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FINDINGS BRIEF

RURAL & MINORITY Health Research Center

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Availability of Dialysis Facilities in Minoritized Racial/Ethnic Group Areas

- Minoritized areas: ZIP Code Tabulation Areas (ZCTAs) were classified as being a top minoritized area if the proportion of persons in the ZCTA who identified as a specific minoritized racial/ethnic group (MRG) met or exceeded the 95th percentile for the proportion of those residents in all rural or urban ZCTAs.
- Dialysis locations and MRG ZCTAs:
  - Within rural ZCTAs, median distance to the nearest dialysis facility ranged from 10.5 miles for top non-Hispanic Black ZCTAs to 18.9 miles for top American Indian/Alaska Native ZCTAs. Rural ZCTAs in the top group for proportion of non-Hispanic White residents were a median of 16.6 miles from the nearest dialysis facility.
  - Within urban MRG ZCTAs, median distances ranged from 1.4 miles for non-Hispanic Asian ZCTAs to 8.9 miles for the top American Indian/Alaska Native ZCTAs. However, among urban ZCTAs, non-Hispanic White ZCTAs had the greatest median distances, reaching 10.1 miles.
- Rural disparities in dialysis access:
  - Across all ZCTAs, rural locations had a median distance of 14.3 miles to care versus 4.3 miles for urban ZCTAs.
  - Frontier and remote (FAR) ZCTAs: As ZCTAs become more remote, median distance to care increases from 16.0 miles in FAR 1 areas to 32.3 miles in FAR 4 areas versus 12.2 miles in all other rural ZCTAs.

The current findings brief is one of a series of reports documenting disparities in geographic access to health services in places that have a relatively high proportion of residents from minoritized racial and ethnic groups (MRGs). We use the term "minoritized" to refer to groups that have historically been marginalized by society and government institutions. This wording, rather than the terms "minority" or "minorities," highlights the intentional social, economic, and political discrimination that these populations have experienced.[1] Work from this series has also been adapted into a web visualization[2] and a peer-reviewed publication[3] both of which appeared in *Health Affairs*.

INTRODUCTION

Chronic kidney disease is present when the kidneys fail to process waste appropriately as measured by estimated glomerular filtration rate (eGFR).[4] Although kidney disease can occur because of infection or injury, it is most commonly a result of inadequately controlled diabetes and hypertension. Approximately 15.0% of White, 15.8% of Black, and 11.8% of Hispanic adults had

some level of chronic kidney disease in the 2015-2018 period.[5] Rates of chronic kidney disease increase with increased rates of local social deprivation and are independently associated with race.[6]

If chronic kidney disease cannot be halted, the individual progresses to end-stage renal disease (ESRD). In 2019, there were approximately 135,000 newly diagnosed cases of ESRD and a population of more than 800,000 persons living with the disease in the U.S.[5] ESRD is treated with a kidney transplant or dialysis. Transplant is preferred because of its lower cost compared to a lifetime on dialysis and for the superior quality of life experienced by patients who no longer require dialysis. Within new cases of ESRD in 2019, 29.7% of patients were treated through a transplant. Transplant was the treatment option for a larger proportion of White patients (35.6%) than Black (21.0%), Hispanic (25.8%), or American Indian/Alaska Native (AI/AN; 20%) patients.[5] Disparities in transplant receipt are most pronounced among young adults aged 22-44 years with Black and Hispanic patients having significantly lower odds of transplant even after adjustment for comorbid conditions, sex, and cause of kidney failure.[7]

Dialysis can be conducted at home with appropriate training and support or in a dialysis facility; most patients receive some form of dialysis at a facility. For these patients, survival with ESRD requires three four-hour visits to a dialysis facility per week. Given the potential adverse effects of a missed visit, factors that could impair compliance with the weekly regimen such as distance to the facility are particularly important.

In 2013, the Rural and Minority Health Research Center (then the SC Rural Health Research Center) published an analysis of dialysis availability in rural counties based on the 2008 Centers for Medicare & Medicaid Services (CMS) Dialysis Compare files together with the Standard Analysis File of the U.S. Renal Data System for the same year. That analysis found similar levels of need for dialysis in urban and rural areas but fewer and less-sophisticated services in rural counties particularly small and remote counties.[8] Analysis of estimated travel burden, working from the ZIP Code of a patient's home to the ZIP Code of the nearest facility, found that these estimated distances increased from 29.3 miles in micropolitan rural counties to 34.4 miles in small adjacent rural counties to 39.8 miles in remote rural counties.[8]

Since that prior report, multiple policy changes with potential implications for dialysis availability have been put in place. In 2011, CMS switched to a prospective payment system for dialysis services.[9] The change in financing was associated with some positive changes such as an increase in the number of patients using peritoneal dialysis which is both lower cost and more convenient for the patient.[10] However, these changes may also have affected the availability of facilities in smaller markets, such as rural communities, making a re-examination of rural distance to care necessary. In addition, although recent research has confirmed higher median travel distances for rural than for urban ESRD patients,[11] that work did not examine the way distances may be affected by population demographics such as a concentration of minoritized populations within certain areas. The report that follows describes distance to dialysis care across rural and urban areas with attention to communities of minoritized persons.

