**Introduction**

**Overview of U.S. Health Care**

Unlike most developed nations, the United States does not have a universal health care system. Instead, the U.S. relies on a network of privately owned facilities, most of which are built around a for-profit model, to provide care. This comes despite the fact that federal and state governments pay a majority of the bill (Himmelstein and Woolhammer, 2016). The result is a system that works smoothly for the privileged few at the expense of minorities, the uninsured, the geographically isolated, and those with lower income.

**Emergency Department Wait Times and Length of Stay**

An emergency department (ED) is the area of a hospital dedicated to providing acute medical and surgical care to patients arriving in need of immediate help. In an emergent situation, a visit to the emergency department, and receipt of proper care upon arrival, can be the difference between a person living and dying. That is why it can be extremely frustrating when a patient arrives at the ED with a painful condition only to be asked to wait. During that time, the injuries that patient came in with worsens, they may start to feel ignored or neglected, and their satisfaction steadily declines. For that reason, wait time is used as a critical quality measure when assessing ED outcomes. Among the studies reviewed herein, “wait time” is defined as the difference in minutes between the time a patient arrives and the time of initial patient examination by an emergency department physician (National Center for Health Statistics, 2019).

Our second important measure is a patient’s emergency department length of stay (LOS). For patients ultimately admitted to the hospital, Pines et al. (2009) define LOS as the difference in minutes between the time a patient arrives at the ED and the time they are admitted to the hospital as an inpatient. For patients not admitted to the hospital, LOS is defined as the difference in minutes between the time a patient arrives at the ED and the time they leave from the visit. Ensuring these measures are as low as possible while still providing quality care to each patient is a critical effort each hospital must constantly strive toward, because the longer a patient stays in the ED, the more likely they are to suffer an adverse health outcome. Research shows for example that extended LOS during an ED visit is associated with increased likelihood of a patient dying in the hospital within 30 days of their visit (Plunket et al., 2011). Based on their observations, the authors recommend a maximum ED stay of 4 and 6 hours for referrals and admissions, respectively. Another study from Australia shows a link between ED overcrowding, as measured by LOS, and an increased likelihood of a patient dying in the hospital within 10 days of their visit. In just one Canberra hospital, the effect of ED overcrowding equated to 13 deaths per year over a three year period (Richardson, 2006).

Closely tied to emergency department wait times is the rate of patients leaving the ED without being seen. Carron et al. (2014) define this “indirect quality indicator” as the proportion of “patients who leave the ED from the waiting room, after having completed their administrative paperwork and usually an initial evaluation by a triage nurse.” These unplanned departures represent a missed opportunity to help a person in need and lead to a higher risk of failing health, hospital readmission and death in the weeks that follow. In the same paper, Carron et al. (2014) examine incidents of patients leaving the emergency department without being seen (LWBS), as well as incidents of patients leaving the emergency department after being seen but against medical advice (LAMA), over a six year period at Lausanne University Hospital in Switzerland. They find that while LWBS patients list a wide range of reasons why they chose to leave before being seen, the majority cite length of stay or waiting time. They also highlight a slight predominance of men in both the LWBS and LAMA groups and point out that these findings are consistent with previous studies.

**Research Objective**

The goal of this study is to identify whether emergency departments that serve higher rates of patients from non-white races and ethnicities perform significantly worse than emergency departments serving lower rates of non-white patients, after controlling for a slate of other independent variables. The final dataset of emergency department (ED) performance metrics contains N = 4216 observations from all 50 United States and the District of Columbia. Analysis will focus on the construction of predictive models for each of our five response variables: ED length of stay for admitted patients (*AdmitLOS*) , time spent in ED waiting for an inpatient bed (*WaitForBed*), ED length of stay for discharged patients (*NonAdmitLOS*), ED length of stay for mental health and substance use patients (*MHLOS*), and rate of patients leaving the ED without being seen (*LWBSrate*).

While prior analyses of these ED performance metrics have focused largely on rudimentary approaches, particularly simple linear regression, this study uses a variety of Generalized Linear Models (GLMs), an iterative weighted regression technique where observations are assumed to be distributed according to some exponential family. For each response variable, an appropriate family of GLM is identified and used to build successively more complex models, with outliers removed when appropriate. Model diagnostics are also performed to ensure each model is an appropriate fit for the data. Results are then presented by response variable, with results from each response variable’s four models displayed side-by-side.