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Methods to improve the measurement of kidney transplant referral rates with incomplete transplant center data

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Methods to improve the measurement of kidney transplant referral rates with incomplete transplant center data

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Introduction

Prior studies have identified differences in kidney transplant rates across the nation, potentially due to differences in referral patterns. The Early Steps to Transplant Access Registry (E-STAR)[1] – currently the only population-based source of kidney transplant referral data in the nation – is voluntary, resulting in potentially inaccurate referral measurement in regions without complete transplant center participation. Adjusting the denominator of referral rates (i.e., person-time from incident dialysis patients) to reflect transplant center participation may improve accuracy. These methods would be particularly relevant for upcoming national referral data collection efforts, which may not have 100% initial participation.[2] We used data from a network with 100% participation in E-STAR (Network 6) to simulate the impact of incomplete center participation on referral measurement and test methods of denominator adjustment to improve accuracy.

Methods

Data Source

We included E-STAR data from the 9 adult kidney transplant centers active in ESRD Network 6 (GA, NC, SC) from 1/1/2015 to 12/31/2019. Data on adult patients living in Network 6 who initiated dialysis in the same period were obtained from the United States Renal Data System (USRDS) (n = 49,613).[3] We assigned patients to a transplant center catchment area based on their home ZIP; catchment areas are described elsewhere.[4] "Market share" for each center was calculated as center transplant volume divided by the total number of transplants performed in the network in the study period.

Methods

Similar to other studies, we defined "referral" as referral to a transplant center within 1 year of dialysis start. We calculated a "gold standard" referral rate (i.e. number of referrals divided by the total person-time on dialysis among incident patients in the network) using data from all centers. Next, we identified all possible combinations of < 9 centers (i.e. 36 possible combinations of 7 centers), totaling 510 combinations. We calculated four denominators per combination (Table 1): unadjusted, market share-adjusted, catchment area-adjusted, and adjusted for both market share and catchment area. From these denominators we calculated four rates for each combination, along with the median and IQR for all possible combinations, stratified by the number of included centers (i.e. a median and IQR for each rate for 7 participating centers). This study was approved by the institutional review boards at Emory (IRB00113572) and Indiana (IRB18998) University.

Results

Referral within 1 year of dialysis initiation in Network 6 was 36%. Including data from one transplant center (11% participation) underestimated the referral rate 10-fold (median: 3.4%, IQR: 1.6%, 7.7%) (Figure 1). Adjusting for catchment area reduced the degree of underestimation (median: 20.9%, IQR: 14.9%, 29.6%). The median market share-adjusted rate overestimated the gold standard by 5 percentage points (median: 41.0%, IQR: 33.2%, 49.4%); results for one center were similar when adjusting for both market share and catchment area.

The extent of underestimation for unadjusted and catchment-area adjusted rates declined with increasing center inclusion; overestimation for market share-adjusted rates remained similar

regardless of the number of included centers. Catchment-area adjustment began outperforming market share adjustment at 77% center participation (-2.3 percentage-point difference from gold standard vs. 4.2 percentage-point difference).

Discussion

In this analysis, we found that incomplete center participation resulted in underestimation of the overall network referral rate; estimation improved with increasing center participation and after adjustment for catchment area. With low transplant center participation, market share-adjustment produces the referral rate most similar to the gold standard; catchment area-adjustment may be more appropriate with high (> 75%) center participation.

The new Organ Procurement and Transplant Network (OPTN) directive includes national collection of referral data.[2] The initial phase of data collection may begin with a voluntary rollout and experience additional challenges, including delays and data entry errors. Our results demonstrate how referral rates can still be calculated without complete data. This is particularly important in the context of the Increasing Organ Transplant Access (IOTA) payment model, a recently implemented policy initiative.[5] Applying our methods could help ensure that even incomplete referral data can be rapidly used to support these initiatives.

Our findings are subject to limitations. The “gold standard” referral rate may itself be an underestimate as it does not include patients referred outside of Network 6. “Volume” as a market share measure is a lagging indicator that is downstream of referral and may miss secular trends in referral. Despite these limitations, our results indicate that referral rates can be estimated even without complete transplant center data using denominator adjustment. These results may help inform HRSA’s planned national referral data collection rollout and support measuring referral in other contexts, such as dialysis facilities.

Author contributions: research idea and study design: KRD, JB, RP; data acquisition: JH, JB, SP, REP; statistical analysis: MD; data interpretation: KRD, JH, JB, ABS, ML, JH, AW, SP, REP; supervision or mentorship: REP. Each author contributed important intellectual content during manuscript drafting or revision and agrees to be personally accountable for the individual's own contributions and to ensure that questions pertaining to the accuracy or integrity of any portion of the work, even one in which the author was not directly involved, are appropriately investigated and resolved, including with documentation in the literature if appropriate.

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Conflict of Interest: The authors have no conflicts of interest to disclose.

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Figure legend

Figure 1. Median and interquartile range (IQR) of calculated within facility kidney transplant referral rates for all possible combinations of 1-8 transplant centers in GA, NC, and SC.

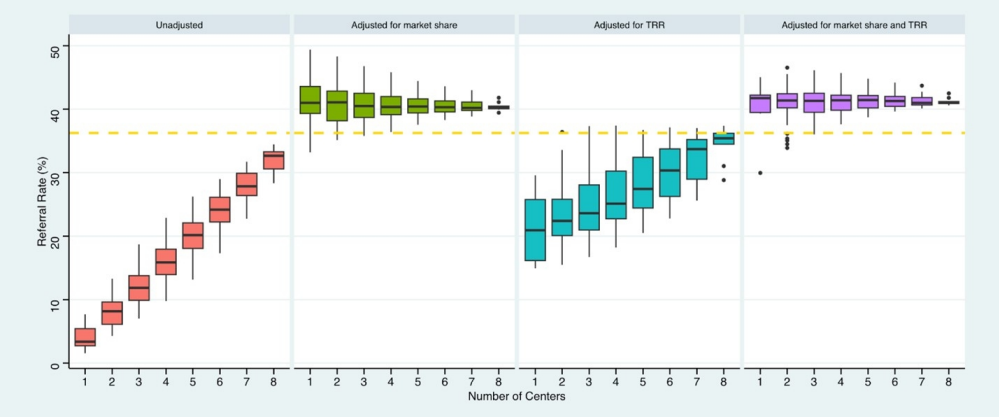

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Table 1. Denominator adjustments.

Adjustment	Description
Unadjusted	All incident adult ESKD patients in Network 6
Adjusted for market share	All incident adult ESKD patients in Network 6, multiplied by the proportion of transplants performed in Network 6 by included centers
Adjusted for catchment area	All incident adult ESKD patients living in catchment areas served by included centers
Adjusted for catchment area and market share	All incident adult ESKD patients living in catchment areas served by included centers, multiplied by the proportion of transplants performed in Network 6 by included centers