METHODS

Defining ZCTAs with a high proportion of minoritized racial/ethnic group (MRG) residents

We have chosen the term "minoritized" to refer to groups that have historically been marginalized by society and government institutions. This phrasing was used intentionally, rather than the terms "minority" or "minorities," to highlight the unjust intentional social, economic, and political oppression that has been inflicted on these racial and ethnic groups historically and at present.[12]

ZCTAs (n = 32,670) were first classified as rural or urban using Rural Urban Commuting Area definitions. ZCTAs classified as level 1 through 3 were defined as urban, and ZCTAs classified as level 4 through 10 were defined as rural.[13] Given differences in the demographic profiles of rural and urban places, rural and urban ZCTAs were examined separately.

Table 1. Proportion of residents needed to meet or exceed the 95th percentile[a] by race/ethnicity and rurality

	Rural	Urban
Non-Hispanic Black	34.4%	49.3%
Hispanic	23.8%	34.1%
Non-Hispanic American Indian/Alaska Native	11.8%	2.2%
Non-Hispanic Asian	2.5%	15.3%

[a] Percentiles derived from population data obtained from the American Community Survey.

ZCTAs were classified as being a "top" MRG area if the proportion of persons who identified as a specific MRG in the ZCTA met or exceeded the 95th percentile for the proportion of those residents in all rural or all urban ZCTAs, respectively. The "top 5%" for any one population group was consistently less than a majority and for some populations was low (Table 1)

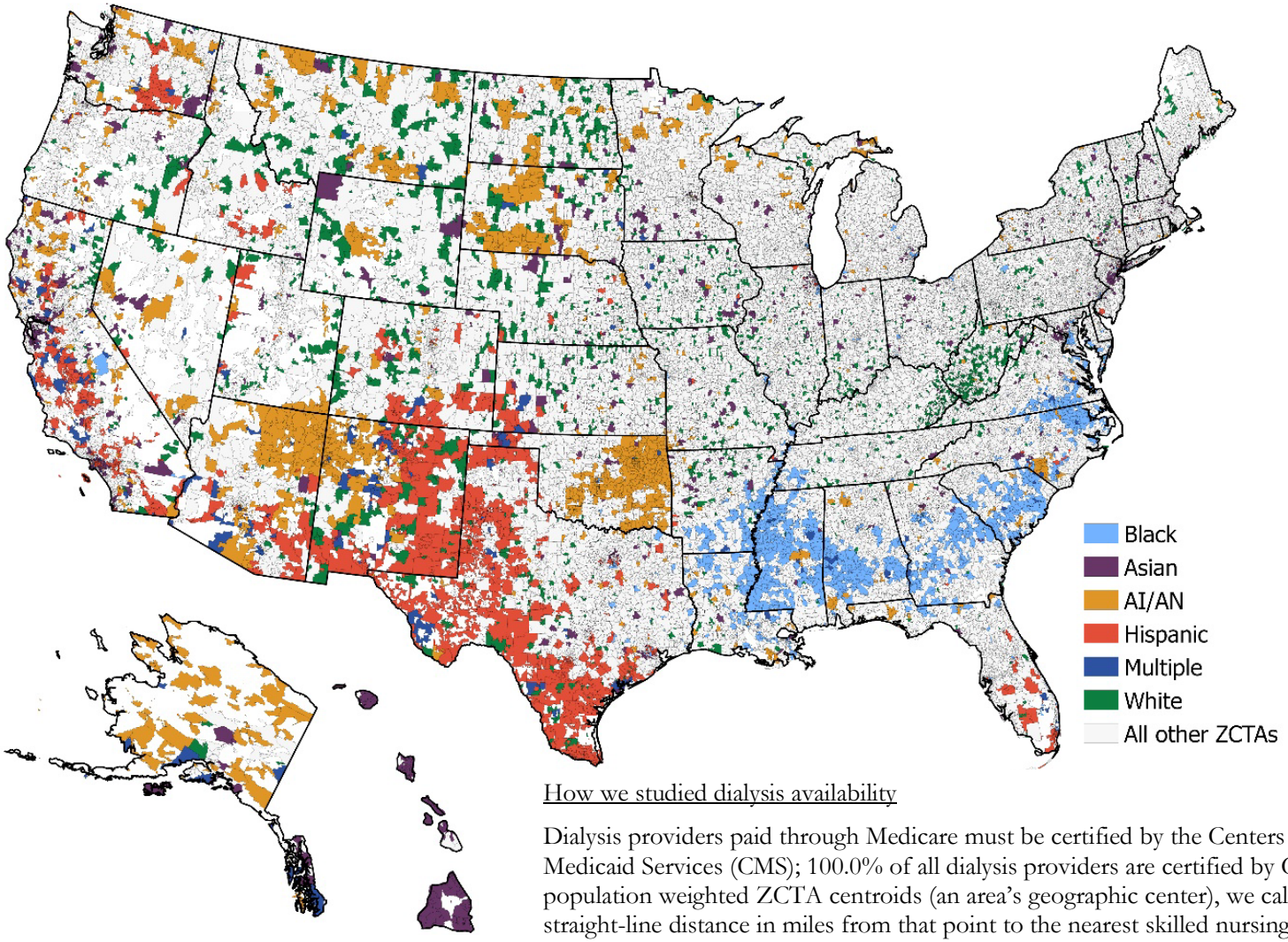
"Hispanic" included all persons of Hispanic ethnicity regardless of race. ZCTAs that fell in the top category for more than one MRG population were grouped separately so that categories do not overlap. Thus, the final analysis included six separate categories within both rural and urban ZCTAs: top ZCTAs for Black, Asian, American Indian/Alaska Native, Hispanic, and multiple MRG populations, and a referent category which included all other ZCTAs (see Table 2 and Figure 1). Note that MRG ZCTAs are not "majority minoritized" places; rather, they are ZCTAs in which the proportion of each group is at the top of the distribution compared to other ZCTAs. The geographic location of MRG ZCTAs is shown in Figure 1.

