Characteristics associated with access to kidney transplantation services in the Ohio River Valley

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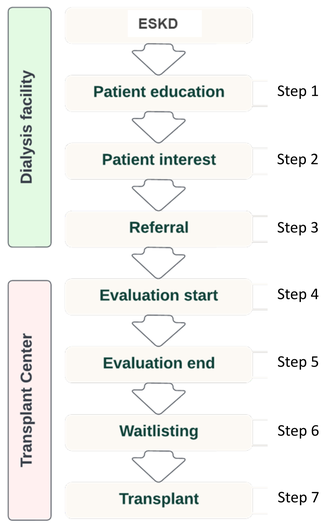
Background

For patients with end stage kidney disease (ESKD), demographic and socioeconomic characteristics affect access to kidney transplantation services. End stage renal disease Network 9, of the Ohio River Valley, is one of the 13 networks which had reduced waitlisting for Black patients compared to White non-Hispanic patients.[1] Additional research has shown that African American patients residing in Indiana, Kentucky, and Ohio had significantly longer time on the waitlist compared to white patients, and this time was significantly longer than the U.S. overall time on the waitlist.[2] Due to the known racial disparities in access, this study further investigated social disparities in access to kidney transplantation in this region. The objective of this study was to describe the medical and non-medical factors associated with referral, evaluation start, and waitlisting among patients with ESKD in the Ohio River Valley (Network 9).

Figure 1. Network 9 of the Ohio River Valley

Figure 2. Steps to Kidney Transplant



Materials & Methods

To identify patients with ESKD in Network 9, United States Renal Data System (USRDS) data were linked to referral and evaluation data from n=4 transplant centers contributing to the Early Steps to Transplant Access Registry (E-STAR), as well as neighborhood-level characteristics from the 2021 American Community Survey. Adult patients residing within Network 9 (Indiana, Kentucky, and Ohio; **Figure 1**) at dialysis start among n=680 dialysis facilities from January 2016-June 2020 (followed through June 2021) were assessed.

Outcomes assessed were: referral to a contributing transplant center among dialysis patients (Figure 2, step 3), transplant evaluation start among referred patients (Figure 2, step 4), and waitlisting among patients who started evaluation (Figure 2, step 6). Multivariable logistic regression models were utilized to examine the association between demographic, clinical, and socioeconomic factors and each outcome.

Table 1. Among patients in the USRDS dataset and on dialysis in Network 9, logistic regression modeling compared patient-, neighborhood-, and geographic-level characteristics with referral for kidney transplantation in Indiana (within 1 year of dialysis start), evaluation start within 6 months of referral (among all referred patients), and waitlisting within 6 months of evaluation (among all evaluated patients).

Variable	Referred within 1 year of dialysis start (n=4674) Odds ratios (95% CI)	Started evaluation within 6 months of referral, among all referred (n=3625) Odds ratios (95% CI))	Waitlisted within 6 months of evaluation, among all evaluated (n=688) Odds ratios (95% CI)
Patient Characteristics			
Age			
18-29	1 (Reference)	1 (Reference)	1 (Reference)
30-39	0.88(0.64,1.20)	0.84(0.61,1.16)	0.82(0.50,1.33)
40-49	0.84(0.62,1.13)	0.83(0.62,1.12)	0.86(0.55,1.35)
50-59	0.84(0.63,1.12)	0.81(0.60,1.08)	0.74(0.48,1.14)
60-69	0.79(0.59,1.05)	0.87(0.65,1.16)	0.75(0.48,1.16)
70-85	**0.53(0.39,0.73)**	**0.49(0.36,0.68)**	**0.45(0.25,0.80)**
Sex			
Male	1 (Reference)	1 (Reference)	1 (Reference)
Female	1.10(0.91,1.13)	0.97(0.87,1.08)	**0.74(0.60,0.92)**
Race			
White, non-Hispanic	1 (Reference)	1 (Reference)	1 (Reference)
Black, non-Hispanic	0.88(0.77,1.01)	**0.85(0.74,0.98)**	0.84(0.64,1.09)
Hispanic	**1.42(1.06,1.91)**	0.91(0.68,1.22)	0.97(0.57,1.65)
Asian	1.17(0.75,1.82)	1.12(0.73,1.74)	0.71(0.36,1.41)
Other(Unknown)	1.61(0.76,3.44)	1.84(0.87,3.86)	0.50(0.11,2.23)
Insurance coverage			
Medicaid	**0.81(.062,0.99)**	**0.47(0.38,0.59)**	**0.39(0.24,0.63)**
Medicare	0.99(0.86,1.14)	**0.73(0.63,0.84)**	**0.61(0.49,0.77)**
Private	1 (Reference)	1 (Reference)	1 (Reference)
Other/Unknown	**0.49(0.40,0.60)**	**0.78(0.64,0.96)**	0.70(0.48,1.03)
Uninsured	**0.28(0.19,0.41)**	**0.30(0.20,0.46)**	0.53(0.20,1.41)
Cause of ESKD			
Diabetes	1 (Reference)	1 (Reference)	1 (Reference)
Hypertension	1.16(0.99,1.36)	0.94(0.79,1.11)	1.35(0.98,1.87)
Glomerulonephritis	**1.26(1.03,1.55)**	**1.41(1.15,1.74)**	**1.52(10.6,2.18)**
Other / Unknown cause	1.17(0.98,1.40)	**1.26(1.05,1.51)**	1.18(0.83,1.67)
Comorbidities present			
Obesity (BMI ≥35 kg/m^2)	1.12(0.99,1.26)	**1.63(1.43,3.86)**	1.09(0.85,1.40)
Congestive heart failure	**1.16(1.02,1.32)**	**1.33(1.63,1.53)**	1.20(0.89,1.63)
Atherosclerotic heart disease	**1.21(1.06,1.50)**	0.90(0.75,1.08)	1.03(0.70,1.50)
Other cardiac disease	0.92(0.80,1.07)	1.08(0.93,1.25)	**1.44(1.04,1.98)**
Cerebrovascular disease (stroke)	0.92(0.75,1.13)	1.17(0.94,1.46)	1.70(0.98,2.95)
Peripheral vascular disease	0.96(0.78,1.18)	1.22(0.98,1.52)	1.42(0.83,2.41)
Hypertension	**0.77(0.65,0.92)**	0.85(0.80,1.14)	1.07(0.78,1.47)
Diabetes	**0.86(0.74,0.99)**	1.07(0.92,1.24)	**1.33(1.00,1.77)**
COPD	0.90(0.74,1.10)	**1.43(1.15,1.77)**	1.45(0.84,2.51)
Cancer	0.99(0.78,1.26)	1.11(0.86,1.43)	0.99(0.60,1.64)
Tobacco use	**1.26(1.06,1.51)**	**1.58(1.30,1.92)**	1.51(0.97,2.35)
Drug dependence	1.08(0.70,1.68)	1.52(0.92,2.48)	-
Alcohol dependence	0.83(0.57,1.21)	0.70(0.48,1.03)	1.51(0.62,3.67)
Neighborhood Characteristics (by ZIP code)			
Poverty≥20% population below poverty level	**1.25(1.00,1.57)**	1.06(0.84,1.33)	0.99(0.60,1.63)
Median household income (MHI)			
Low	1.02(0.82,1.27)	0.85(0.68,1.06)	0.65(0.41,1.03)
Middle	1.00(0.88,1.15)	**0.81(0.71,0.93)**	1.09(0.86,1.39)
High	1 (Reference)	1 (Reference)	1 (Reference)
Geographic Characteristics			
Urban (>50,000)	1 (Reference)	1 (Reference)	1 (Reference)
Large rural city(10,000-49,999)	0.92(0.78,1.09)	0.94(0.80,1.11)	1.19(0.87,1.62)
Small rural town (adjacent to town of 2,500-10,000)	1.25(0.93,1.68)	**1.41(1.15,1.74)**	0.66(0.36,1.23)
Isolated small rural town (not adjacent to town)	1.07(0.73,1.58)	**1.26(1.05,1.51)**	1.02(0.46,2.72)

