



**GEOMED 2022**  
UCI, October 12-14, 2022

## Abstract book - Poster presentations

### In-person posters

**Presenter (First Name, Last Name):** Gabrielle Benoit  
**Affiliation:** University of California, Santa Barbara  
**Title:** Household education and children's microplastic burden

#### **Abstract:**

Microplastics, or plastics that are less than 5mm, are ubiquitous. They are found in clothes, flooring, toys, and even blood. Microplastics can make their way into bodies through ingestion, inhalation, and dermal absorption. Given that health literacy and health behaviors are more attainable for certain populations with greater access to resources, I hypothesize that socioeconomic status (measured by household education) will be highly associated with the level of microplastics in children's urine. I will use the publicly available National Health and Nutrition Examination Survey (NHANES), years 2001 to 2016 to explore the relationship between socio-demographic characteristics and phthalate metabolites. Socio-demographic variables include: education, gender, age, and family income in relation to poverty guidelines. Urine samples measuring phthalates are available for ~22,000 participants. Key components in plastics are phthalates, which are chemicals that are used to make plastics flexible and durable. Microplastics are concerning due to their impact on health through gut microbial disruption. They are physically disruptive - impacting digestion of nutrients, they are vehicles for pathogens - transporting bacteria into the gastrointestinal tract, and they are chemically disruptive through their ability to mimic and alter the synthesis and function of natural hormones. I hypothesize that education, age, and income are correlated with microplastic burden, however, I predict that this is due to a more robust, resilient gut microbiome, that serves a more effective role as a gatekeeper to the negative health cascade that ensues as a result of microplastic exposure causing gut dysbiosis.

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**Presenter (First Name, Last Name):** Veronica J. Berrocal

**Affiliation:** University of California, Irvine

**Title:** How close and how much? Linking health outcomes to built environment spatial distributions

**Abstract:**

It is well known that built environment features may support or restrict health related behaviors and thus impact health. Here, we are interested in understanding whether the spatial distribution and quantity of fast-food restaurants (FFRs) influence the risk of obesity in schoolchildren. To achieve this goal, we propose a two-stage Bayesian hierarchical modeling framework. In the first stage, examining the position of FFRs relative to that of schools, we model the distances of FFRs from schools as realizations of Inhomogeneous Poisson Processes (IPP). With the goal of identifying representative spatial patterns of exposure, we model the intensity functions of the IPPs and cluster them using a Bayesian nonparametric approach. The second stage model relates exposure patterns to obesity. We offer two different approaches to carry out the second stage; they differ in how they accommodate uncertainty in the exposure patterns. In the first approach, the odds of obesity at the school level is regressed on cluster indicators, each representing a major pattern of exposure to FFRs. In the second, we employ Bayesian Kernel Machine regression to relate the odds of obesity to the multivariate vector reporting the degree of similarity of a given school to all other schools. Our analysis on the influence of patterns of FFR exposure on obesity among California schoolchildren has indicated that, in 2010, among schools that are consistently assigned to a cluster, there is a lower odds of obesity amongst 9th graders who attend schools with most distant FFR occurrences in a 1-mile radius compared to others.

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**Presenter (First Name, Last Name):** Renan Cai

**Affiliation:** University of Waterloo

**Title:** Mapping the spatiotemporal variation of small-area data between business days and Non-business days using Bayesian modelling: A case study of crime in Toronto

**Abstract:**

Non-business days (i.e., weekends and public holidays) usually present different patterns of human activities compared to business days. This may affect the spatial risk patterns of various issues, such as car accidents, acute diseases, and crimes. Understanding the distinctive patterns of such issues on non-business days can aid in effectively allocating resources to respond to or prevent the incidents. This study presents a method to map the spatiotemporal variation of small-area data between business days and non-business days using Bayesian modelling and investigates the crime patterns in Old Toronto, a district of high population mobility within the City of Toronto. Crime has detrimental effects on both individuals and society and violent crime can directly cause injuries. Knowledge of crime patterns is essential for planning police and emergency health services. This study analyzes two violent crimes (assault and robbery) and three property crimes (auto theft, break and enter, and theft over \$5,000) at the dissemination area level. For each crime type, the local temporal changes in small areas vary across the study region, but crime hot spots generally do not differ between business days and non-business days. Nevertheless, some areas that are considered

to be hot spots of assault, robbery or auto theft have significantly higher crime risks on non-business days compared to business days. Additionally, some sociodemographic characteristics (e.g., low income) and built environment factors (e.g., parks) are significantly associated with the spatiotemporal patterns of crime. These results provide implications for local police, health, and planning departments.