Table 2. Distribution of ZCTAs in the top 5th percentile for minoritized racial/ethnic group population by rurality and racial/ethnic group (2015-2019 American Community Survey)

	Urban ZCTAs		Rural ZCTAs		Total, all ZCTAs	
Minoritized racial/ethnic group	n	%	n	%	n	%
Hispanic	755	4.2	594	4.0	1,349	4.1
NH* American Indian/Alaska Native.	825	4.6	668	4.5	1,493	4.6
NH* Asian	851	4.8	622	4.2	1,473	4.5
NH* Black	874	4.9	709	4.8	1,583	4.9
>1 MRG	127	0.7	156	1.1	283	0.9
NH* White	1,203	6.8	2,177	14.6	3,380	10.3
All other ZCTAs	13,160	74.0	9,949	66.9	23,109	70.7
Total	17,795	100.0	14,875	100.0	32,670	100.0

Note: Percentiles derived from population data obtained from the 2015-2019 American Community Survey. More than 5% of ZCTAs in both urban and rural areas had 100% white populations; all such ZCTAs were classified as high NH White ZCTAs. *Hispanic includes all racial identities. All other racial/ethnic groups classified as "NH" (non-Hispanic).

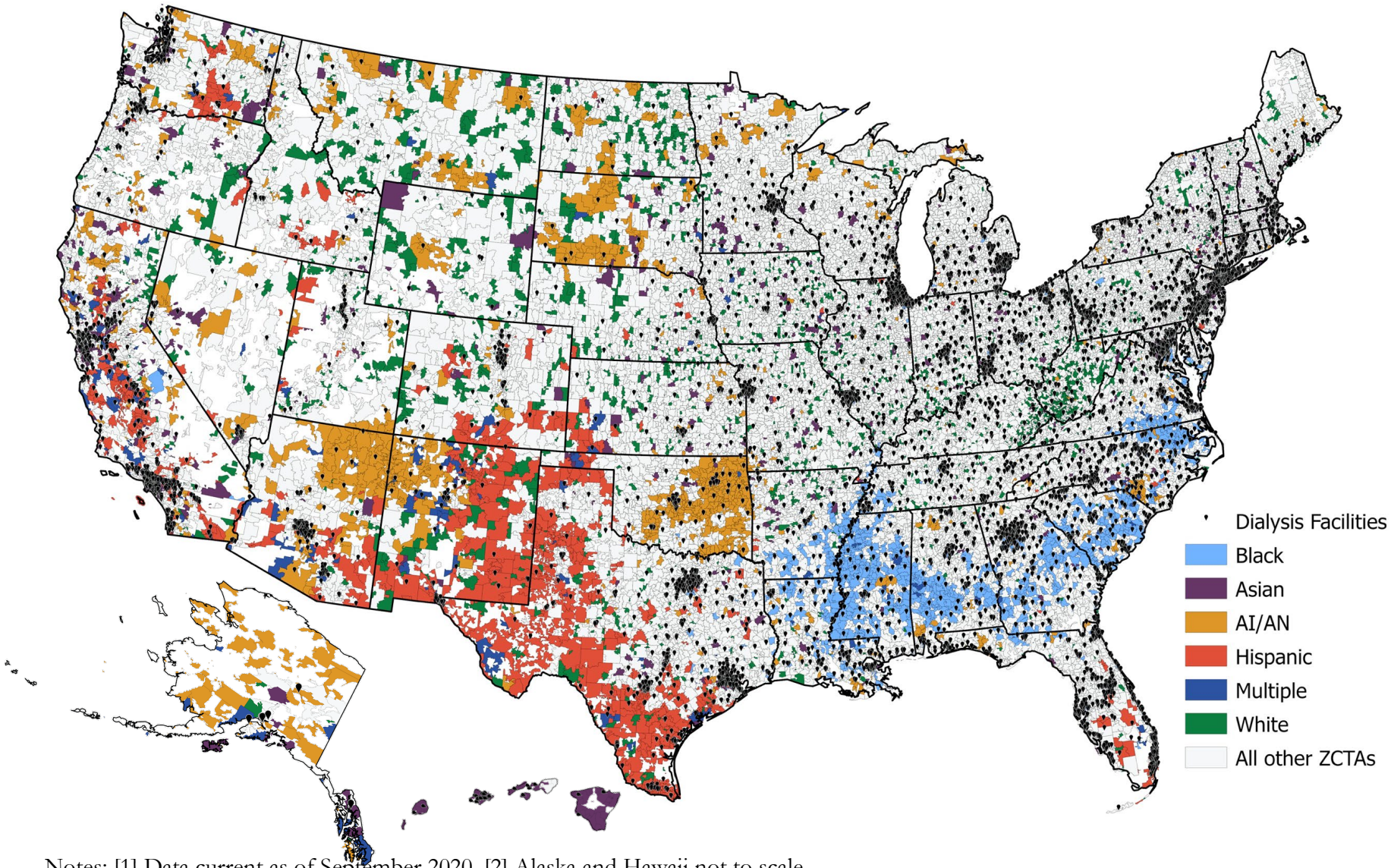
Figure 1. Locations of top minoritized racial/ethnic group (MRG) population ZCTAs, 2015-2019 American Community Survey
(ZCTAs meeting the 95th percentile threshold by racial and ethnic group)[a]



How we studied dialysis availability

