IOWA | Department of Biostatistics

Iowa Summer Institute in Biostatistics

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2024 Iowa Summer Institute in Biostatistics Presentations

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Mapping Breast Cancer Risk Factors in Iowa

According to the Iowa Cancer Registry 2024 Cancer in Iowa Report, Iowa continues to have the second-highest and fastest-growing rate of new cancers in the U.S. The purpose of this study is to identify potential factors that may contribute to the increasing incidence of breast cancer amongst females in Iowa relative to their geographic location. This study assesses the association between binge drinking, obesity, a sedentary lifestyle, fertility, level of education, and race on the age-adjusted breast cancer rate in each Iowa county. The correlation methods used to associate factors and growing breast cancer rates are Pearson's correlation, estimated marginal means, and multiple regressions. Moran's I, geographically weighted regression, and conditional autoregression are used to assess spatial relations between each factor and breast cancer rates. The data was analyzed using RStudio. Each factor variable was found to be significantly correlated with breast cancer rates individually and in a multivariate model. The correlations identified in this study provide a basis for future research to reduce the rising incidence of breast cancer.

Dr. Jacob Oleson, Professor, Dept. of Biostatistics, University of Iowa

Madelyn Popp
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Factors Influencing Post-Resuscitation Survival and Neurologic Function for Out-of-Hospital Cardiac Arrest

Roughly 350,000 Americans experience out-of-hospital cardiac arrest (OHCA) annually. OHCA is unfortunately associated with very poor survival rates, with the majority of victims perishing in the pre-hospital setting. However, a substantial proportion of OHCA-related deaths occur in hospitalized patients following the return of spontaneous circulation (ROSC) (i.e., during the post-resuscitation phase), since resuscitated patients remain at risk for anoxic brain injury and multi-organ failure.

For this project, using data from the Cardiac Arrest Registry to Enhance Survival (CARES), we will investigate the factors that impact post-resuscitation survival and neurologic function for patients experiencing OHCA. We will consider the following sets of explanatory variables: (1) patient factors (age, sex, medical comorbidities, race), (2) cardiac arrest characteristics (location of arrest, arrest witness status, first rhythm type), (3) bystander response (bystander automated external defibrillator, CPR use), (4) EMS response (on-scene time), and (5) hospital-level interventions (coronary angioplasty, targeted temperature management). We will characterize the associations between the dichotomous outcomes of interest and the explanatory variables using logistic regression, and employ our models to estimate the probability of survival and positive neurologic function based on hypothetical patient profiles.

Dr. Joseph Cavanaugh, Professor, Dept. of Biostatistics, University of Iowa
D. Erik Boonstra, Graduate Student Mentor, Dept. of Biostatistics, University of Iowa

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Radionuclide therapy and immortal time bias in patients with neuroendocrine tumors

Peptide receptor radionuclide therapy (PRRT) is a promising cancer treatment approved in Europe and recently in the US. This research focuses on finding an unbiased evaluation of the benefits of PRRT. The challenge with analyzing this survival data is the varying treatment times among patients if they even received it at all. Failing to properly consider this could lead to immortal time bias, a period during which the outcome of interest cannot occur for some patients. Additionally, the issue of censoring happens when researchers have incomplete information about a subject's survival time as they can't observe the death of some subjects before the study ends. We used a Cox proportional-hazards model to compare the chances of survival for patients on PRRT versus those not on PRRT. Our analysis accounts for the constraints of time-to-event data, in addition to that we examined the impact of metastasis on a patient's survival. We find that PRRT reduces the risk of death by 37% ($p = 0.03$).

Dr. Patrick Breheny, Professor, Dept. of Biostatistics, University of Iowa
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Exploring Electrodermal Activity Through Genetic Algorithms as a Proxy for Engagement in Learning Activities

In education research there has been ongoing interest in quantifying how individuals are engaging with activities in a learning environment. In particular, researchers have been investigating the use of electrodermal activity (EDA) in the skin as a proxy for learning and engagement. The University of Iowa's Department of Neuropsychology conducted a video recorded experiment on 20 participants who were each given three tasks: a mathematical task, a language task and an algorithmic task. Our contribution to this research is (1) assessing the effectiveness of a genetic algorithm in detecting structural breaks and (2) assessing possible relationships between intellectual humility and approximate entropy in EDA time series. We found the genetic algorithm to be effective in recognizing structural breaks that corresponded to thinking, frustration, movement, and response to feedback. Approximate entropy of the EDA time series was found to be negatively correlated with intellectual humility. The results of this research holds the potential to make learning more accessible by helping instructors to understand whether or not they are engaging their students and whether or not their students' frustrating reactions during learning could be used to inform teaching pedagogy.

Dr. Gideon K. D. Zamba, Professor, Dept. of Biostatistics, University of Iowa

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Predicting Antibiotics Usage for Improved Healthcare-Associated Infection Risk Assessment

Healthcare-associated infections (HAIs) impact an estimated 1 in 31 hospital patients and 1 in 43 nursing home residents. Many HAIs are caused by pathogens resistant to antibiotic treatments, while other HAIs arise from antibiotics suppressing probiotics (helpful microorganisms). One prevalent example of the latter is Clostridioides difficile (C. difficile), which in 2017 led to 223,900 infections and 12,800 deaths in the U.S. To prevent further harm, it is imperative to develop a better understanding of how these pathogens are transmitted within healthcare facilities, especially in relation to antibiotic usage.

This research implements machine learning techniques to build predictive models for medical prescriptions of antibiotics found to lead to high C. difficile infection risk. These models were trained on over 26 million hospital encounters from the Premier Health database, using patient demographics, procedural codes, Elixhauser comorbidity indices, and diagnosis-related groups as predictor variables. These predictive models, which have the advantage of overcoming inherent imbalance issues in the dataset, can be used to predict antibiotic usage in other large claims databases that do not contain antibiotic information, but that do contain information on other vital data elements such as facility level information. Such results could then be used to more accurately represent antibiotic prescription patterns, with some potential use cases being improved agent-based models of regional HAIs and better assessments of healthcare facilities' risk of importing HAIs.

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Burnout Among Servicemen: A Case of the Russian-Ukraine War

Burnout is a syndrome that causes emotional exhaustion among working individuals due to repeated stressors. Over time, burnout can lead to mental health consequences, short-term memory loss, decreased professional efficiency, and chronic cardiovascular issues. The intent of this study was to understand the primary causes of burnout from a range of factors such as age, participation in special forces, and religion. The dataset consists of 404 soldiers from Ukraine and three assessment tools, Burnout Assessment Tool (BAT), Basic Psychological Need Satisfaction and Frustration scale (SAT), and Interpersonal Guilt Rating Scales (IGRS). Poisson Regression, Multinomial Regression, and Logistic Regression were used to analyze the survey data. Contingency analyses were used to compare categorical variables and assessment questions. It was found that religion, length of service, age, and specialized combat roles had significant effects in predicting burnout among soldiers. Overall, this study suggests that soldiers are vulnerable to burnout and military personnel should be aware of its damaging effects.

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