**Co-author:** Su-Yin Tan, University of Waterloo.

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**Presenter (First Name, Last Name):** Maria de Fátima De Pina

**Affiliation:** Fiocruz/Icict

**Title:** Trends and inequalities in the georeferencing of addresses in the Mortality Information System in Brazil, 2004 to 2019

**Abstract:**

**Background:** Analysis in micro areas are frequent in many epidemiology studies, but there are no studies analyzing the quality of address of health events. The aim of this study is to analyse inequalities in the georeferencing of addresses of deaths.

**Methods:** We georeferenced in the census tracts, the addresses of Brazilian mortality system (SIM) from 2004 to 2019 (n=19,248,977) using the Brazilian National Statistical Address Register, a database containing all addresses visited in each census tract in the 2010 Census. Each address was linked to the respective census tract.

**Results:** 13,732,411 (71%) addresses were successfully georeferenced, but there were strong geographic inequalities, being 79% for Southeast, 71% for South, 62% for Center-West, 62% for Northeast and 61% for North region.

The georeferencing increased with age, being respectively 64%, 70% and 74% for 0-19, 20-64 and 65+ years-old. The more educated, the higher success of georeferencing, being 67% for no education, 70% for elementary school, 74% for medium/high school, 76% for incomplete higher education and 79% for complete higher education.

Inequalities were found by color/race, being 76% for white, 67% for black/brown and 50% for indigenous and by socioeconomic status (SES), using tertile of Human Development Index, being 76% for the more affluent, 64% for medium and 58% for the more deprived municipalities.

**Discussion:** There are clear trends in the inequalities of georeferencing addresses showing that the missing addresses are not randomly distributed. Interpretation of results from epidemiological studies in micro areas must take these inequalities into account.

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**Presenter (First Name, Last Name):** Qianyu Dong

**Affiliation:** Wake Forest University

**Title:** Using Bayesian spatio-temporal models to optimize resource allocation for the opioid epidemic in North Carolina

**Abstract:**

The opioid overdose epidemic has been a severe public health issue. In North Carolina, the trends of the opioid overdose crisis were similar to the nation-wide trends, with opioid-related deaths and emergency department (ED) visits increasing substantially over the last decade. The state government developed and implemented the Opioid and Substance Use Action Plan (OSUAP) in 2017 to track opioid-related outcomes and to develop resources/strategies to help control the crisis. In this work, we develop a data-driven approach based on Bayesian spatio-temporal models to optimize resource allocation for the opioid epidemic in North Carolina. We quantify how changes in the resource structure influence opioid-related outcomes, and we identify which locations should have priority in receiving additional OSUAP resources. We first develop a Bayesian hierarchical model for illicit opioid deaths in each county in North Carolina. We use a Poisson autoregressive model to relate the changes in the rate of deaths to the changes in the amount of opioid-related resources. Our model accounts for socio-economic variables and controls unexplained spatial heterogeneity through an intrinsic conditional autoregressive random effect. We then use the proposed model to predict the number of deaths for future time periods under different resource schemes. We consider the resource allocation question to be a constrained optimization problem. Given a limited capacity of additional resources, we solve for the optimal addition of resources in each county that minimizes the overall predicted number of deaths.

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**Presenter:** María Eugenia García Fernández

**Affiliation:** University of Chile

**Title:** Geospatial location of young people between 15 and 29 years old exposed to cyberbullying and who declare to have symptoms associated with depression in Chile, years 2020 - 2021

**Abstract:**

**Introduction:** This study aims to determine if young people between the ages of 15 and 29 who are exposed to cyberbullying and have depressive symptoms, have differences and/or similarities between the regions of Chile. This study considers the adverse consequences on mental health (depression) of being exposed to digital environments and not necessarily physical spaces, where cyberbullying is experienced.

The study was carried out by the company StatKnows in collaboration with the Faculty of Psychology of the Universidad del Desarrollo and the Katy Summer Foundation, as part of a service to the Citizen Participation and Non-Discrimination Observatory.

**Methodology:** The initial study had a cross-sectional design, using self-reported data, collecting two independent samples for replication and comparison purposes. The samples were collected in December 2020 and December 2021.

The study used the sampling methodology of the company "StatKnows" for online surveys. This methodology employs artificial intelligence to efficiently identify participants based on publicly available information that is voluntarily provided by participants in previous studies. The sampling strategy was probabilistic and stratified with allocation proportional to the size of each stratum. The selection of the sample was carried out in two phases: the probability of being an Internet user was considered first and the probability of being a victim of cyberbullying second.

**Results:** Some results by region: nationwide, 47% of young people say they have been cyberbullied at least once. Within this group, 38% present major depressive symptoms and 10% minor depressive symptoms. The Metropolitan Region has a behavior similar to the results at the national level: 43% cyberbullied, 40% major depression and 10% minor.

The region with the most cyberbullied youth is Los Lagos with 62%, while the region with the fewest cyberbullies is the Biobío region with 42%.

The region that has the most young people with major depressive symptoms is Atacama with 68%, while the one with the fewest young people with major depressive symptoms is Los Lagos with 27%.