Dialysis providers paid through Medicare must be certified by the Centers for Medicare and Medicaid Services (CMS); 100.0% of all dialysis providers are certified by CMS.[1] Using population weighted ZCTA centroids (an area's geographic center), we calculated the straight-line distance in miles from that point to the nearest skilled nursing facility. Actual driving distances will be longer than this measure, so the information provided here is a conservative estimate of travel distances. Distance calculations were restricted to the contiguous 48 states which exclude Alaska and Hawaii. The unusual geography of these two states would distort distance measures.

Figure 2. Geocoded locations of dialysis facilities across top MRG ZCTAs



Notes: [1] Data current as of September 2020. [2] Alaska and Hawaii not to scale.

FINDINGS

Dialysis availability across the U.S.

The locations of dialysis facilities are overlaid on the location of MRG ZCTAs in the maps below. The CMS dataset listed 7,724 facilities; these are broadly distributed across the country (Figure 2, Page 5).

Travel distances for dialysis care

Across all rural ZCTAs in the 48 contiguous states, the median distance to a dialysis facility was 14.3 miles versus 4.3 miles among urban ZCTAs ($p < .001$). The proportion of ZCTAs within which residents would experience a high travel burden, defined as more than 30 miles, was markedly higher in rural areas: 15.2% of rural ZCTAs versus 0.9% of urban ZCTAs exceeded this travel distance ($p < .001$).