Results

During the study period, there were 38,944 incident dialysis patients in Network 9, of which 8,824 were referred (4,674 [12%] referred within 1 year) to a contributing transplant center. Of the 8,824 referred patients, 3,955 started evaluation for transplant (3,265 [37%] within 6 months of referral). Of the 4,362 evaluated patients, 1,133 were waitlisted for transplant (688 [26%] waitlisted within 6 months of evaluation start).

Factors contributing to increased odds of <u>not</u> being referred by 1 year after dialysis start, in the adjusted analysis, included patient age >70 (OR=0.53, 95% CI 0.39-0.73) vs. younger age, and patients with unknown (OR=0.49, 95% CI 0.40-0.60) or no insurance (OR=0.28, 95% CI 0.19-0.41) vs. private insurance. **Factors contributing to increased odds of being referred by 1 year** were Hispanic ethnicity (OR=1.42, 95% CI 1.06-1.91) vs. white race and ZIP code-level poverty >20% (OR=1.25, 95% CI 1.00-1.57) vs. <20%.

Factors contributing to increased odds of <u>not</u> having a transplant evaluation within 6 months of referral were age >70 (OR=0.49, 95% CI 0.36-0.68) vs. younger age; Black race (OR=0.85, 95% CI 0.74-0.98) vs white race; Medicaid (OR=0.47, 95% CI 0.38-0.59), Medicare (OR=0.73, 95% CI 0.63-0.84), unknown insurance (OR=0.78, 95% CI 0.64-0.96), or no insurance (OR=0.30, 95% CI 0.20-0.46) vs. private; and middle MHI tercile (OR=0.81, 95% CI 0.71-0.93) vs. high MHI tercile. **Factors with increased odds of starting evaluation within 6 months were** residing in small rural (OR=1.41, 95% CI 1.15-1.74) or isolated rural towns (OR=1.26, 95% CI 1.05-1.51) vs. urban areas.

Factors contributing to lower odds of waitlisting 6 months after evaluation start included age >70 (OR=0.45, 95% CI 0.25-0.80) vs. younger age, female vs. male sex (OR=0.74, 95% CI 0.60-0.92), and Medicaid (OR=0.39, 95% CI 0.24-0.63) or Medicare (OR=0.61, 95% CI 0.49-0.77) vs. private insurance.

Discussion

Among incident ESKD patients referred to a transplant center in Network 9, age, sex, race, insurance status, MHI, and rurality were associated with delayed access to kidney transplantation services. Understanding patient characteristics affecting access to transplantation is an essential step in developing tailored interventions and targeting populations for improving equity in access.

Limitations: 4 out of 14 transplant centers in Network 9 contribute to E-STAR and our analysis is reflective of those 4 centers. Further, reason for referral/no referral was not available (e.g. some patients were likely not medically eligible for referral).

References

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Conflicts of Interest: The authors have nothing to disclose.

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