These geospatial data have served as input for public health communication campaigns and prevention, information and awareness initiatives and/or activities, focused mainly on audiences identified as more vulnerable or exposed to cyberbullying situations.

**Conclusion:** There are differences between some regions in the levels of cyberbullying and levels of major depression.

**Keywords or phrases:** Geospatial location, cyberbullying, depression.

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**Presenter (First Name, Last Name):** Catalina Medina

**Affiliation:** University of California, Irvine

**Title:** Determinants of exposure to Aedes mosquitoes: a comprehensive geospatial and ecological analysis in peri-urban Cambodia

**Abstract:**

Aedes mosquitoes are some of the most important and globally expansive vectors of disease. Public health efforts are largely focused on prevention of human-vector contact. A range of entomological indices are used to measure risk of disease, though with conflicting results (i.e. larval or adult abundance does not always predict risk of disease). There is a growing interest in the development and use of biomarkers for exposure to mosquito saliva, including for Aedes spp, as a proxy for disease risk. In this study, we conduct a comprehensive geostatistical analysis of exposure to feeding Aedes mosquitoes among a pediatric cohort in a peri-urban setting endemic to dengue, Zika, and chikungunya viruses. We use demographic, household, and environmental variables in a Bayesian geostatistical model to predict antibody responses to Aedes aegypti salivary gland extract (SGE). We found that hotspots of exposure to Ae. aegypti SGE were discrete and stable across the two-year study period. Age was negatively associated with antibody responses to Ae. aegypti SGE. We estimate those living in agricultural settings had lower antibody responses than those in urban settings, whereas living near recent surface water accumulation was associated with higher responses. Finally, we did not find evidence that measures of larval or adult density affect the

estimation of antibody response, given the other predictors. Our results indicate that targeted house- or neighborhood-focused interventions may be appropriate for vector control in this setting. Further, demographic and environmental factors more capably predicted exposure to *Ae. aegypti* mosquitoes than commonly used entomological indices.

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**Presenter (First Name, Last Name):** Nivedita Nukavarapu

**Affiliation:** Health Data at Scale Collaboratory, Department of Population Sciences, Beckman Research Institute, City of Hope

**Title:** GeoAI-based prediction of eating events in free-living individuals

**Abstract:**

**Background:** Eating behaviors are difficult to predict, but the ability to do so could result in useful mobile health (mHealth) interventions for weight loss and regulation of chronic disease risk. Currently, mHealth interventions focused on eating are based on a priori assumptions such as set times and locations when/where eating may occur. This research study presents a different approach by developing a geospatial artificial intelligence (GeoAI) informed algorithm for predicting the minute level likelihood of eating using body-worn sensor data joined with environmental features.

**Methods:** Data was pooled from three different studies of adults in San Diego County (n=209). Participants wore an accelerometer and Global Positioning System (GPS) on the hip for up to one week, and a camera around the neck (SenseCam), which collected images continuously. GPS data was joined with different environmental layers. All data were aggregated to the minute level. A GeoAI-based Gradient Boosting algorithm was applied to features for the prediction of minute level eating at the time of the event and 1-4 minutes leading up to the eating event.

**Results:** Model accuracy for predicting eating events at the time of the event was 74%, 2 minutes prior, 80%, and 4-minutes prior, 86%.

**Conclusions:** We showed that minute-level eating prediction is possible using passive sensors and that GeoAI aids in model accuracy. Results will be useful for designing future customized mHealth interventions.

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**Presenter (First Name, Last Name):** Emmanuel Roux

**Affiliation:** IRD, Universite' de Montpellier

**Title:** Malaria risk mapping in cross-border areas

**Abstract:**

Cross-border malaria is a major obstacle for malaria elimination » as stated by Wangdi et al. (2015). In residual transmission foci of the cross-border areas, the high spatial resolution risk mapping would help defining and/or evaluating context-dependent surveillance, control and elimination actions. High spatial resolution remote sensing (RS) permits to characterize the environment, landscape and human settlements independently of international limits. However, RS-based risk mapping of vector-borne diseases rarely specifies, in a complete and standard way, the underlying risk model. Here, we

propose to explicit the different risks, their links and determinants, to better specify and justify the malaria risk estimation process and better evaluate the results significance.

With the help of the actors involved in malaria surveillance and control in the region, we first built and formalized in Unified Modeling Language (UML) a systemic and holistic conceptual model of the malaria risks and their determinants. Then, spatialized and qualified indicators related to the presence probability of the main malaria vector in the region, the susceptibility of the landscape to favor human-vector exposure, and the human presence, density and activities, were combined by means of a multiplicative aggregation procedure.

The conceptual model permitted to our mapping approach to be better justified, positioned and qualified. We state this approach can help the RS-based risk mapping to actually enter the public health practice, by facilitating the understanding and informed interpretation of the method and results by the health actors, especially in cross-border contexts where RS data are particularly relevant.