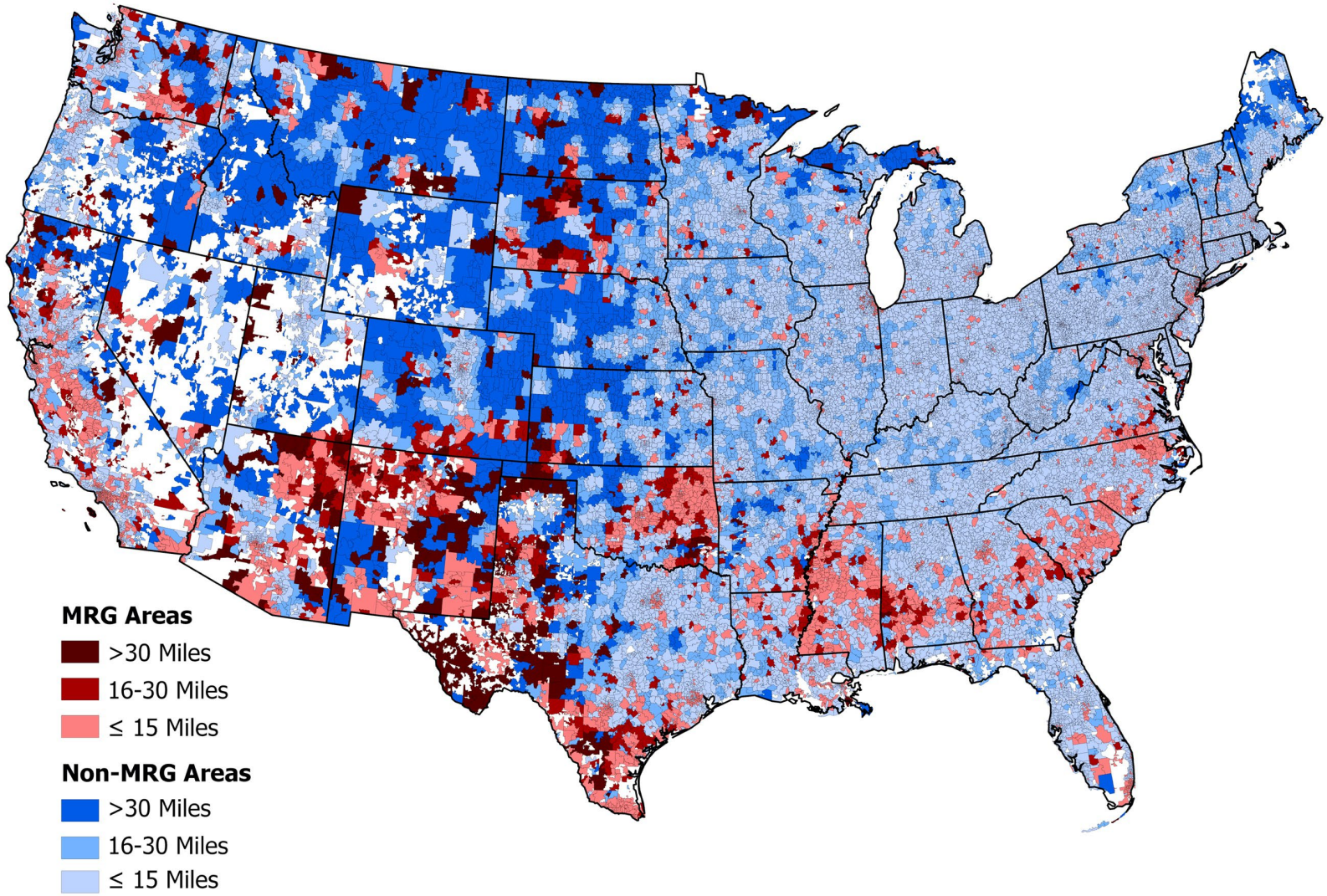
Within rural ZCTAs, the median distance in miles to the nearest dialysis facility varied from 10.5 miles for top non-Hispanic Black ZCTAs to 18.9 miles for top AI/AN areas (all differed from the referent category of "all other"). There was no clear pattern of greater distances for minoritized ZCTAs, and top non-Hispanic White ZCTAs were a greater median distance from a dialysis facility than top non-Hispanic Black ZCTAs.

Table 3. Driving distances to the nearest dialysis facility by rurality and top minoritized racial/ethnic group (MRG) status, 48 contiguous states

ZCTA category	Rural (n = 14,608)				Urban (n = 17,727)			
	Median Miles[a]	% ZCTAs within			Median Miles[b]	% ZCTAs within		
		<15 miles	>15-30 miles	>30 miles		<15 miles	>15-30 miles	>30 miles
All	14.3	52.6	32.2	15.2	4.3	89.3	9.8	0.9
NH Black	10.5	71.5	27.4	1.1	1.5	94.2	5.9	0.0
Hispanic	18.1	42.3	33.5	24.2	1.6	95.2	3.4	1.3
NH American Indian/Alaska Native	18.9	38.8	37.1	24.1	8.9	75.1	21.1	3.9
NH Asian	13.7	57.0	30.5	12.5	1.4	99.4	.04	0.2
Multiple MRGs	12.7	51.9	23.3	12.9	1.7	94.5	4.7	0.8
NH White	16.6	44.6	31.9	23.5	10.1	73.4	22.9	3.8
All other ZCTAs[c]	14.0	54.1	32	13.5	4.7	90.3	9.2	0.5

Note: Distance was measured from each ZCTA's geographic centroid to the address of the closest dialysis facility using shortest-route distance approach calculated by Microsoft MapPoint 2013. A "highly represented group" was defined as areas that met the 95th percentile criteria for a racial/ethnic group (refer to Table 1).
[a]All rural ZCTAs differ from the referent group at $p < 0.05$ or better.
[b]All urban ZCTAs differ from the referent group at $p < 0.001$.
[c]All other ZCTAs include those ZCTAs that did not meet the 95th percentile threshold for any of the included racial and ethnic groups.

