EXAMINING THE ASSOCIATION OF AIR QUALITY ON COVID-19 PATIENT OUTCOMES USING AREA LEVEL DATA FROM THE ELECTRONIC HEALTH RECORD

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Background: Within the coronavirus 2019 (COVID-19) pandemic, literature has found worsened patient outcomes and increased virus transmissibility associated with reduced air quality. This factor, a structural social determinant of health (SDOH), has shown great promise as a link between air quality and patient outcomes during the COVID-19 pandemic. Researching SDOH within our patient populations is often difficult and limited by poor documentation or extensive questionnaires or surveys. The use of demographic data derived from the electronic health record (EHR) to more accurately represent SDOH holds great promise.

The use of area-level determinants of health outcomes has been shown to serve as a good surrogate for individual exposures. We posit that an area level measure of air quality, the county-level Air Quality Index (AQI), will be associated with disease worsening in intensive care unit (ICU) patients being treated for COVID-19.

Methods: We will calculate AQI using a combination of open-source records available via the United States Environmental Protection Agency (EPA) and manual calculations using geospatial informatics systems (GIS) methods. Subjects will be identified as adult ($\geq$ 18 years) patients admitted to Vanderbilt University Medical Center's ICUs between January 1, 2020, and March 31, 2022 with a positive SARS-CoV-2 laboratory analysis result. We will exclude patients without a home address listed.

Patient demographic and hospital data from ICU admission to 28 days following admission will include: age, sex, home address, race, insurance type, primary language, employment status, highest level of education, and hospital course data. Together these will be collated to produce our primary outcome variable of WHO Clinical Progression Scale score. These validated scores range from 0 (uninfected) to 10 (dead) to track clinically meaningful progression of COVID-19 infected patients.

Our AQI variable will be obtained from the EPA available county-level monitoring station spatial data combined with open-source state/county center point spatial data. These data contain historic cataloguing to determine air quality at both specific time points and averages over time. Where a county's average yearly AQI is not available due to lack of a monitoring station, we will use spatial data tools to calculate an average based on data from nearby stations. We will utilize yearly averages of AQI in the year prior to COVID-19 diagnosis to describe overall impact of air quality on patients' respiratory outcomes as opposed to single day exposures. Linkage of patient data to AQI database will be performed using patient addresses.

Discussion: By combining area level data with electronic health record (EHR) data, we will be positioned to understand the contribution of environmental and social determinants of health on patient outcomes. Our long-term goal is to elucidate which social and environmental determinants of health are associated with worse outcomes from COVID-19 and other respiratory viruses, using data extracted from the EHR.