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**Presenter (First Name, Last Name):** Jeffrey W. Rozelle

**Affiliation:** University of Southern California, Spatial Sciences Institute

**Title:** Probabilistically linking household surveys to health facilities and other geographic features

#### **Abstract:**

Access to quality healthcare remains a critical yet understudied challenge among low- and middle-income countries. Data collected through the Demographic & Health Surveys Program are nationally representative resources for studying health behaviors, burdens, and access. The geotagged Service Provision Assessment (SPA) is a granular tool capturing facility quality of care and readiness to provide healthcare and is routinely used to score facilities in essential service domains. The Demographic & Health Survey (DHS) is a household with detailed health information, but community locations are displaced to protect anonymity. While linking these data sources can inform how facility quality influences household-level indicators, survey displacement makes the linkage of data sources challenging.

Common practice has been to link displaced household data to facilities through buffers or to link all health facilities and displaced communities within an administrative boundary. When a community is linked to multiple health facilities, the health service environment is typically calculated as a simple average score of the linked facilities. These approaches are subject to notable shortcomings.

To mitigate shortcomings with existing techniques, I demonstrate a new method using SPA and DHS data from Haiti. Based on the probability density function for the DHS displacement algorithm, I create a raster with probability that a cell contains the true community location. I draw Thiessen polygons around each facility, and calculate the health service environment by taking a mean of health facility service readiness scores weighted by the probability that the true location falls within a facility's Thiessen polygon. This method may be a more useful linking technique for many analyses.

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**Presenter (First Name, Last Name):** Insang Song

**Affiliation:** University of Oregon

**Title:** Matching by Multivariate Similarity Matrix with Geographic Coordinates: Causal Inference of the Relationship between Residential Greenspace and Deaths by Mental Illness

**Abstract:**

Greenspace is considered an important factor to human mental health outcomes. Most observational studies for examining an effect of the exposure to greenspace to mental health outcomes rely on finding the association rather than causation. Causal inference methods can provide an alternative framework to derive a causal relationship between greenness and mental health from observation data. Based on matching methods that are a branch of causal inference implementation framework, this study aimed to estimate a causal effect of the greenspace exposure to deaths by mental illness. Jensen-Shannon divergence was used to measure the covariate and locational similarity between observations, which is an extension of a spatial weight matrix to the attribute space. The proposed approach was applied to the 2019 death registry in Oregon. Greenspace exposure was evaluated by satellite imagery for one-year or summer median enhanced vegetation index (EVI) values in 2018. I matched observations from groups with low (EVI 0.2; controlled) and high (EVI 0.5; treated) residential greenspace exposure. The residential exposure was operationalized as isochrones of 15-minute walking distance from each individuals' residential locations, which were extracted from the OpenStreetMap road networks. The effect estimates from the matched data using the suggested approach showed that the exposure to the greener environment lowered (odds ratio=0.48 and 0.57 for the one-year and summer median EVI, respectively) the occurrence of mental illness-derived deaths among the deceased population. The results contribute to expand our understanding of the positive impact of the greenspace exposure to mental health outcomes.

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**Presenter (First Name, Last Name):** Calvin Tribby

**Affiliation:** City of Hope

**Title:** Temporal patterns of walking physical activity and built environment exposures

**Abstract:**

**Background:** Environmental features supportive of physical activity (PA), such as walkability, are important to facilitate PA behavior change and maintenance. Research has examined walkability statically by summarizing environmental features in spatial extents around the home or within activity spaces; or dynamically, including duration of time in environments using space-time summary measures. However, by associating daily or weekly PA summaries with total walkability exposure, models are subject to potential spatial and temporal mismatch that may obscure the spatiotemporal link. The goal of this research is to examine distributions of minute-level walking PA with matched minute-level exposure to built environment walkability.

**Methods:** 602 adult participants from the Community of Mine study in San Diego County wore GPS and accelerometers for an average of 13 days. Walking was identified using the validated PALMS algorithm. Walkability was an index of intersection density, land use mix, and residential



population density on a 200x200m grid. First, we will compute daily empirical distribution functions (EDFs) for walking and kernel density estimation-based walkability exposure. We will test whether the EDF distributions are different using the 2-sample Kolmogorov-Smirnov test, adjusting for multiple comparisons. Second, for the entire sample, we will assess clusters of walking and exposure using support vector clustering to group individuals based on their temporal distributions of walking and exposure. Descriptive statistics of the groups will highlight potential demographic and spatial similarities between clusters.

**Conclusion:** By spatiotemporally matching minute-level walking behavior with walkability, we may more precisely characterize the relationship between behavior and environment.