Figure 3. Geographic distribution of driving distances to a dialysis facility by minoritized racial/ethnic group (MRG) classification, 48 contiguous states



Travel distances to dialysis facilities from top MRG ZCTAs are illustrated in the map on Figure 3 (Page 7). For both MRG and other ZCTAs, travel distances are greatest in the portions of the U.S. characterized by low population density.

The "frontier and remote" (FAR) designation is helpful for examining which ZCTAs have low access to dialysis services as well as differences across MRG communities.[14] The FAR designation is applied to ZCTAs using a combination of the number of persons living in the ZCTA plus distance to the nearest urbanized area (see below).

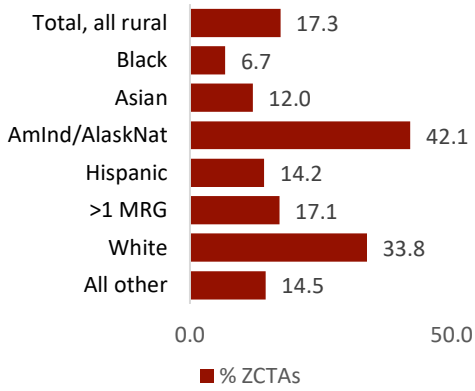
The majority of all ZCTAs with a FAR level 4 designation are rural (98.1%). As shown in Table 4 on the next page, the proportion of ZTCAs located more than 30 miles from the nearest dialysis facility increases as the ZCTA becomes more remote. Only 5.7% of rural ZTCAs without a FAR designation fall into the highest distance category versus 54.4% of ZCTAs in the FAR 4 group.

Table 4. Distance to the nearest dialysis facility by frontier and remote (FAR) designation category in percent (48 contiguous states)

Rural ZCTAs by FAR designation	Median distance in miles	Distance to nearest dialysis facility		
		<15 miles	>15-30 miles	>30 miles
		%	%	%
FAR 1 (1,116)	16.0	46.6	42.4	11.0
FAR 2 (934)	14.4	53.3	41.3	5.4
FAR 3 (565)	14.3	51.9	23.9	24.3
FAR 4 (2,261)	32.3	11.4	34.1	54.4
All other (8,205)	12.2	63.6	30.7	5.7

Reflecting differing population densities across the states in which the top MRG ZCTAs are located, only 6.7% of top Black MRGs are in FAR 4 areas versus 42.1% of top rural AI/AN ZCTAs and 33.8% of top rural White ZCTAs (Figure 4). Thus, the high proportion of top rural AI/AN ZCTAs falling into the highest distance (>30 miles) category, 24.1%, (Table 3) may reflect their location in these less densely populated areas.

Figure 4. Percent of Rural ZCTAs that meet FAR 4 definition, 48 contiguous states



Limitations

Our analysis is based on raw distances calculated from a ZCTA centroid to the nearest facility rather than actual patient behavior. Patients may choose other locations. A recent analysis in a major metropolitan area found that Black patients, although living closer to the nearest facility

than White dialysis patients, traveled the same distance to their place of care.[15] In addition, this analysis does not examine the types of dialysis supported by each facility (in-center versus home-based hemodialysis and peritoneal dialysis) which may differ across locations.

Frontier & Remote Area Designations	
Level 1—FAR areas consist of rural areas and urban areas up to 50,000 people that are 60 minutes or more from an urban area of 50,000 or more people	**Level 3**—FAR areas consist of rural areas and urban areas up to 10,000 people that are: 30 minutes or more from an urban area of 10,000-24,999; 45 minutes or more from an urban area of 25,000-49,999 people; and 60 minutes or more from an urban area of 50,000 or more people.
Level 2—FAR areas consist of rural areas and urban areas up to 25,000 people that are: 45 minutes or more from an urban area of 25,000-49,999 people; and 60 minutes or more from an urban area of 50,000 or more people	**Level 4**—FAR areas consist of rural areas that are: 15 minutes or more from an urban area of 2,500-9,999 people; 30 minutes or more from an urban area of 10,000-24,999 people; 45 minutes or more from an urban area of 25,000-49,999 people; and 60 minutes or more from an urban area of 50,000 or more people.

