Determinants of COVID-19 Hospital Outcomes in the University of Pennsylvania Health System

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Background:
- SARS-CoV-2 and its associated clinical disease, COVID-19, have caused over 2.5 million deaths worldwide since December 2019, including over 500,000 in the United States alone.
- Disproportionate impact of COVID-19 across racial, economic, and clinical risk factors is well-documented.
- Patterns during and after hospitalization are not as well understood.
- Conflicting results regarding race among the few existing hospital studies [1, 2].

Study Objectives:
- Describe the determinants of clinical outcomes among patients hospitalized for COVID-19 in the University of Pennsylvania Health System (UPHS).
- Assess time trends in rates of discharge and mortality as competing risks within eight weeks of hospital admission.
- Investigate death and re-admission after discharge.

Methods:
- Study Cohort: 2,785 admissions across 2,500 individuals hospitalized with PCR-confirmed COVID-19 prior to September 17, 2020 at five UPHS hospitals.
- Data collected using Electronic Health Records (EHR).
- Comorbid conditions classified using ICD-10 codes within past year.
- Cumulative incidence curves calculated for outcomes of interest.
- Two multivariate cause-specific Cox proportional hazards models fit for death and discharge.
  - Model 1 predictors: demographic information, baseline clinical factors, month of admission, hospital of admission, indicator for ICU-level care on day of admission as measure of severity of disease at admission.
  - Model 2 predictors: demographic information, baseline clinical factors, month of admission, hospital of admission, indicators for comorbidities identified as potential risk factors for severe COVID.
- Markers of severity at presentation and comorbidities considered separately to address potential mediation.
- Multivariable Poisson regression model with robust variance estimation fit for incidence of death after discharge.

Results: Racial Disparities in Underlying Conditions
- Rates of underlying conditions, markers of severe disease at admission, and residence in lower-income zip codes higher in Blacks compared to Whites and Other race.

Results: Cumulative Incidence
- 384 (15.4%) of patients died within eight weeks of initial hospital admission.
- 2073 (82.9%) were discharged without death.
- From March to November 2020, hospital admission and mortality rates decreased while discharge rates increased.

Results: Factors Associated with Mortality
- Severe disease at admission, increasing age, underweight, time period, and admitting site associated with an increased hazard for mortality.
- Similar risk factors persist after discharge. 11.6% of discharged patients age 75+ still died within 56 days of first admission.
- In Model 2, no comorbidities associated with increased hazard for mortality, but cancer and heart failure associated with decreased hazard for discharge.

Discussion
- Racial disparities in underlying conditions and severe disease risk factors present among individuals hospitalized with COVID-19.
- No racial differences in discharge or mortality outcomes after controlling for other demographics, clinical factors, and site of admission.
- Further research needed to understand drivers of the outcomes differences by hospital.
- EHR data have limitations and potential bias. Prospective studies needed to confirm identified associations.

References

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