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**Presenter (First Name, Last Name):** Helen Wilson

**Affiliation:** University of Warwick

**Title:** The risk of local transmission of Chikungunya in Canada via importation from travellers from endemic countries under projected climate scenarios

**Abstract:**

Chikungunya causes debilitating arthritic pain with symptoms which may last up to a couple of years and like many other arboviruses poses an increasing threat due to climate change expanding the habitat of their vectors. Until 2004, Chikungunya only caused occasional outbreaks in Africa and Asia, post-2004, it has rapidly spread through over 60 countries resulting in local transmission in continents which had never experienced it before. Chikungunya is carried by both *Aedes aegypti* and *albopictus*. However, *Ae. albopictus* is a greater concern as it has co-evolved with the Indian Ocean Lineage of Chikungunya to reduce the extrinsic incubation period and also has diapausing egg allowing it to tolerate milder climates. For local transmission to occur, alongside a stable population of the vector, introduction of the virus through travellers is required and many cases are asymptomatic (3-28%) meaning travellers may not be aware that they are carrying it. Canada has had a stable population of *Ae. albopictus* in Southern Ontario since 2018. This project explores the risk of local transmission of Chikungunya occurring in Canada from importation from endemic countries under different climate scenarios (Representative Concentration Pathway 4.5 and 8.5) by using a tau-leap metapopulation model and historical and projected mean monthly minimum temperature data from 2008-2100 alongside world flight data from 2015-2017. This model considers the role of asymptomatic transmission alongside the role of vertical transmission within the vector and whether surveillance at specific airports may be sufficient to halt the spread of Chikungunya.

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**Presenter (First Name, Last Name):** Jiue-An Yang

**Affiliation:** City of Hope

**Title:** Exploring the impact of the COVID-19 pandemic among medically underserved areas/populations

**Abstract:**

**Background:** Medically Underserved Area/Population (MUA/Ps) are designated by the Health Resources and Services Administration as lacking primary care providers, high infant mortality, high poverty rate, or with high elderly population. While disparities in rates of COVID-19 infections and vaccination have been recorded in racial and ethnic minorities, we do not know if such disparities were seen in populations residing in MUA/Ps.

**Methods:** Preliminary analysis was conducted for a subset of California MUA/P (n=37) and non-MUA/P (n=186) census tracts in Southern and mid-Northern California. American Community Survey (ACS) data was used to assess socio-demographic differences between MUA/Ps vs. non-MUA/Ps. ZIP code vaccination and case counts aggregated by race/ethnicity were obtained through the UC Health-CDPH COVID Modeling Consortium for dates 03/17/2020 to 07/27/2021 to study COVID-19 trends. ZIP codes were determined to be in MUA/Ps if their centroid was in an MUA/P.

**Results:** Compared to non-MUA/Ps, MUA/Ps had fewer households with broadband internet, higher percentage of people employed in services and sales roles, and higher rates of public insurance. MUA/Ps had higher COVID-19 case rates (10,760 vs. 7,858; per 100,000 people) despite having similar vaccination rates (41,651 vs. 43,631 for 2-dose vaccines; 2,466 vs. 1,841 for 1-dose vaccine). For both MUA/Ps and non-MUA/Ps, Hispanic/Latino had the highest COVID-19 case rates while Asian being the lowest. For vaccination, African American population were least-vaccinated regardless of MUA/P status. The analysis will be extended to all of California.

**Conclusions:** Because MUA/Ps offer distinct geographical boundaries, understanding pandemic-related disparities in these regions may allow for more targeted prevention and treatment efforts in future crises.

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## Remote posters

1.

**Presenter (First Name, Last Name):** Satwik Acharyya

**Affiliation:** University of Michigan

**Title:** SpaceX: Gene co-expression network estimation for spatial transcriptomics

**Abstract:**

The analysis of spatially-resolved transcriptome enables the understanding of the spatial interactions between the cellular environment and transcriptional regulation. In particular, the characterization of the gene-gene co-expression at distinct spatial locations or cell types in the tissue enables delineation of spatial co-regulatory patterns as opposed to standard differential single gene analyses. To enhance the ability and potential of spatial transcriptomics technologies to drive

biological discovery, we develop a statistical framework to detect gene co-expression patterns in a spatially structured tissue consisting of different clusters in the form of cell classes or tissue domains. We develop SpaceX (spatially dependent gene co-expression network), a Bayesian methodology to identify both shared and cluster-specific co-expression network across genes. SpaceX uses an over-dispersed spatial Poisson model coupled with a high-dimensional factor model which is based on a dimension reduction technique for computational efficiency. We show via simulations, accuracy gains in co-expression network estimation and structure by accounting for (increasing) spatial correlation and appropriate noise distributions. In-depth analysis of two spatial transcriptomics datasets in mouse hypothalamus and human breast cancer using SpaceX, detected multiple hub genes which are related to cognitive abilities for the hypothalamus data and multiple cancer genes (e.g. collagen family) from the tumor region for the breast cancer data.

