAPS cohort, exposure assessment and modeling, as well as statistical methods for evaluating the lagged effects of environmental exposures on health outcomes will benefit the proposed project. I look forward to contributing to this important, timely, and impactful research proposal.

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.

3. 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.

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
2017	CCHMC Epidemiology & Biostatistics Top Research Achievement

C. Contribution to Science

1. My early career was spent developing exposure assessment models for spatial pollutants and community characteristics based on machine learning techniques. Specifically, applying random forest to land use models results in higher accuracy and precision of air pollution exposure assessment by elucidating complex interactions and nonlinear relationships between land use predictors and pollutant concentrations. 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.

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. Collaborating with other researchers wishing to use geospatial characteristics of research participants within existing cohorts and multi-site studies has highlighted the significant need for a reproducible and distributed method for extracting place-based information from a residential address while maintaining the privacy of protected health information. I have developed a novel approach and accompanying software package called DeGAUSS which overcomes the multiple challenges in the use of address data in multi-site studies and also serves as a more general reproducible 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. 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.

b. 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.

c. 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.

Complete List of Published Work in ORCiD:

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

D. Research Support

Ongoing Research Support

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 5UG3OD023282-02
Children's Respiratory Research and Environment Workgroup (CREW)
Gern, PI (9/01/2016 - 8/31/2023)
This consortium will identify asthma endotypes and overcome shortcomings of individual cohorts by providing a large (nearly 9000 births and long-term follow-up of 6000-7000 children and young adults) and diverse national data set, harmonizing data related to asthma clinical indicators and early life environmental exposures, developing standardized measures for prospective data collection across CREW cohorts and other ECHO studies, and conducting targeted enrollment of additional subjects into existing cohorts.
Role: Co-I

NIH/NHLBI R01HL141286-01A1
Mapping Environmental Contributions to Rapid Lung Disease Progression in Cystic Fibrosis
Sczcesniak, PI (1/1/19 - 12/31/23)
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/NIA R21AG057983
A Novel Research Infrastructure Enabling Life-Course Studies of Healthy Aging
Woo/Urbina, PI (8/15/18 - 7/31/23)
The goal of this two-phase study is to develop the data and biospecimen infrastructure for the Bogalusa Heart Study, the Princeton Lipid Research Study and the NHLBI Growth and Health Study (R21 phase) and to conduct pilot evaluations of the feasibility, acceptability and validity of data collected using a variety of biometric sensors relating to cardiometabolic risk, sleep quality and cognition in these cohorts (R33 phase). These two phases will together prepare these cohorts for future aging-related studies.
Role: Co-I

AHRQ PEDSnet K12
Inpatient Screening for Parental Adversity and Resilience
Shaw, PI (1/1/19 - 12/31/20)
This award will work to establish and implement a screening approach for the assessment of parental adverse childhood experiences in the hospital setting.
Role: Co-I

NIH/NINDS R01 NS030678
Comparison of Hemorrhagic & Ischemic Stroke Among Blacks and Whites
Kleindorfer, PI (04/01/15 - 03/31/20)

Tracking of population-based stroke incidence in the Greater Cincinnati and Northern Kentucky region, with special emphasis on stroke in the young and stroke recurrence.
Role: Biostatistician

Recently Completed Research Support

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 (9/1/17 - 6/30/19)
Retrospective epidemiological studies are often created using electronic health record databases. Although these records are "wide", they are not "deep" with respect to 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. This will solve the urgent problem of unconfounding for individual SES in the execution of EHR based research.
Role: PI

Internal Arnold W. Strauss Fellowship Award - Cincinnati Children's Hospital
Assessing Exposure to Air Pollution Across Time and Space
Brokamp, PI (7/1/16 - 6/30/17)
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 (1/24/17 - 6/30/17)
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