UNIVERSITY OF SOUTH CAROLINA
College of Pharmacy

Dear Selection Committee,

I am writing to apply for participation in the NBER Digital Economics and AI Tutorial. I am a Ph.D. candidate in Pharmaceutical Sciences at the University of South Carolina College of Pharmacy, where I began my doctoral studies in **Spring 2023**. My research focuses on health economics and outcomes research, pharmacoepidemiology, and the application of machine learning and causal inference to real-world healthcare data.

1. Course of Graduate Study

My graduate training provides a rigorous interdisciplinary foundation in advanced quantitative methods, health economics, and real-world data analytics. Through coursework such as Pharmacoeconomics Principles, Pharmacoepidemiology, Intermediate Biometrics, Social Epidemiology, Managerial Economics, Database Development, Implementation Science, and Deep Reinforcement Learning, I have developed strong expertise in economic evaluation, causal inference, and machine learning. This comprehensive methodological preparation enables me to conduct high-quality empirical research at the intersection of digital health, AI, and policy-relevant economic analysis.

2. Research Interests

- **Machine Learning and Causal Inference with Real-World Data**

My research integrates machine learning (ML) and causal inference to transform real-world data into reliable, actionable evidence for healthcare decision-making. I utilize advanced methods, such as double/debiased machine learning (DML) and causal forests, to draw causal conclusions from complex observational and administrative health data. By using multiple real-world data sources, including U.S. national surveys, Medicare and Medicaid claims, and disease registries, I aim to uncover causal effects and evaluate how clinical, demographic, and social determinants jointly influence patient outcomes. For example, my study titled “Causal Effect of Conventional Anti-dementia Drugs on Economic Burden: An Orthogonal Double/Debiased Machine Learning Approach,” published in BMC Geriatrics, demonstrated the causal relationship between anti-dementia drug use and the resulting economic impact among patients with dementia.

- **Economic Evaluation and Cost-Effectiveness Analysis**

My research also encompasses economic evaluation and cost-effectiveness analysis, focusing on quantifying both the clinical benefits and economic consequences of pharmacological interventions. Using analytical tools such as Markov models and Monte Carlo simulations, I evaluate the cost-effectiveness of therapies to support evidence-based healthcare decision-making and value-based policy development. For example, my dissertation focuses on assessing the economic and clinical impact of anti-dementia drugs, with a particular emphasis on how different therapeutic strategies influence the cost, disease progression, and quality of life of patients with Alzheimer’s disease and related dementias (ADRD). By integrating real-world data into pharmacoeconomic modeling, this research aims to provide a comprehensive framework for evaluating treatment value, informing drug pricing and reimbursement policies, and ultimately promoting equitable and sustainable access to cognitive health interventions.

- **Algorithmic Fairness and Bias Mitigation**

Another major focus of my research involves algorithmic fairness and bias mitigation in healthcare predictive modeling. As data-driven methods increasingly shape clinical decision-making and health policy, ensuring that these models perform equitably across populations has become a critical ethical and methodological challenge. My work in this area seeks to identify, quantify, and reduce bias in predictive algorithms to promote equity-aware and trustworthy machine learning in healthcare research. For example, I am the Principal Investigator of the SPARC Graduate Research Grant (2025–2026) awarded by the University of South Carolina, leading a project that applies algorithmic fairness frameworks to evaluate and mitigate bias in predictive modeling among colorectal cancer patients.

3. In Process Research Projects

My ongoing research focuses on advancing the use of machine learning and causal inference to address high-priority questions in population health and pharmaceutical policy. One major project applies double/debiased machine learning, causal forests, and real-world Medicare and Medicaid data to estimate the causal effects of antihypertensive medication (AHM) use on Alzheimer's disease and related dementia (ADRD) outcomes. This work quantifies how AHM treatment influences both dementia risk and economic burden, and examines heterogeneous treatment effects across age, sex, racial and ethnic groups, and social determinants of health. The goal is to generate robust, equity-aware causal evidence that informs chronic disease management and dementia prevention strategies.

Another ongoing research integrates machine learning, deep learning, and causal inference to predict cancer immunotherapy utilization and adverse events using multimodal data. Building on large-scale electronic health records, genomic information, and lifestyle and social determinants of health, I develop and validate predictive models to identify which patients are most likely to receive and benefit from immune checkpoint inhibitors, and who may face a greater risk of immune-related adverse events. Model explainability techniques, such as SHAP (Shapley Additive Explanations), are used to improve transparency, while causal frameworks estimate individualized treatment effects. This research aims to uncover clinical and sociodemographic drivers of treatment heterogeneity, support precision oncology, and guide equitable resource allocation.

4. Dissertation

- **Title:** Cost-Effectiveness Analyses of New Antidementia Drugs in Patients with Early Alzheimer's Disease

- **Short Description**

Alzheimer's disease (AD) imposes substantial clinical and economic burdens on patients, caregivers, and public insurance systems, with prevalence and associated costs projected to rise sharply in the coming decades. While traditional symptomatic treatments such as cholinesterase inhibitors and N-Methyl-D-Aspartate (NMDA) receptor antagonists offer limited cognitive benefit, recently approved monoclonal antibodies (aducanumab, lecanemab, and donanemab) target amyloid pathology and

represent a major shift toward disease modification. However, their clinical value remains debated, and growing economic evidence suggests that these therapies may not be cost-effective at current prices. Existing studies are fragmented, often rely on outdated pricing, lack direct head-to-head comparisons, and do not incorporate value-based pricing (VBP) or age-stratified analyses.

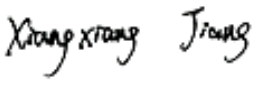
My dissertation will address these critical gaps through three aims: (1) conducting a systematic review and analysis of the cost-effectiveness of all FDA-approved AD drugs; (2) assessing the cost-effectiveness of lecanemab compared to aducanumab in patients with early AD in the U.S. and identifying the VBPs of lecanemab and aducanumab; and (3) evaluating the cost-effectiveness of donanemab compared to lecanemab in patients with early AD in the U.S. and determining the VBP of donanemab. Collectively, these studies will generate updated, comparative, and policy-relevant economic evidence to inform payer coverage decisions, pricing strategies, and the equitable allocation of emerging AD therapies.

- **Committee Members**
  - **Major Professor:** Z. Kevin Lu (Ph.D., Associate Professor, University of South Carolina)
  - **Additional Major Professor:** Gene Reeder (Ph.D., Distinguished Professor Emeritus, University of South Carolina)
  - **Committee Members:** Bryan L. Love (Pharm.D., Associate Professor, University of South Carolina), Chengwen Teng (Pharm.D., Ph.D., Assistant Professor, University of South Carolina)
  - **Outside Member:** Xiaomo Xiong (Ph.D., Assistant Professor, University of Cincinnati)

As a researcher working at the intersection of health economics and outcomes research and AI, my work aims to improve healthcare systems by generating rigorous, policy-relevant evidence using advanced quantitative and computational methods. Attending the NBER Digital Economics and AI Tutorial would provide an exceptional opportunity to engage with leading scholars, strengthen my methodological foundation in digital economics and AI, and deepen my understanding of how these tools can be applied to real-world health and policy challenges.

Thank you for considering my application. I look forward to the opportunity to participate in this tutorial!

Sincerely,



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