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2.

**Presenter (First Name, Last Name):** Tatiane Bahia Do Vale Silva

**Affiliation:** Fundação Oswaldo Cruz and Universidade Do Estado Do Pará

**Title:** Admission and lethality trends for ambulatory care sensitive condition (ACSC) in primary care in the state of Pará from 2008-2017

**Abstract:**

This study aims to describe the sociodemographic characteristics of Hospitalizations of Sensitive Conditions to Primary Care (ACSC) of elderly people living in the state of Pará, and evaluate the association between hospitalization and lethality trends by ACSC with social vulnerability variables and primary care coverage (CAB) in the state of Pará in the years 2008 to 2017. This is an ecological study that used secondary data from the Hospital Information System (SIH-SUS), the E-Manager System and the Social Vulnerability Index (IVS-IPEA). In the period investigated, ACSC accounted for 45% of admissions, with males and long-lived elderly being the most affected. The fatality rate at 6%. The results showed an association between ACSC, CAB and IVS-IPEA, with infectious gastroenteritis and complications as the main ACSC group, and ACSC rates with heterogeneous distribution among municipalities, factors that highlight the need for actions focused on interventions for primary health care, aimed at this age group.

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3.

**Presenter (First Name, Last Name):** Thibault Catry

**Affiliation:** IRD/UMR Espace-Dev

**Title:** Predicting Tiger mosquito breeding sites through Earth Observation and statistical analysis

**Abstract:**

Reunion Island is a densely populated French region of the Indian Ocean. There, the Asian Tiger mosquito, *Aedes albopictus*, is the main vector of arboviroses such as dengue and chikungunya. Recently, vector control services have been collecting in situ data on potential breeding sites

covering about 10% of the districts of the island. This study investigates the capability of environmental features extracted from earth observation data to be used in predicting the distribution of potential breeding sites of *Ae. albopictus* in Reunion Island. Spectral indices (NDVI, NDWI and Brightness index) were calculated from a very-high spatial resolution Pléiades mosaic of 2020 images over the island, while data on the annual cumulative rainfall and the annual average temperature were obtained from the Météo-France / CIRAD network. Textural information over urban areas was also extracted from the Pléiades mosaic. Corresponding textural indices highlight different district typologies based on spatial arrangements between buildings and vegetation. For each district, we analyzed the correlations between i) the number of potential observed breeding sites and ii) the mean values of textural and spectral indices, as well as the mean precipitation and annual temperature, through both univariate and multivariate analysis; the most significant variables were eventually combined using a generalized linear model. We found that the correlation between those combined variables and in situ data on breeding sites of *Ae. albopictus* is significant. This statistical relationship makes it possible to use earth observation environmental variables as predictors of the number of potential breeding sites for all areas in the island.

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#### 4.

**Presenter (First Name, Last Name):** Jonelle Campbell

**Affiliation:** Medical College of Wisconsin

**Title:** Associations among neighborhood green space, air pollution and sleep duration in children: Evidence from the Survey of the Health of Wisconsin

#### **Abstract:**

**Introduction:** Sleep plays an important role in child health and is affected by neighborhood physical and social environments. Neighborhood green space and air pollution have received little attention in relation to sleep among children. This study examined relationships between both neighborhood green space and air pollution ( $PM_{2.5}$ ,  $O_3$ ) and sleep duration in children.

**Methods:** Survey data was obtained from the Survey of the Health of Wisconsin (SHOW) database (n=482) and linked to air pollution data from EJSCREEN (2014-2016) and landcover data from the Wisconsin Department of Natural Resources (2010-2014). Participants included Wisconsin residents ages 3-17. Survey regression analysis was used to examine the relationship between green space (percent forested or grassland areas, in three equal interval categories),  $PM_{2.5}$ , and  $O_3$  and the outcomes of healthy weekday and weekend sleep duration, as defined by the National Sleep Foundation, controlling for covariates.

**Results:** There is a small but significant relationship between percent green space as a continuous predictor and healthy weekday sleep duration (OR 1.011 [1.00, 1.02]) but not weekend sleep duration (OR 1.005 [0.99, 1.02]) in adjusted models. Fully adjusted models showed no statistically significant relationship between  $O_3$  or  $PM_{2.5}$  and weekday/weekend sleep duration.

**Conclusions:** Neighborhood green space may be associated with healthier weekday sleep duration in children and is one neighborhood level intervention that may be useful in ensuring that children meet daily sleep recommendations.

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5.

