Iowa Summer Institute in Biostatistics

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Iowa Summer Institute in Biostatistics Presentations

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A Lane Position Analysis of Drivers with Parkinson's Disease Given a Distractor Task via Driving Simulator

Driving is a staple of transportation in most of the United States and in many other parts of the world, especially in places where public transportation is not widely available. Older adults with cognitive impairments, such as Parkinson's Disease (PD), may be more at risk for accidents while driving. It is important to monitor the driving of people with PD to determine if and when their driving privileges should be reduced or revoked. Due to the high complexity and high frequency of data collected from driving simulators, it is necessary to summarize these data so that meaningful metrics can be calculated. For this study (Year 1), 71 subjects with PD and 65 control subjects drove on a curved route using the Simulator for Interdisciplinary Research in Ergonomics and Neuroscience (SIREN) owned by the University of Iowa. We extracted 2 sections of 1500 frames (about 50 seconds a piece) from each subject to reduce the data; one straight-away section with no distraction and another section where the subject was given a distractor task. We then defined and calculated four metrics that would reduce each segment into individual metrics summarizing the subjects' lane position at any given time during those sections. These metrics were analyzed to determine if they were affected by the presence of a distraction and if the effect of the distraction varied between PD subjects and controls. It was found that the distractor task had no effect on the metrics, but PD subjects were more varied with their lane position than controls. Furthermore, several subjects from Year 1's PD group returned two years later and were retested on the same simulated route. We analyzed this data (Year 3) and found that PD subjects in Year 3 made more lane crossings than in Year 1.

Mentors of Research Group
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Terraforming the Teenage Wasteland: Youth Violence, Mental Health, and State Policy

Youth violence in the United States is common and is associated with numerous adverse academic, health, and psychosocial outcomes. Programs aimed at preventing youth violence have shown only modest success. Consequently, researchers have begun exploring additional primary prevention strategies that can augment existing programs, including anti-bullying policies. Though all 50 states have enacted some type of anti-bullying legislation, there is a striking dearth of research on the efficacy of such laws in preventing bullying, other forms of youth violence, and adverse mental health effects. In order to begin to address this deficiency, we will perform analyses based on individual-level survey data supplied by the Youth Risk Behavioral Surveillance System (YRBSS) in conjunction with a comprehensive legal dataset that codifies anti-violence laws (and amendments) from their inception in 1999 through 2017. In addition to considering the efficacy of anti-bullying legislation, we also evaluate the impact of individual-level risk factors.

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Too Hot to Handle: An Assessment of the Relationship Between Heat Waves and Criminal Activity

Heat waves are the leading cause of death among natural disasters in America. While the effect that they have on physical health has been studied, the consequences on human behavior have not been extensively explored. This project investigated the trends, if any, between heat waves and number or types of crimes committed in small U.S. cities. By definition, a heatwave is present during a period of two or more consecutive days for which the daily maximum temperature is beyond the historical 95th percentile for the region of interest. In this observational study, we used location-based data of incident reports on various categories of violent and non-violent crimes reported to local police departments over a twelve-year period in Iowa City, IA, Charleston, SC, and McKinney, TX. Daily recorded temperature maximums from local weather stations in these locations were used to identify the occurrences of summer heat waves in the months of June, July and August of each year. Using statistical methods such as Poisson regression, we assessed the relationship between the frequency of crimes and daily temperatures. While neither Iowa City nor McKinney yielded statistically significant results, Charleston demonstrated a negative association between number of assaults and both heatwaves and temperature as a continuous variable.

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Prognostic Factors for T1 High Grade Bladder Cancer Recurrence and Estimation of Overall Survival between Induction Recurrence vs Cystectomy

Patients with high grade T1 bladder cancer are at high risk for disease recurrence, which is a major determinant of long-term outcome. The 2016 American Urological Association guidelines for treatment of patients with recurrent disease after an intravesical treatment course of bacillus Calmette-Guerin (BCG) recommend removal of the urinary bladder (cystectomy). However, with the advent of newer treatment options, the dilemma for urologists is how to select patients for bladder-conserving therapies versus more aggressive but dramatically more quality of life-impactful radical cystectomy. For this project, recurrence-stratified Prentice Williams Pearson (PWP) and Kaplan Meier methods were employed to identify prognostic factors of recurrence, and assess the efficacy of both immediate and delayed radical cystectomies against continued therapeutic management in terms of survival over time. Of the factors studied age was to be found reliably prognostic, along with the less reliable prognostic factors of urethral cancer grade, performance of a re-resection, and time from previous recurrence. In addition, continued induction treatments were found to provide a measurable increase in survival probability as opposed to both types of cystectomies, which were indistinguishable from each other.