CONCLUSIONS

Residents of rural ZTCAs are estimated to live farther from dialysis services than urban residents. Rural ZCTAs live a median of 14.3 miles from the nearest facility versus a median of 4.3 miles for urban ZCTAs. Rural travel distances were greatest from Hispanic and non-Hispanic American Indian/Alaska Native ZCTAs with median distances of 18.1 and 18.9 miles, respectively. Top rural non-Hispanic Black ZCTAs, which are principally located in the South, were a median of 10.5 miles from care.

The funding environment for ESRD care differs from all other disease states in the U.S. as it is the only condition specifically tied to guaranteed funding through Medicare. Anyone who develops ESRD, assuming they have a sufficient Social Security work history or are the spouse or dependent of such a person, qualifies for Medicare benefits beginning with the fourth month of dialysis treatments; coverage pays for either dialysis or transplant costs.[16] If the individual has private health insurance when becoming ill, that insurance will cover the first three months of care with Medicare assuming the financial burden from the fourth month on. Even among persons who are uninsured when their condition progresses to ESRD, the financial liability of the person and thus the financial risk to institutions providing care is limited.

Because of this unique "no loss" financial situation, the market appears to have been more responsive to local need for dialysis care than for other, less profitable healthcare service lines. It is notable that very few top non-Hispanic Black rural ZCTAs and no top non-Hispanic Black urban ZCTAs are more than 30 miles from a dialysis facility. This contrasts with obstetric services. Among top rural Black ZCTAs, the median travel distance to obstetric care is 19.8 miles. 23.8% of these ZCTAs are more than 30 miles from hospital-based obstetric care.[17]

ESRD care is currently undergoing major adjustments in both the clinical and financial realms. Clinically, major professional groups have changed the metric used to calculate estimated glomerular filtration rate (eGMR) removing a prior algorithm that disadvantaged Black patients.[18, 19] The population effects of this revised diagnostic tool have not yet been assessed, but changing to a race-neutral calculation of eGFR is likely to increase the number of Black patients who meet criteria for chronic kidney disease at lower levels, as well as, the proportion who qualify for transplant.[5, Chapter 9, 20]

Financially, the Centers for Medicare & Medicaid Services (CMS) issued proposed rule changes in 2021 intended to encourage the use of home hemodialysis and promote health equity. These changes include increased reimbursement for home dialysis.[21] In addition, CMS has found that within the overall Medicare Advantage framework, beneficiaries covered by an insurer with a Special Needs Plan specifically for ESRD patients have better outcomes.[22] The distribution of these plans across rural locations in general and particularly in rural areas with top concentrations of minoritized residents has not yet been studied.

ESRD is costly with expenditures of $51.0B in 2019. This was approximately 7.2% of the total Medicare expenditures across a 10-year period (2009-2019).[5] As would be anticipated from the chronic nature of kidney failure, ESRD patients are disproportionately represented in the "high user" Medicare population.[23] The most effective way of changing the burden of ESRD costs long term is to reduce the incidence of the condition. Treating chronic kidney disease before it progresses to ESRD or preventing chronic kidney disease by improving control of diabetes and hypertension will reduce the need for expensive care. Expanding health insurance coverage more broadly in the population is an upstream intervention that might help reduce rates of ESRD. For states reluctant to fully expand Medicaid, subsidies that expand care specifically for persons with chronic kidney disease might be appropriate.

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APPENDIX

Data Sources

Data on the racial/ethnic composition of ZCTAs and their socioeconomic conditions comes from the U.S. Census Bureau's American Community Survey 5-year estimates. Information on home health agencies was derived from the Centers for Medicare & Medicaid Services (CMS) Provider dataset and was current as of October 2020.[24] [https://data.cms.gov/provider-data/] CMS supplies two datasets: a listing of all providers with their address, ownership, and services provided and a list of all ZIP Codes reported as being serviced by each home health agency. The two files were linked using the CMS Provider ID number.

Key Definitions

Rurality was defined using the ZIP-approximated Rural Urban Commuting Area (RUCA) codes. Specifically, ZCTAs were assigned the RUCA code for the matching ZIP even if additional ZIP Codes were included in the creation of the ZCTA boundary. RUCA codes 1–3 were defined as urban, and codes 4–10 were defined as rural; this corresponds to the metropolitan/non-metropolitan split.

Minoritized racial/ethnic group (MRG) area: ZCTAs were defined as a "top" proportion of residents of a specific racial/ethnic identity if the proportion of persons reporting that identity within the ZCTA was at or above the 95th percentile of that group's proportion of the population across all ZCTAs. Because we created mutually exclusive categories for ZCTAs that fall into the top 5th percentile for each MRG, the total proportion of MRG ZCTAs equals 18.9% of all ZCTAs.