**Presenter (First Name, Last Name):** Nicole Dear

**Affiliation:** Michigan State University

**Title:** Racial residential segregation and sexually transmitted infections during pregnancy in the Detroit Metropolitan Area: 2015-2019

**Abstract:**

Sexually transmitted infections (STIs) remain pervasive in the United States, despite the availability of safe and effective treatments. Black women are at substantially higher risk of STIs compared to White women of similar age groups. Racial residential segregation, defined by the dimensions of racial unevenness and isolation, may confine Black women to neighborhoods of high infectious disease transmission. Furthermore, concentrated poverty and limited resources in segregated neighborhoods may exacerbate conditions that drive racial and ethnic disparities in STIs. We assessed the relationship between segregation and racial disparities in STIs among women who gave birth in the Detroit Metropolitan Area, 2015-2019. Individual women with a STI or treated for a STI (chlamydia, gonorrhea, syphilis, herpes) at the time of her infant's birth, and residence at birth were evaluated using the Michigan Vital Statistics Birth records, 2015-2019. Black exposure/isolation at the census tract level and Black/White dissimilarity at the township level was calculated using the American Community Survey 2015-2019 estimates to represent the timing of women's prenatal exposure. Multi-level logistic regression models were estimated to evaluate the effect of these segregation indices on the odds of STIs, independently and jointly, adjusting for potential individual and area-level confounding. The findings from this study will inform the State's STI program to reduce STI incidence and improve Black women's health in Michigan's largest metropolitan area. These findings will also inform a future study on STIs and preterm birth, to reduce racial disparities in adverse birth outcomes in Michigan and the United States.

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6.

**Presenter (First Name, Last Name):** João Pedro Lima

**Affiliation:** Federal University of Espírito Santo and Sao Paulo State University

**Title:** COVID-19 in Brazil: The role of hierarchy diffusion and the urban network

**Abstract:**

Emerging and re-emerging infectious diseases are one of the major challenges of health care systems in the globalized world. COVID-19 emerged in 2019 and quickly becoming pandemic, affecting most countries in the world by 2020. The provisory outcome of this pandemic - spread of diffusion, cases and deaths - are related to several components, such as sociopolitical engagement and the use of scientific evidence to drive public policy. Space components such as distance and hierarchy of urban centers modulates the diffusion of disease and reveals the main paths from past and present pandemics. This study investigates the paths and diffusion types made by COVID-19 in Brazil using spatial analysis. Study period derives from February 2020 to October 2021 (608 days). We've used the municipalities and epidemiological weeks as spatial and temporal units. The

COVID-19 data was provided by Brasil.IO, an open access database. We've mapped the date of the first reported cases and death by municipality, the total number of cases and deaths in the period and the hierarchy level of the municipality. The Hierarchy level is provided by the Brazilian Institute of Geography and Statistics. The analysis of diffusion was made by interpolating municipalities' first case and deaths with Inverse Distance Weighted. The interpolation was performed using the inverse distance squared weighted ( $p=2$ ) with a minimum of 8 neighbors and a maximum of 12. As result we identified a strong association between urban hierarchy and the diffusion of COVID-19 in Brazil, with regional differences especially in the Amazon.

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7.

**Presenter (First Name, Last Name):** Aynaz Loftata

**Affiliation:** Chicago State University

**Title:** Assessing association between obesity prevalence and neighborhood determinants using spatial machine learning in Chicago, Illinois, USA

**Abstract:**

Some studies have established relationships between neighborhood conditions and health. However, they neither evaluate the relative importance of neighborhood components in increasing obesity nor, more crucially, how these neighborhood factors vary geographically. We use the geographical random forest to analyze each factor's spatial variation and contribution to explaining tract-level obesity prevalence in Chicago, Illinois, United States. According to our findings, the geographical random forest outperforms the typically used non-spatial Random Forest model in terms of the out-of-bag prediction accuracy. In the Chicago tracts, poverty is the most important factor, whereas biking is the least important. While poverty appears to be the most important predictor in the city's south, crime is the most critical factor in explaining obesity prevalence in Chicago's south suburbs. For policy planning and evidence-based decision-making, our results suggest that social and ecological patterns of neighborhood characteristics are associated with obesity prevalence. Consequently, interventions should be devised and implemented based on local circumstances rather than generic notions of prevention strategies and healthcare barriers that apply to Chicago.

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8.

**Presenter (First Name, Last Name):** Camila Lorenz

**Affiliation:** University of Sao Paulo, Brazil

**Title:** Spatiotemporal Bayesian modelling of scorpionism in the state of São Paulo, Brazil

**Abstract:**

Background: Scorpions stings in Brazil represent a major public health problem not only because of their incidence but also for their potential ability to induce severe clinical situations, especially among children and elderly people. Thus, our study aimed to model scorpionism in Sao Paulo

state (SP) using a spatiotemporal Bayesian approach and to investigate its relationship with demographic, socioeconomic, environmental, and climatic variables. **Methods:** This is an ecological study with secondary data on scorpion accidents in SP from 2008 to 2018 obtained from the Notifiable Disease Information System. We used the Integrated Nested Laplace Approximation (INLA), coupled with the Stochastic Partial Differential Equation method to elaborate a model to detect the areas and periods with most suitable conditions for scorpionism. **Results:** The risk of occurrence of scorpion stings increased continually from 2008 to 2018, with higher values in spring and lower values in autumn. From 2008 to 2018, the RR increased from 0.62 to 4.21, almost six times higher. It was possible to see that the regions with higher rates of scorpion accidents (located in general in the western, northwestern, and northern of SP) are the regions with higher temperatures, lower incidence of rain, and lower presence of natural vegetation. **Conclusions:** By capturing the local and temporal relationships across the space and time, the authorities can design more effective, locally and temporally specific strategies. This understanding is especially important where the control and prevention resources are limited.