Mentors of Research Group
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Spatio-Temporal Risk for Infantile Hypertrophic Pyloric Stenosis Among a Cohort of Iowa Births

Infantile Hypertrophic Pyloric Stenosis (IHPS) is a rare condition that causes gastric outlet obstruction and projectile vomiting in infants through the thickening of muscles in the pyloric sphincter. We analyzed several genetic and environmental (broadly defined) antecedents among a 15-year cohort of births across the state of Iowa. Using records from infants who had surgery to correct IHPS, and a 10% sample of live births, we plotted various maps over time that are stratified by various factors in order to show the estimated prevalence of the condition. Odds ratios and confidence intervals were calculated using a simple logistic regression model for selected covariates. Additionally, we utilized a generalized additive model (GAM) in order to examine how an infant's odds of having IHPS changes depending on various factors, including birth residence and year. We observed that the odds of having IHPS on newborn males is 5.16 (95% CI: 4.40, 6.06) times the odds of having IHPS on newborn females. Also, for each additional year in time, we observed a decrease of 3% in the expected odds of having a case of IHPS. These results have implications on how the selected antecedents of IHPS affects risk and how risk is changing over time.

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Inadequate Sleep and Unhealthy Metabolism: Insights from the National Health and Nutrition Examination Survey

Many recent studies have shown that sleep is an important determinant of human health. However, the relationship between sleep and metabolism is less well understood. This research investigates and quantifies the impact of sleep on metabolism using a stratified cluster data sample collected by the National Health and Nutrition Examination Survey (NHANES). Using complex survey sample analyses, we can identify relationships between sleep timing and/or duration and metabolic health through regression models. Our research measures metabolism by BMI, cholesterol levels, blood pressure, among other metabolic markers. Our results conclude that sleep (while adjusting for age, race, gender, and annual income) has an impact on a number of metabolic markers. The question of their clinical significance provides a framework for further research.

Mentor of Research Group

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Modeling Lyme Disease in Iowa

Lyme disease rates have been on the rise nationwide and captured national attention. The severe and long-lasting effects produced from Lyme disease as well as the complex transmission paths and life cycles of the infectious organisms all motivate further study of this topic. Ticks are the primary disease vectors, and they infect dead end hosts such as humans and dogs as well as reservoir hosts such as mice during several stages of their life cycles. This project examines Lyme disease over time and space within the state of Iowa and explores the effect of weather events such as precipitation, evaporation, and temperature on the spread of human disease. To do this, we built time series models of Lyme incidence and produced maps to explore the spatial distribution of cases. In addition, we explored the forecasting ability of temporal statistical models.

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Evaluating the Impact of Timing of Therapy on Tuberculosis Risk in HIV Patients

For individuals that have contracted HIV, the recommended treatment is antiretroviral therapy, or ART. In 2014, a randomized controlled trial was conducted in Haiti to confirm that early initiation of ART was effective on the risk of tuberculosis (TB) (Collins et al. 2015). However, due to limited resources, low to middle income countries cannot afford to initiate therapy until the patients fall below the guideline set by the World Health Organization (WHO). The optimal time to treatment is unknown, and thus, the focus of this project was placed on evaluating the impact of timing of ART on TB incidence using subgrouping analyses. It was found that patients who wait longer for ART initiation based on the WHO guideline are more likely to have a higher risk of TB. Further investigating whether the timing of ART initiation is associated with characteristics of patients at baseline, it was confirmed that patients with higher CD4 cell counts and hemoglobin are more likely to receive therapy later. These results imply that, based on the WHO guideline, healthier patients in Haiti are more likely to receive ART later, and thus, are at a greater risk of contracting TB.

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