Characteristics of top MRG ZCTAs

Top MRG ZCTAs could differ from other ZCTAs in the U.S. on characteristics that affect demand for dialysis services. To provide context for our dialysis availability results, we compared MRG ZCTAs, defined as those in the 95th percentile for the proportion of each group, to all other ZCTAs (labeled "all other;" Table A-1, page 13).

- Demographic characteristics:
  - Across both rural and urban ZCTAs, the proportion of the population that is age 65 or older is significantly lower in MRG ZCTAs than in "all other" ZCTAs.
  - Top MRG areas, except for top Asian ZCTAs, generally had higher proportions of the population under age 65 who lacked health insurance. Absence of insurance can lead to higher rates of ESRD as precipitating conditions are not adequately treated.
- Disease prevalence: Hypertension or high blood pressure and diabetes are major conditions having ESRD as a possible outcome if the conditions are not adequately controlled.
  - Although top Hispanic and Asian ZCTAs had lower estimated prevalence of hypertension and diabetes than referent ZCTAs, NH Black and NH American Indian and Alaska Native ZCTAs had disease rates that exceeded the referent category.
- Household characteristics: We examined vehicle availability within the household as an indicator of transportation difficulty for persons needing dialysis, particularly in rural places. Community poverty can make an area unattractive for healthcare providers of all kinds as persons who are uninsured or whose care is funded by lower-paying insurers, such as Medicaid, offer lower payment for the provider.

- Within rural MRG ZCTAs, ZCTAs in the top group for AI/AN, Black, and multiple MRG populations had higher proportions of households that lacked a vehicle; the Asian ZCTAs did not differ from the "all other" group.
- The top AI/AN ZCTAs were the only group for which the proportion of households without a vehicle was significantly higher among rural than among urban ZCTAs (rural 19.0%, urban 5.8%).
- The proportion of households with incomes at or below 200% of the Federal Poverty Level was higher among MRG ZCTAs than the "all other" group for all except top Asian ZCTAs.

Table A-1. Characteristics of top MRG ZCTAs when compared to all other ZCTAs by rurality[1] in percent (population and household data from the 2015-2019 American Community Survey; estimated disease prevalence from CDC Places tool)

	Personal Characteristics				Household Characteristics	
	Demographic		Estimated prevalence of		Lack vehicle	At or Below 200% FPL
	Residents over 65	Lack health insurance	High blood pressure	Diabetes		
Rural ZCTAs (14,875)	%	%	%	%	%	%
>1 MRG (156)	16.6 ***	15.6 ***	34.9 **	13.7 ***	11.6 ***	45.0 ***
Hispanic (594)	17.2 ***	15.1 ***	34.3 ***	13.7 ***	5.2	45.4 ***
NH Am. Ind./AK Nat. (668)	16.6 ***	20.5 ***	37.0 ***	15.0 ***	19.0 ***	49.5 ***
NH Asian (622)	20.5 **	7.4 **	32.6 ***	11.0 ***	4.7	32.8 *
NH Black (709)	19.3 ***	12.6 ***	45.3 ***	17.3 ***	10.5 ***	51.6 ***
NH White (2,177)	26.2 ***	7.5 ***	37.5 ***	12.8 ***	4.2 **	35.2 *
All other ZCTAs (9,949)	21.7	8.4	36.2	12.1	4.8	34.4
Urban ZCTAs (17,795)	%	%	%	%	%	%
>1 MRG (127)	12.3 ***	14.6 ***	30.6 **	13.3 **	11.5 ***	49.3 ***
Hispanic (755)	12.1 ***	17.0 ***	30.7 ***	13.5 ***	10.5 ***	48.1 ***
NH Am. Ind./ AK Nat. (825)	17.4	11.2 ***	34 ***	11.7 ***	5.8	36.7 ***
NH Asian (851)	14.0 ***	5.3 ***	25.3 ***	8.6 ***	12.1 ***	21.6 ***
NH Black (874)	15.0 ***	11.3 ***	42.4 ***	16.5 ***	17.8 ***	49.0 ***
NH White (1,203)	23.9 ***	6.6 **	36.5 ***	12.2 ***	5.1 *	31.8 ***
All other ZCTAs (13,160)	17.7	7.2	32.2	10.4	5.6	27.1

[1]With the exception of lack of health insurance, ALL rural values differ significantly from the corresponding urban value. [2]NH = Non-Hispanic [3]Statistical indicators: Group differs from Referent ZCTA within either all rural or all urban ZCTAs. * = p < .05; ** = p < .01; *** p < .001

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