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9.

**Presenter (First Name, Last Name):** Chelsea Lyons

**Affiliation:** University of Waterloo

**Title:** Violence as a public health issue: The role of crime prevention through environmental design

**Abstract:**

The impact of violence is felt around the world, causing adverse outcomes which can be long-term and affect quality of life – yet violence is preventable. The built environment can influence opportunities for violent crime; however, public health implications are seldom considered. Altering the built environment has potential to reduce violence and promote healthy living. This study investigates the intersection of the built environment, violent crime and community health using regression models and exploratory spatial statistics within the City of Toronto, Canada, to better understand the influence of the built environment on violence and the implications for public health. Using spatial regression models, violent crime and community health are shown to be spatially dependent at the dissemination area level, a small census geographic unit of analysis. In addition, built environment features related to mobility and transit are found to be significantly associated with violent crimes. The inclusion of community health data revealed that violence and most built environment features are also significantly associated with each of the community health variables: perceived health, perceived life stress, sense of belonging to local community, and satisfaction with life. The results from this study contribute to addressing the knowledge gap between crime, built environment and public health. Policymakers and urban planners can incorporate the insights from this research in policies and urban design to control violent crime and foster positive health outcomes.

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10.

**Presenter (First Name, Last Name):** Dennise Rodríguez

**Affiliation:** Universidade de Brasilia

**Title:** Health as commodity and necessity: A geographical overview from two Latin-American border regions

**Abstract:**

Health is an irreplaceable good for humanity. In order to acquire, maintain or improving health, and in a global context of weakening of state institutions, many people is searching health services beyond borders. Borders are spaces that offer a broad empirical possibility to address aspects that coexist in so-called spaces of exception, and when the main theme is health services, borders have various simultaneous processes, such as migration due to humanitarian crises, purchase of trip packages to obtain medical services and cross-border search of medical care. But even these phenomena are unequal for North and Global South.

This work reviews the diversity of health mobilities in two Latin American border regions, Northern Mexico and Northern Brazil. A systematic bibliographic review was used to understand the multiple dynamics related to health services occurring in these regions. Results show that in Northern Mexico prevails the commodification of health, as it is offered for Americans and Canadians -which have a higher payment capability-; but, in contrast, health prevails mostly as a public good that is searched even by citizens of other countries in Northern Brazil. Among the conclusions of the research, the need to build a theoretical and methodological basis to study these mobilities related to health is argued.

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11.

**Presenter (First Name , Last Name):** Immad A. Shah

**Affiliation:** Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir

**Title:** An approach to preliminary detection and confirmation of potential outliers using R: A case of false suspicion of outliers in data

**Abstract:**

In order to verify, regulate, and monitor processes, it is critical to use visual as well as analytical tools to identify outliers. The root cause analysis of a possible outlier should be done using analytical approaches to establish if a suspect point is indeed an outlier and whether it should be deleted from the data set. While outliers can be spotted visually, they can also be identified analytically, hence this study aims to draw a line between the two methods in order to prevent misinterpretation and "legitimately" classify a dubious observation as an outlier.

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12.

**Presenter (First Name, Last Name):** Chih-Chieh Wu

**Affiliation:** National Cheng Kung University, Taiwan

**Title:** Spatially varying effects of measured confounding variables on disease risk

**Abstract:**

Considerable spatial variability in incidence intensity suggests that risk factors are unevenly distributed in space and influence the geographical disease incidence distribution and pattern. As most human common diseases are complex traits and as new factors associated with increased risk are discovered, statistical spatial models are needed that investigate geographical variability and heterogeneity in the association between disease incidence and confounding variables and evaluate spatially varying effects on disease risk related to known risk factors. We proposed a statistical spatial model that incorporates information on known risk factors, previously detected geographical disease clusters of peak incidence and paucity of incidence, and their interactions as covariates into the framework of interaction regression models. The spatial scan statistic and the generalized map-based pattern recognition procedure that we developed in 2020 were both considered for geographical disease cluster detection.

We exemplified the proposed method by analyzing data on the spatial occurrence of sudden infant death syndrome with confounding variables of race and sex in North Carolina in 1970s.