

## Making the Crooked Way Straight: Interpreting Geography and Health Care Delivery in CKD

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Every valley shall be filled in, every mountain and hill made low. The crooked ways shall become straight, the rough ways smooth.—Luke 3:5

To straighten the crooked you must straighten yourself—*The Dhammapada*

Inequality seems a fact of life. However, our society increasingly expects uniform outcomes, or at least common minimum standards, in many areas, especially medicine. Of all external factors associated with inequalities, geography may be the most bewildering, but one with possibly the greatest impact (1). CKD, just like health care in general (2–6), also demonstrates geographic variability (7). This variation includes exceptions to overall findings (*i.e.*, possible superior survival of black patients undergoing dialysis [8] and diminished disparities in certain health systems [9–11]). Yet more detailed analysis does not always yield expected results. A parallel may be found in the popular depiction of United States political affiliation by state during the last presidential election (12). We might expect that within “blue” (*i.e.*, Democrat) states, for example, most of the counties within that state are also that color. However, this is not the case: Within “blue” states, most of the individual counties are actually “red” (*i.e.*, Republican), with islands of (generally) much more populous blue counties interspersed. Thus, the overall state is “blue” because the unit of measurement is total votes. However, if the unit of measurement were total counties, the designation of a state as “red” or “blue” would be very different. Therefore, it may be the population density of one’s geographic position, rather than the particular geographic location, that predicts political affiliation.

In this issue of *CJASN*, Yan and colleagues used this concept to see whether it would yield a unifying explanation of variation in pre-ESRD care by geography (13). By merging Area Resource Files (a database containing such attributes as the population for all United States counties) with the United States Renal Data System, the authors assigned counties into four categories based on population: large metropolitan,

median/small metropolitan, suburban, and rural. They then associated population density with whether patients were seen by a nephrologist at least 6 or 12 months before dialysis initiation. In patients seen by a nephrologist, they further selected markers of pre-ESRD care (arteriovenous fistula [AVF] at first outpatient dialysis, receipt of dietitian care, and receipt of erythropoietin-stimulating agent [ESA]) as their outcomes, adjusted for demographic, geographic, and clinical factors known or suspected to influence outcomes.

At first glance, the authors’ findings are similar to those in previous reports: Pre-ESRD nephrology care was most frequent in median/small metropolitan counties. Subsequent dietitian care and receipt of ESA were most frequent in metropolitan counties, and receipt of AVF for first outpatient dialysis was most frequent in rural counties. The authors confirmed that black patients were less likely to receive pre-ESRD care overall than white patients. They also demonstrated that for ESA use and early nephrology care, disparities were somewhat attenuated (but not negated) after adjustment for employment and health insurance. The authors quite correctly point out that measurement based at county, or even ZIP code, level may mask considerable variation (*i.e.*, residual confounding, or ecological fallacy [14]). The authors did not account for income, although currently that too is available at ZIP code level and therefore is inevitably linked with location; thus, income would have considerable (but not total) overlap with population.

It is also noteworthy, but not emphasized in the discussion, that the number of nephrologists per capita markedly declines between the metropolitan counties and the suburban/rural counties—but that rural nephrologists appear to provide similar care to more patients. With nearly four to five times the number of nephrologists per capita, patients in large metropolitan areas are no more likely to receive early nephrology care than rural patients. In fact, despite the enormous disparity in nephrologists per capita, rural patients are significantly more likely to have a functional AVF at first outpatient dialysis. This finding was seen despite the lack of significant differences in pre-ESRD nephrology care, which in other studies has been associated with increased placement of AVFs (15). Curiously, other factors associated with improved AVF placement were greater availability of nephrologists and

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surgeons for a given population (16), along with coordinated care (17), a factor not discernible from the database. O'Hare *et al.* previously reported that despite differences in the structure of dialysis care in rural areas, dialysis facilities in these regions performed at least as well as (if not better than) their urban counterparts on several quality measures (18).

In summary, as Yan *et al.* state, pre-ESRD care outcomes are highly variable among population and geographic categories. Their key finding is that health care policies directed at eliminating pre-ESRD care disparities will not necessarily make "the crooked way straight." The way forward is likely to be anything but straightforward—but there are potential investigative and intervention tools available, including analysis of complex systems and game, or queuing, theory (19–22). For instance, geospatial analysis has been used to quantify current and future health care needs in high-risk regions and identify mismatches between needs and available resources, thus informing resource allocation and policy decisions (23). Telemedicine could potentially improve access to good-quality care to otherwise isolated communities, either rural or urban—allowing effective application of evidence-based guidelines (24). Unfortunately, the current inflexible nature of reimbursement for telehealth may perpetuate existing disparities. Coordinated care, as used in federal health systems, has also been associated with improved metrics, such as AVF placement, despite a globally distributed patient population (17). Perhaps the study and attenuation of disparities can be the "killer app" for such tools.

### Disclaimer

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Army, the Department of Defense, or the U.S. government.

### Disclosures

None.

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