Racial and Socioeconomic Differences in Infection Control Quality at Dialysis Centers

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Introduction

- More than 785,000 US residents have End Stage Renal Disease (ESRD), over 500,000 need dialysis to survive
- ~35% of hemodialysis patients had infections due to vascular access in 2019
- Infections account for one-third of hospitalizations and 11% of deaths in dialysis patients and cost $3 billion annually in inpatient costs
- Black and low-income dialysis patients are less likely to be covered by private insurance which reimburses dialysis care costs at higher amounts
- Centers serving these patients may offset decreased revenue by increasing patient load (without increasing capital, labor or productivity), decreasing infection control quality

Research Questions

Q1. Is hemodialysis infection control quality lower at centers with high proportions of Black patients or located in low-income areas?
Q2. Have these differences in infection control quality changed over time?
Q3. What facility, patient and community level factors are associated with these differences in quality?

Methods

- Measures:
  - Outcome measure: SIR (Facility bloodstream standardized infection ratio)
  - Independent variables:
    - Patient racial/ethnic mix, area income, time, patient volume, patient-staff ratio, profit status, rurality, mean patient age, mean patient comorbidities, % female patients, % patients on Medicare

Analytic sample and datasets:

- 34,723 dialysis facility-years 2014-2019 from
  - 1. ESRD-QIP Performance Score Summary Reports 2014-2019
  - 2. CMS Dialysis Facility Reports 2014-2019
  - 3. American Community Survey 2014-2019
  - 4. CMS Carrier Files 2014-2019

Statistical Analyses:

- 1. Log-linear regression model of SIR on race and area-level income
- 2. Log-linear model with race*time and income*time interactions
- 3. Oaxaca-Blinder analysis to decompose the role of patient, facility and community characteristics in the observed race and income disparities

Results

Table 1: Unadjusted and adjusted association of facility patient racial mix and area-level median household income with facility standardized infection ratios (SIR)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Unadjusted model</th>
<th>Fully adjusted model</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>% change in SIR</td>
<td>% change in SIR*</td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td></td>
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<tr>
<td>High</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Mid</td>
<td>+5.17*</td>
<td>+5.22*</td>
</tr>
<tr>
<td>Low</td>
<td>+10.29***</td>
<td>+5.74*</td>
</tr>
<tr>
<td>ZCTA median income</td>
<td></td>
<td></td>
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<tr>
<td>High</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Mid</td>
<td>+13.43***</td>
<td>+5.42*</td>
</tr>
<tr>
<td>Low</td>
<td>+17.14***</td>
<td>+10.28***</td>
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</tbody>
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% Black patients

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Conclusions

- Dialysis centers in low-income areas reported a 10% higher SIR compared to high-income areas in unadjusted analyses and a 6% higher SIR in adjusted analyses
- Facilities with high (compared to low) proportions of Black patients had a 17% higher SIR in unadjusted analyses but no significant difference in adjusted models
- The racial and income differences in infection control quality did not change over the study period
- Patient volume, patient age, area income and facility profit status are significant contributors to the racial difference in infection control quality
- The racial difference in dialysis infection control quality can be mitigated by capping patient volume and taking measures to address the social determinants of health

Fig 1: Model-predicted estimates for mean standardized infection ratio (SIR) over time, grouped by proportion of Black patients (A) and area income tertile (B)

Fig 2: Explained difference or composition effect (A) and unexplained difference or relationship effect (B) of patient, facility and area-level factors associated with log-transformed Standardized Infection Ratios (SIR) between dialysis centers with high vs low proportions of Black patients. Significant (α = 0.05) associations are represented as red bars, while nonsignificant associations are shown as grey bars. * - p < 0.05, ** - p < 0.01, *** - p < 0.001

SIR – Standardized Infection Ratio, CMS – Center for Medicare and Medicaid Services, ESRD-QIP – End Stage Renal Disease Quality Incentive Program, ZCTA – Zip Code Tabulation Area